INVITATION TO BID
PUBLIC WORKS
PROJECT NUMBER
NW-C1218B

PROJECT MANUAL

FOR

PHASE 3A

MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

AT

NISQUALLY STATE PARK

IN

PIERCE COUNTY

BID DEADLINE: 1:00 P.M., TUESDAY, JUNE 24, 2025
Bidders are required to submit bid prices electronically through the State Parks Public Opportunities-MRSC Bonfire Procurement Portal
https://mrscrosters.bonfirehub.com

****BIDS WILL BE OPENED WITHIN THREE BUSINESS DAYS****

WASHINGTON STATE PARKS & RECREATION COMMISSION
1111 ISRAEL ROAD SW
TUMWATER, WA 98501-6512
POST OFFICE BOX 42650
OLYMPIA, WASHINGTON 98504-2650

PROJECT MANUAL

FOR

PHASE 3A
WASTEWATER TREATMENT FACILITY
AND MAINTENANCE BUILDING

AT

NISQUALLY STATE PARK

IN

PIERCE COUNTY

PROJECT LANDSCAPE ARCHITECT

Approved for Construction _____
Heather Saunders, Assistant Director

WASHINGTON STATE PARKS AND RECREATION COMMISSION
1111 ISRAEL ROAD SW
TUMWATER, WASHINGTON 9501-6512
P.O. BOX 42650
OLYMPIA, WASHINGTON 98504-2650

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

END OF SECTION

Diana Dupuis,
Director

STATE OF WASHINGTON

WASHINGTON STATE PARKS AND RECREATION COMMISSION

1111 Israel Road SW • PO Box 42650 • Olympia, WA 98504-2650 • (360) 902-8500
Internet Address: http://www.parks.wa.gov

ADVERTISEMENT FOR BID

Sealed bids will be received for the following project:

PROJECT NUMBER:	NW-C1218B
PROJECT TITLE:	Nisqually State Park – Phase 3A Maintenance Building and Wastewater Treatment Facility
PROJECT DESCRIPTION:	This project includes a new Wastewater Treatment Facility, Pump House, Host Campsite, Utility Infrastructure, and expansion of the existing Maintenance Building. Work includes, but is not limited to, site preparation, erosion control, excavation, construction of building, aggregates, cast-in-place concrete, concrete, asphalt paving, on-site drain fields, water lines, sanitary sewer lines, fences/slide gate, catch basins, and subsurface drainage, topsoil, restoration plantings and miscellaneous site improvements.
PROJECT LOCATION:	The project is located at the crossroads of SR7 and Mashel Prairie Road E, approximately 1-mile south along Mashel Prairie RD E on the west. The addresses associated with the project include: Nisqually State Park - Maintenance Building: 44280 Mashel Prairie RD E Eatonville, WA 98328. Pierce County
ESTIMATED BID RANGE:	$10,400,000.00 - $11,700,000.00
PROJECT REPRESENTATIVE:	Deana Bishop
PROCUREMENT COORDINATOR	Manuel Iglesias
PREBID WALKTHROUGH:	**10:00 AM on Wednesday, June 4, 2025.** Meet at Nisqually State Park - Maintenance Building: 44280 Mashel Prairie RD E Eatonville, WA 98328.
SUBMITTAL DUE DATE/TIME:	**1:00 PM on Tuesday, June 24, 2025**
ELECTRONIC BIDDING:	Bidders are required to register as vendors on the MRSC Bonfire Procurement Portal https://mrscrosters.bonfirehub.com to be eligible to submit bids. All bid submissions must be completed electronically through the State Parks Public Opportunities section of the portal. Bidders must use the official Bid Proposal Form, provided as part of the electronic bid documents, ensuring that all required fields are properly filled out and submitted before the deadline. (See Bonfire support details further down.)

PLANS, SPECIFICATIONS, ADDENDA, AND PLAN HOLDERS LIST: Contractors can access plans and specifications through the State Parks Public Opportunities-MRSC Bonfire Procurement Portal at https://mrscrosters.bonfirehub.com/portal.

Important: Bidders are encouraged to "Register as a Prime/GC Interest" on the project details page of the MRSC Rosters Bonfire Procurement Portal to be placed on the Bidders List. This service is free for Prime Bidders, Subcontractors, and Vendors interested in bidding on this project.

Additionally, plans and specifications are available through Builders Exchange Washington, Inc. at http://www.bxwa.com. Posted Projects"; "Public Works", "Washington State Parks and Recreation. Bidders have the option to access Bid Documents, including Specifications and Drawings, at www.parks.wa.gov/contracts by clicking on the Construction Projects link for reference purposes. However, the official channel for bid notifications and addenda is the State Parks Public Opportunities-MRSC Rosters Bonfire Portal, and bidders should rely on it for the most up-to-date information.

PLANS MAY ALSO BE VIEWED THROUGH: Associated Builders And Contractors, Spokane WA; Tri City Construction Council, Kennewick WA; Daily Journal of Commerce, Seattle WA; Weekly Construction Reporter, Bellingham WA; Daily Journal Of Commerce Plan Center, Portland OR; Lower Columbia Contractor Plan Center, Longview WA; Abadan Spokane Plan Center, Spokane WA; ARC Document Solutions, Seattle, WA; Associated General Contractors, Boise, ID; Dodge Construction, Bedford, MA; Hermiston Plan Center, Hermiston, OR; Contractor Plan Center, Clackamas, OR; Wenatchee Plan Center, Wenatchee, WA; Spokane Regional Plan Center, Spokane, WA; Associated General Contractors, Spokane, WA; Walla Walla Valley Plan Center, Walla Wall, WA; Yakima Plan Center, Yakima, WA.

TECHNICAL QUESTIONS regarding this project shall be directed to: Jonah Hayes, PLA, Owner's Representative at: Robert W. Droll, Landscape Architect, PS., Address: 4405 7th Avenue SE Lacey, WA 98503, Phone: (360) 456-3813, e-mail: jonah@rwdroll.com.

BID RESULTS will be published on the State Parks Public Opportunities-MRSC Rosters Bonfire Portal https://mrscrosters.bonfirehub.com/portal following the bid deadline and in the Construction Projects section at www.parks.wa.gov/contracts after the bid submittal. This practice ensures that those involved and interested can readily view bid outcomes, enhancing transparency and efficiency in the bidding process.

THE STATE OF WASHINGTON PREVAILING WAGE RATES are applicable for this public works project. Bidders are responsible to verify and use the most recent prevailing wage rates. The "Effective Date" for this project is the bid submittal time and date above.

BIDDER RESPONSIBILITY will be evaluated for this project. In determining bidder responsibility, the Agency shall consider an overall accounting of the criteria set forth in Division 00 – Supplemental Responsibility Criteria. Please direct questions regarding this subject to the Project Representative.

MANDATORY 15% APPRENTICE LABOR HOURS of the total labor hours are a requirement of this construction contract. Voluntary workforce diversity goals for this apprentice participation are identified in the Instructions to Bidders. Bidders may contact the Department of Labor & Industries, Apprenticeship Section, to obtain information on available apprenticeship programs.

SUBCONTRACTOR LISTINGS: Per RCW 39.30.060, when the bid proposal combined with any alternates totals one million dollars or more, the Bidder must list the Subcontractors they intend to use for structural steel, rebar installation, heating, ventilation, and air conditioning (HVAC), plumbing, and electrical work on the Subcontractor Utilization List form for this project.

ACCESS EQUITY: The successful Bidder is required to complete their vendor registration in Access Equity, a secure B2GNow online vendor management system. Prime Contractors already registered with B2GNow for any public entity must ensure their information is up to date. The system can be accessed either directly at https://omwbe.diversitycompliance.com/ or via the Office of Minority and Women's Business Enterprises (OMWBE) website at https://omwbe.wa.gov/.

FOR THIS PROJECT, VOLUNTARY DIVERSITY GOALS HAVE BEEN SET: 10% for Minority Business Enterprises (MBE), 6% for Women's Business Enterprises (WBE), 5% for Washington Small Businesses, and 5% for Veteran-owned businesses. While meeting these goals is not mandatory, it is strongly encouraged to promote diversity in business participation.

Bidders may contact the Office of Minority and Women's Business Enterprise (OMWBE) at: http://omwbe.wa.gov/ to obtain information on certified firms. Bidders may also utilize Washington Small Businesses registered in WEBS at https://pr-webs-vendor.des.wa.gov/ and Veteran-owned Businesses at https://www.dva.wa.gov/veterans-their-families/veteran-ownedbusinesses/vob-search.

Washington State Parks reserves the right to accept or reject any or all proposals and to waive informalities.

STATE OF WASHINGTON
PARKS AND RECREATION COMMISSION
CONTRACTS AND GRANTS

For assistance with the Bonfire Vendor Registration Process, please visit the following link: Vendor Registration Support

For guidance on the Bonfire Bid Submission Process, refer to this link: Bid Submission Support

Additional Bonfire Vendor Support resources, including support articles and instructional videos, are available at: Bonfire Vendor Support

If vendors experience any technical issues, they can contact Bonfire Support via email at Support@GoBonfire.com.

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

INVITATION TO BID

1.1 SPECIAL NOTICE(S)

A. Project work included in this bid will overlap and occur simultaneously with separately bid, adjacent, projects onsite. The Contractor shall schedule work to accommodate others' work onsite.

B. Bidders are reminded that workers who work on construction, alteration, repair, improvement, or maintenance of park ranger residences are covered by the residential scopes for work *on or in the residence itself only*. Residential prevailing wage rates are not applicable to sidewalks, driveways, patios, detached garages, other outbuildings, and any other work not in or on the residence itself. The bidder must use commercial prevailing wage rates for work not on or in the residence itself.

1.2 DESCRIPTION OF WORK

A. The Washington State Parks and Recreation Commission proposes Phase 3A improvements to Nisqually State Park. This project includes a new Wastewater Treatment Facility, Pump House, Host Campsite, Utility Infrastructure, and expansion of the existing Maintenance Building. Work includes, but is not limited to, site preparation, erosion control, excavation, construction of building, aggregates, cast-in-place concrete, concrete, asphalt paving, on-site drain fields, water lines, sanitary sewer lines, fences/slide gate, catch basins, and subsurface drainage, topsoil, restoration plantings and miscellaneous site improvements.

1.3 LOCATION OF PROJECT

A. The project is located at the crossroads of SR7 and Mashel Prairie Road E, approximately 1-mile south along Mashel Prairie RD E on the west. The addresses associated with the project include:

Nisqually State Park - Maintenance Building: 44280 Mashel Prairie RD E Eatonville, WA 98328

1.4 TECHNICAL QUESTIONS

A. Direct project questions to:

Jonah Hayes, PLA, Owner's Representative at:
Robert W. Droll, Landscape Architect, PS
4405 7th Avenue SE
Lacey, WA 98503
Phone: (360) 456-3813,
e-mail: jonah@rwdroll.com

1.5 PRE-BID PROJECT SITE TOUR

DATE:	Wednesday, June 4, 2025
TIME:	10:00 AM - Noon
LOCATION:	Nisqually State Park - Maintenance Building: 44280 Mashel Prairie RD E Eatonville, WA 98328

1.6 BID OPENING

A. Bidders must be registered as vendors through the MRSC Bonfire Procurement Portal https://mrscrosters.bonfirehub.com/portal, which is free to sign up for, before submitting their bids electronically through the State Parks Public Opportunities section of the same portal. All bids must be submitted using the Bid Proposal Form, provided as part of the electronic bid documents. Submissions must fully comply with the requirements outlined in Sections 3.1 and 4.1 of the Instructions to Bidders. Bids are due at 1:00 p.m., Tuesday, June 24, 2025. Late submissions will not be accepted.

B. The Agency does not guarantee a specific timeframe for the public release of bid results; however, they are typically available within three business days of the bid opening, often on the same day. Bid results can be accessed through the MRSC Bonfire Procurement Portal https://mrscrosters.bonfirehub.com/portal and public notices. Additionally, they may be available on the Washington State Parks website at www.parks.wa.gov/contracts under "Construction Projects – Public Works Bid Results." Bid results may also be shared through Plan Centers, but Bidders should note that the State Parks Public Opportunities - MRSC Rosters Bonfire Procurement Portal serves as the official release point for the Bid Tabulation or Bid Record for this solicitation.

C. The Agency reserves the right to accept or reject all bids and to waive informalities. The Bidder will allow 60 days from bid opening date for acceptance of its bid by the Agency.

1.7 COVID 19

A. COVID-19 Refer to the Department of Labor & Industries website for requirements regarding any safety plans needed. Novel Coronavirus Outbreak (COVID-19) Resources (wa.gov)

1.8 FOR INFORMATION ON:

A. Bidder Responsibility: Bidder responsibility will be evaluated for this project. In determining bidder responsibility, the Agency will consider an overall assessment of the criteria outlined in Division 00 – Instructions to Bidders.

For any questions regarding this topic, please contact the Project Representative or submit a vendor discussion through the State Parks Public Opportunities - MRSC Bonfire Procurement Portal https://mrscrosters.bonfirehub.com/portal. To ensure consideration, all inquiries must be received at least seven (7) working days before the bid opening date.

B. Reciprocal Preference: See Instructions to Bidders 11.1 Reciprocal Preference for Resident Contractors.

C. Apprenticeship Requirements: For projects estimated at or over $1,000,000, Apprenticeship Participation, Mandatory 15 percent apprentice labor, see Instructions to Bidders 5.1B Apprenticeship Participation.

D. Subcontractor Listings: When the base bid combined with any alternates totals $1,000,000 or more, the Bidder must list the Subcontractors they intend to use for structural steel, rebar installation, heating, ventilation, and air conditioning (HVAC), plumbing, and electrical work on the Subcontractor Utilization List form for this project, see Instructions to Bidders 5.1A Subcontractor Listing.

E. MWBE goals: See Instructions To Bidders 12.1 Minority And Women's Business Enterprise (MWBE) Utilization. For Veteran-Owned and Small Business utilization, see Instruction to Bidders 12.2.

F. Modification of Bid: See Instructions to Bidders 6.3 Modification of Bid.

G. Withdrawal of Bid: See Instructions to Bidders 6.4 Withdrawal of Bid.

H. Bid Guarantee: See Instructions to Bidders 4.1 Bid Bond. No particular bid bond form is required.

I. Bid Tabulation and Bid Record: See Instructions to Bidders 7.1B for Bid Tabulation, Bid Record, and Announcement of Apparent Low Bid.

J. Records Request: All submitted bids are subject to public records request once the lowest bidder has been determined and officially announced. See Instructions to Bidders 7.1D Records Request.

1.9 ACCESSIBILITY

A. Sites may not be fully accessible to people with disabilities. Please contact the Project Representative at least five (5) days prior to scheduled pre-bid tour if special accommodation is required for your attendance.

END OF SECTION

1.1 BIDDER DEFINED

A. A "*Bidder*" is an entity or person who submits a bid proposal for the work described in the contract documents.

B. The Bidder must be registered with the Washington State Department of Labor and Industries in accordance with RCW 18.27.020. The contractor registration number, expiration date, Uniform Business Identifier (UBI) number, and federal tax identification number must be entered in the applicable spaces on the Bidder Compliance Form within the Bid Proposal Form.

2.1 EXAMINATION OF THE WORK SITE AND BIDDING DOCUMENTS

A. Bidder acknowledges that it has taken steps necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and road; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during the work.

The bidder also acknowledges that it has satisfied itself as to character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including exploratory work done by the Agency, as well as from the drawings and specifications made a part of this contract. Any failure of the Bidder to take the actions described and acknowledged in this paragraph will not relieve the Bidder from responsibility for estimating properly the difficulty and cost of successfully performing the work.

B. No statement by any officer, agent, or employee of the Agency pertaining to the physical conditions of the site of the work will be binding on the Agency other than those statements issued in the contract documents.

C. Bidders shall promptly notify the Agency of ambiguities, inconsistencies, or errors, if any, which they may discover upon examination of the Bidding Documents or of the site and local conditions.

D. Interpretations and Clarifications

1) Prospective Bidders seeking clarification or interpretation of the solicitation, drawings, or specifications must submit a written request to the Project Representative listed in the Invitation to Bid or through the **State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal** https://mrscrosters.bonfirehub.com/portal by submitting a vendor discussion. Requests must be received at least seven (7) working days prior to the bid deadline to be considered.

2) Any Agency responses that do not modify the Scope of Work outlined in the contract documents may be posted on the State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal prior to the bid submission deadline. Such clarifications will not be considered part of the contract documents and do not need to be acknowledged by Bidders in their Bid Proposal Form. The Agency retains sole discretion to determine whether a clarification or interpretation affects the Scope of Work and requires inclusion in the Contract Documents.

3) Changes to the Scope of Work or schedule described in the contract documents will only be issued as written ADDENDA.

4) Oral interpretations or clarifications are not legally binding.

E. Substitutions

1) The product, equipment, materials, or methods described or noted within the Bidding Documents, whether currently available or not, are to establish a standard of quality, function, appearance and dimension. A proposed substitution shall have equal attributes in all respects.

2) No substitution will be considered unless a written request for approval is submitted by the Contractor, after Award, in accordance with the applicable provisions of Section 012500 of the specifications. If no Section 012500 is available, then see section 016000 Product Requirements, sub-section 1.5. Each such request shall describe the proposed substitution in its entirety including name of the material or equipment, drawings, catalog cuts, performance or test data and all other information required for an evaluation. The submittal shall also include a statement noting all changes required in adjoining, dependent or other interrelated work necessitated by the incorporation of the proposed substitute. The Bidder shall bear the burden of proof of merit of the proposed substitution. The Project Representative's decision of approval or disapproval of a proposed substitution shall be final.

3.1 BID PROPOSAL

A. Bidders must be registered as vendors through the **MRSC Rosters Bonfire Procurement Portal** https://mrscrosters.bonfirehub.com/portal. All bid submissions must be made through the State Parks Public Opportunities section on the same portal. The individual who signs and submits the bid through the Bonfire Portal must be an authorized designee responsible for the bid submission.

B. All bidders for Small Works Projects must be currently registered on the MRSC Small Works Roster (vendor list) found http://mrscrosters.org/.

C. Bidders are required to submit bid prices electronically through the **State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal**. Submissions must be completed using the Bid Proposal Form, provided as part of the electronic bid proposal documents. The Bid Proposal Form is a spreadsheet consisting of four tabs:

1. Bidder Compliance Form
2. Bid Form
3. MWBE
4. Subcontractor Utilization (if applicable)

All fields in the Bid Proposal Form tabs must be properly and completely filled out to ensure compliance. Failure to fill in all required fields may result in the bid being deemed non-responsive.

The Bidder Compliance Form must include the Bidder's full and complete address and information, typed in the spaces provided. The Bid Form must be electronically signed in the firm's name, and a typewritten name is acceptable as an electronic signature, provided it complies with electronic submission requirements.

Once the Bid Proposal Form is completed, it must be uploaded in its original form to the appropriate section of the State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal https://mrscrosters.bonfirehub.com/portal. Bidders are reminded to thoroughly review their submission before uploading to ensure compliance with all instructions and requirements. Incomplete submissions will be deemed non-responsive.

D. Except as otherwise provided in these instructions, bid proposals that are incomplete, or that are conditioned in any way, or that contain alterations, or items not called for in the contract documents, or that do not conform to the call for bids, may be rejected as non-responsive at the discretion of the Agency unless the law requires that the omission be deemed non-responsive, in which case the bid will be rejected as non-responsive. Only the amounts and information asked for on the Bid Proposal Form and the plans and specifications furnished will be considered as the bid. Bid amounts include all taxes imposed by law, **except** for Washington Sales Tax unless noted otherwise.

E. Each Bidder must submit their bid exactly as specified and as provided in the Bid Proposal Form. Bidders are required to include bids for all alternates if alternates are indicated on the Bid Form. For alternates that have no charge, the Bidder must type "**$0.00**" in the column for the unit price on the Bid Form.

F. Bidders shall acknowledge receipt of any ADDENDA to the solicitation for bids on the Bid form. Failure to do so may result in the bid being declared non-responsive.

G. Substitute bid forms will not be considered unless this solicitation authorizes their submission.

H. The bid prices listed in the Bid Form must include all labor, materials, equipment, overhead, and compensation necessary to complete the work for each item, while the costs for the building permit and public utility hookup fees will either be reimbursed directly to the Contractor or paid by the Agency to the permitting agency and therefore should not be included in the bid amount.

I. The low Bidder, for purposes of award, shall be the responsive and responsible Bidder offering the low aggregate amount for the base bid item, plus additive or deductive bid alternates selected by the Agency, and within funds available for the project. The Bidder agrees to hold all bid alternate prices for sixty (60) days from date of bid deadline.

4.1 BID GUARANTEE: BID BOND

A. A bid bond is not required when the total bid amount, including the base bid and all additive alternates, is $35,000 or less. In such cases, instead of providing a bid bond, Bidders must complete and upload the **Bid Bond Requirement Statement** as part of their bid submission. This ensures compliance with the bidding requirements for projects below the $35,000 threshold.

B. When the sum of the base bid plus all additive alternates is greater than $35,000.00, a bid guarantee in the amount of 5% of the base bid amount is required. Failure of the Bidder to provide bid guarantee when required shall render the bid non-responsive.

C. Acceptable forms of bid guarantee are: A bid bond. A scanned copy (e.g., PDF) of the bid bond must be uploaded to the State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal (https://mrscrosters.bonfirehub.com/portal) along with your bid response to the Agency. See also, Section 6.1 SUBMISSION OF BID.

D. The Bidder will allow 60 days from bid deadline for acceptance of its bid by the Agency.

E. Should the successful Bidder fail to enter into a contract and furnish a satisfactory performance bond within 15 days after receiving properly prepared contract forms from the Agency, the bid bond may be forfeited as liquidated damages for advertisements and administration of bid procedures. Additionally, the Agency reserves the right to terminate the contract award.

F. Bid bonds must be held for the three low bids for 30 days or until a contract is executed with the successful Bidder. All other bid bonds will be released or returned to the Bidders within 15 days of the bid deadline.

5.1 REQUIREMENTS FOR PROJECTS ESTIMATED AT $1,000,000 OR MORE

A. SUBCONTRACTOR LISTING

Pursuant to RCW 39.30.060, if the base bid combined with the sum of the alternates exceeds one million dollars ($1,000,000.00) or more for the construction, alteration, or repair of any public building or public work of the state shall require each Bidder to submit as part of the bid the names of subcontractors with whom the Bidder, if awarded the contract, will subcontract for performance of the work of heating, ventilation and air conditioning, plumbing, and electrical, structural steel installation, rebar installation or to name itself for the work. The Bidder shall not list more than one subcontractor for each category of work identified, unless subcontractors vary with bid alternates, in which case the Bidder must indicate which subcontractor will be used for which alternate.

Subcontractor listing is not required for Small Works Projects under $350,000.

Failure of the Bidder to submit as part of the bid, the names of such subcontractors, or to name itself to perform such work, or the naming of two or more subcontractors to perform the same work, or failure to sign the form shall render the bid as non-responsive and therefore void.

B. APPRENTICESHIP PARTICIPATION

In projects estimated to cost one million dollars ($1,000,000.00) or more, be aware that the following requirements will be part of the resulting contract.

Apprenticeship requirements do not apply to Small Works Projects estimated below $350,000.

In accordance with RCW 39.04.320 (Apprenticeship Training Programs), for all public works estimated by the Agency Project Engineer to cost **one million dollars or more,** the state of Washington requires no less than **15% of the labor hours be performed by apprentices.** A contractor or subcontractor may not be required to exceed the 15% requirement. The bid advertisement and Bid Proposal Form shall establish a minimum required percentage of apprentice labor hours compared to the total labor hours. The project's apprenticeship utilization rate is calculated using the approved affidavits from the L&I portal.

1. **Incentives** - The Contractor who meets or exceeds this utilization requirement on eligible contracts, will be awarded a monetary incentive described in the Apprentice Utilization Requirements section of the Bid Proposal Form.

2. **Penalties** - The Contractor who fails to meet the utilization requirement and fails to demonstrate a Good Faith Effort, as outlined below, is subject to penalties described in the Apprentice Utilization Requirements section of the contract Bid Proposal Form. Contractor will receive an invoice payable to the Agency within 30 days. The contractor will have 30 days to pay the penalty invoice at the time of receipt before the penalty is considered outstanding. Contractors with outstanding apprenticeship penalties may be considered non-responsive.

3. **Cost Value** - The expected cost value associated with meeting the goal is included in the Base Bid as described on the Bid Proposal Form.

4. **Utilization Plan** - The Contractor shall provide an Apprentice Utilization Plan (Plan) demonstrating how and when they intend to achieve the Apprenticeship Utilization Requirement. The Plan shall have enough information to track the Contractor's progress in meeting the utilization requirement. The Contractor shall submit the Plan on the Apprentice Utilization Plan template within 10 business days of Notice to Proceed of the contract and prior to submitting the first invoice. The Contractor shall provide an updated Plan during the course of construction when there are significant changes to the Plan which may affect their ability to meet the requirement.

   a) The Plan shall be uploaded to the Department of Labor & Industries' (L&I): ***Prevailing Wage Intents and Affidavit (PWIA) system on L&I's website.***

   b) The Plan is not submitted for approval.

   c) It is expected that the Contractor will actively seek out opportunities to meet the Apprentice Utilization Requirement during construction even if the Plan indicates a shortfall in meeting the requirement.

   d) If the Plan indicates that the Contractor will not attain the Apprentice Utilization Requirement, then Contractor must submit "Good Faith Effort" (GFE) documentation with their Plan to L&I's PWIA system.

C. APPRENTICESHIP - GOOD FAITH EFFORT (GFE)

1. **Good Faith Effort (GFE)** documentation shall describe in detail why the Contractor is not or was not able to attain the Apprentice Utilization Requirement.

   a) Contractors may submit Good Faith Effort (GFE) documentation at any time during the construction.

   b) All GFE documentation must be submitted no later than 30 days before substantial completion.

   c) Only the awarding Agency can approve GFEs. The Department of Labor & Industries (L&I) may provide assistance but does not have approval authority

   d) The Awarding Agency must document its GFE decision in writing, including any monetary penalty if denied.

e) Good Faith Effort (GFE) documentation must be in signed letter format uploaded to the PWIA system and include:

1. The contract number, title and the apprentice utilization requirements,

2. The amount of apprentice labor hours the contract can or did attain along with the percentage of labor hours,

3. Contractors may receive a GFE credit for graduated Apprentice hours through the end of the calendar year for all projects worked on as long as the Apprentice remains continuously employed with the same Contractor they were working for when they graduated. If an Apprentice graduates during employment on a project of significant duration, they may be counted towards a GFE credit for up to one year after their graduation or until the end of the project (whichever comes first). Determination of whether or not Contract requirements were met in good faith will be made by subtracting the hours from the journeyman total reported hours for the project and adding them to the apprentice hour total. If the new utilization percentage meets the Contract requirement, the Contractor will be reported as meeting the requirement in good faith,

4. Anticipated or actual shortfall (in apprentice labor hours and percentage) and the reason(s) for not attaining the required apprentice labor hours,

5. Information from one or more of the following areas:

   (a) Names of any State-Approved Apprentice Training Programs contacted with the name(s) of person(s) contacted and dates of contacts, and a copy of each response from the Training Program(s),

   (b) Reference Contract Specifications or documents that affected the Contractor's ability to attain apprentice utilization,

   (c) Discuss efforts the Contractor has taken to require Subcontractors to solicit and employ apprentices,

6. Backup documentation to the letter consisting of the following:

   (a) Letters, emails, phone logs including names dates and outcomes, posters, photos, payrolls, timecards, schedules, copies or references to other contract specifications or documents.

Additional Resource Information

(a) For questions regarding how to complete the Apprentice Utilization Plan template or Good Faith Effort documentation, please contact the Project Manager listed in the Bid Advertisement.

(b) Step-by-step instructions on how to access and navigate the L&I's PWIA system, including uploading required documents can be found on the L&I website.

(c) Additional information about apprentice utilization on Public Works Project can be found on the L&I website.

6.1 SUBMISSION OF BID

A. Bids must be submitted on or before the time as specified in the Invitation to Bid.

B. Bid responses will only be accepted electronically through the State Parks Public Opportunities section using the MRSC Rosters Bonfire Procurement Portal as specified in the Invitation to Bid. https://mrscrosters.bonfirehub.com/portal.

C. People with disabilities who wish to request special accommodation, (e.g., sign language interpreters, braille, etc.) need to contact the Agency ten (10) working days prior to the scheduled bid deadline.

D. In the event the MRSC Rosters Bonfire Procurement Portal is unavailable to all users at the bid submittal deadline, the Agency will contact the Bidders within 24 hours and the Agency will extend the bid submittal time.

E. Neither Agency nor MRSC Rosters Bonfire Procurement Portal can guarantee the availability of Internet connectivity or related telecommunication and hosting services and will not be liable or responsible if the Bidder and its representative(s) or designee(s) cannot connect to the MRSC Rosters Bonfire Procurement Portal.

F. The Bidder must comply with the MRSC Rosters Bonfire Portal's Terms of Service (https://gobonfire.com/termsservice/) when submitting the Bid through the MRSC Rosters Bonfire Procurement Portal.

6.2 BID CLOCK:

A. After the 1 P.M. bid deadline, which serves as the official bid clock to determine timely submission, Agency staff will review the bids. The MRSC Rosters Bonfire Procurement Portal does not permit submissions after the deadline, so bidders must ensure their bids are submitted on time. Late submissions will not be accepted under any circumstances.

B. CAUTION: To avoid issues, submit your bid response electronically well in advance of the deadline to account for potential technological delays, slow-downs, or malfunctions. Bids received after the deadline, regardless of the reason or responsibility, will be rejected.

6.3 MODIFICATION OF BID

A. Bidders may update their bid electronically via the MRSC Rosters Bonfire Procurement Portal before the bid due date.

Modifying: Modifying refers to altering information already contained in a submitted bid. If your submission has been finalized but needs modifications, you may update it electronically before the bid due date by navigating to the Submissions page and un-submitting your submission.

NOTE: Un-submitting removes your original bid, so ensure you resubmit before the deadline. Only upload updated files; unchanged files remain in place. A new confirmation email will be sent upon resubmission.

6.4 WITHDRAWAL OF BID

A. Withdrawal refers to a bid that has already been submitted to the Agency. A bid response may be withdrawn electronically by the Bidder's authorized representative before the Bid Deadline (due date) for the bid. The FAILURE TO WITHDRAW a bid prior to the bid due date deadline exposes the Bidder to the possibility that the Agency will make a demand against the Bidders bid bond.

B. Procedure for Withdrawing a Bid After Bid Deadline Due to Error: If a Bidder discovers an error in its bid following the bid deadline, the Bidder must submit written notification of the withdrawal to contracts@parks.wa.gov within 24 hours following the bid deadline. Follow the example subject line. Example email subject line: SW-C9999 Withdraw Bid ACME Construction Inc.

- The Bidder must provide written documentation of the claimed error to the satisfaction of the Agency within 72 hours following the bid deadline.

- The Agency will approve or disapprove the request for withdrawal of the bid in writing. If the Bidder's request for withdrawal of its bid is approved, the Bidder will be released from further obligation to the Agency without penalty. If it is disapproved, the Agency may retain the Bidder's bid bond.

6.5 REJECTION OF BID

A. The Agency reserves the right to reject any or all bids and to waive informalities in connection with the bids.

7.1 BID EVALUATION AND AWARD OF CONTRACT

A. Award of contract will be made by the Agency based upon any combination of the base bid and alternates that, in the Agency's sole discretion, is in the Agency's best interest considering price, schedule, and other factors. The numbering of the alternates in the bid proposal bears no relationship to the order in which the alternates may be selected by the Agency. Additionally, the Agency reserves the right to negotiate base bid prices (including changes to the contract plans and specifications) with the low responsive, responsible Bidder to bring the final contract amount within the funds available per RCW 39.04.015.

B. BID TABULATION, BID RECORD AND ANNOUNCEMENT OF APPARENT LOW BID:

The Agency does not guarantee when the Bid results will be released to the public. The bid results are usually released within three business days of the bid deadline and often the same day. Bid results can be obtained from MRSC Rosters Bonfire Procurement Portal (https://mrscrosters.bonfirehub.com/portal) and viewing public notices. Bid Results may also be obtained by accessing the Washington State Parks webpage at www.parks.wa.gov/contracts (see "Construction Projects- Public works bid results"). The Bid results may also be released through the Plan Centers. But, Bidders are cautioned that the State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal is the official release point for the Bid Tabulation or Bid Record for this solicitation.

The bid tabulation will identify all bids received by the Agency. Bids that were not rejected and not withdrawn prior to the bid deadline will be ranked by base bid price. The first three lowest base bids will reflect detailed pricing information. The remaining Bidders will reflect only the base bid pricing. Bids that were rejected for any reason will reflect **Non-Responsive** in the bid tabulation but may include its total pricing.

The bid record will list all bids received, ordered alphabetically. Rejected bids will not show detailed pricing. The bid record is used for projects with Alternates. The Agency may consider Alternate Bid Items in any combination. The low Bidder for award purposes is the responsive Bidder offering the lowest aggregate amount for the base bid plus selected alternates, within available project funds.

Release of the Bid Tabulation or Announcement of the Apparent Low bid information that a Firm was identified as the apparent low base bid simply means that at this point in time the Agency believes the subject bid was the lowest cost responsive bid, but designation as the apparent low responsive bid is not a guarantee of a contract with the Agency. The Agency reserves the right to reevaluate the bid and determine whether the bid was responsive and responsible and successful as first thought. The Bidder identified as the apparent low responsive bid is cautioned not to commit funds, resources, and effort prior to receiving an actual executed contract. The Bidder identified as the apparent low responsive bid that commits funds, resources, and effort prior to a contract do so at its own risk and peril.

Within two (2) business days following the day of the release of the Bid Tabulation/Bid Record or the Announcement of the Apparent Low bid, the Bidder may file a Protest (Protest procedures are outlined in Section 9.1).

C. REJECTION LETTER & PROTEST: No matter the phase of the evaluation, if the Agency determines that the bid is not responsive or the Bidder is not responsible, the Agency will reject the bid/bidder, and send the bidder a Rejection Letter explaining why the bid/bidder was rejected. Within two (2) business days following the day of the release of the Rejection Letter, the Bidder may file a Protest, provided it meets one of the three (3) protest grounds (Protest procedures are outlined in Section 9.1 E.). The Rejection Letter will be sent by email/email attachment to the email address provided by the Bidder in the Bidder's bid response.

D. RECORDS REQUEST: All submitted bids are subject to public records request once the lowest bidder has been determined and officially announced.

After the announcement of the lowest bidder, any member of the public may request access to the bid documents. No official format is required for making a records request; however, the Agency recommends that requests be made through the Public Records Request Center on our website:https://parks.wa.gov/about/contact-us/public-records-requests.

E. The intent of the Agency is to award a contract to the low responsive, responsible bidder.

8.1 RESPONSIVE AND RESPONSIBLE BIDDER

A. The Agency will evaluate bids responsiveness and responsibility in the MRSC Rosters Bonfire Procurement Portal https://mrscrosters.bonfirehub.com/portal.

B. RESPONSIVE - A bid will be considered responsive if its electronic response meets the following requirements:

1. It is received at the proper submittal time, date and location online through the State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal.

2. It meets the required requested information of the Bid Proposal Form through the State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal.

3. It meets the requirements as stated in section 3.1. of the Instructions To Bidders.

4. It is submitted by a licensed/registered contractor within the state of Washington at the time of bid deadline and is not banned from bidding by the Department of Labor and Industries.

5. It is accompanied by a bid guarantee, if required.

If inconsistencies or errors are noted in the bid proposal prices, the **unit and lump sum prices have precedence over their total amounts**; and the **total amounts have precedence over the total base bid**.

The apparent low Bidder, for purpose of award, is the responsive and responsible Bidder offering the low aggregate amount for the base bid plus selected additive or deductive bid alternates and meeting all other bid submittal requirements.

C. RESPONSIBLE – Before award of a public works contract, a Bidder must meet the following **mandatory responsibility criteria** under RCW 39.04.350 (1) & (2) to be considered a responsible Bidder and qualified to be awarded a public works project. The individual who has signed/submitted the Bid through the State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal shall be the authorized designee responsible for bid submissions. The Bidder must:

1. At the time of bid submittal, have a certificate of registration in compliance with RCW 18.27, a plumbing contractor license in compliance with RCW 18.106, an elevator contractor license in compliance with RCW 70.87, or an electrical contractor license in compliance with RCW 19.28 as required under the provisions of those chapters;

2. Have a current state Unified Business Identifier (UBI) number;

3. If applicable, have industrial insurance coverage for the Bidder's employees working in Washington as required in RCW 51; an employment security department number as required in RCW 50; and a state excise tax registration number as required in RCW 82;

4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3);

5. If bidding on a public works project subject to the apprenticeship utilization requirements in RCW 39.04.320, not have been found out of compliance by the Washington State Apprenticeship and Training Council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under Chapter 49.04 RCW for the one-year period immediately preceding the date of the bid solicitation; and

6. Public Works and Prevailing Wage Training/Exemption. Bidders shall have received training on the requirements related to public works and prevailing wage under this chapter and chapter 39.12 RCW. The bidder must designate a person or persons to be trained on these requirements. The training must be provided by the department of labor and industries or by a training provider whose curriculum is approved by the department. The department, in consultation with the prevailing wage advisory committee, must determine the length of the training. Bidders that have completed three or more public works projects and have had a valid business license in Washington for three or more years are exempt from this subsection. The department of labor and industries must keep records of entities that have satisfied the training requirement or are exempt and make the records available on its website. Responsible parties may rely on the records made available by the department regarding satisfaction of the training requirement or exemption.

https://lni.wa.gov/licensing-permits/public-works-projects/contractors-employers/contractor-training

7. Within the three-year period immediately preceding the bid solicitation, not have been determined by a final a binding citation and notice of assessment issued by the department of labor and industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of Chapters 49.46, 49.48, or 49.52 RCW. By signing the Bid Proposal Form, the bidder verifies under penalty of perjury, pursuant to RCW 9A.72.085. that the bidder is in compliance with this subsection

8. **Supplemental Responsibility Criteria**: In addition to the mandatory Bidder responsibility, the Agency may adopt relevant supplemental criteria for determining Bidder responsibility applicable to a particular project which the Bidder must meet (RCW 39.04.350 (3)).

   a. If applicable, the Agency shall consider an overall accounting of the attached supplemental criteria for determining Bidder responsibility "DIVISION 00 SUPPLEMENTAL RESPONSIBILITY CRITERIA".

   b. At least seven (7) days prior to the bid submittal deadline, a potential Bidder may request that the Agency modify the supplemental responsibility criteria. The Agency will evaluate the information submitted by the potential Bidder and respond before the bid submittal deadline. If the evaluation results in a change of the criteria, the Agency will issue an ADDENDA to the bidding documents identifying the new criteria. The Addendum will be posted as a public notice in the State Parks Public Opportunities-MRSC Rosters Bonfire Procurement Portal.

   c. Upon the Agency's request, the apparent low Bidder must supply the requested responsibility information within two (2) business days of request by the Agency. Withholding information or failure to submit all the information requested within the time provided may render the bid non-responsive and the bid/Bidder may be rejected by Rejection Letter. The rejection is specific to this project and will have no effect on other or future projects.

   d. The Agency will not execute a contract with any other Bidder until two (2) business days after the Bidder determined to be not responsible has received the rejection letter.

9.1 PROTEST PROCEDURES

A. GENERAL:

This protest process is a courtesy provided by the Agency and it is not governed by Washington's Administrative Procedures Act (APA), RCW 34.05, nor does it confer any additional rights above and beyond what the Bidder already enjoys as a taxpayer. The purpose of this process is to allow the Agency to correct evaluation process errors and problems before a contract is executed.

Only a Bidder may file a protest regarding this solicitation.

The Bidder must strictly adhere to the protest process as set forth herein, the failure of which may result in a summary determination that the protest is without merit without an opportunity to cure.

B. FORM AND CONTENT:

All protests must:

- Be in writing.
- The protest must state and clearly articulate the grounds for the protest with specific facts and complete statements of the action(s) being protested.
- A description of the relief or corrective action being requested should also be included.
- All protests shall be addressed to the Procurement Coordinator.

C. CONTENT LIMITATIONS:

The Agency does not currently mandate any page limitation. However, the protest must be clearly articulated, succinct, organized, logical, and professional.

The Agency will reject protests that:

- fail to state and clearly articulate at least one of the three GROUNDS;
- contain rants, attacks, and/or disparaging or abusive remarks;
- include multiple attachments or references (document dumping, document overload); or,
- appear to require the reader piece together voluminous amounts of material to decipher the argument being made.

D. SUBMISSION OF PROTEST:

- All protests must be submitted within two (2) business days following the day of the release of the Bid Tabulation/Announcement of the Apparent Low bid or after the formal Rejection Letter is sent. For purposes of timing the day of the release of the Bid Tabulation or the day of the Rejection Letter is sent to the Bidder shall not count.
- Bidders must send all protests to: contracts@parks.wa.gov. See also Subject Line.
- SUBJECT LINE: Must include the bid's identification number, and "PROTEST" in the subject line. Failure by the Bidder to include this information in the subject line may result in Bidder's protest not being timely recognized.

E. GROUNDS WHICH MAY BE PROTESTED:

- Conflict of Interest on the part of Agency staff.
- Errors in computing the score.
- Non-compliance with procedures described in the procurement document.

Protests will be rejected as without merit if they do not clearly and convincingly meet one of the GROUNDS above and/or seems to address issues such as:

- An evaluator's professional judgment on the quality of a response, or
- The Agency's assessment of its own and/or other agencies' needs or requirements, or,
- Issues, concerns, objections, or requests for changes that were or could have been addressed prior to the bids due date deadline.

Protests that do not clearly and convincingly meet the requirements and standards described herein are without merit and may be rejected.

F. MANAGER ASSIGNMENT AND REVIEW:

Upon receipt of a protest that meets the requirements described herein, a protest review will be held by the Agency. The Agency will assign a Manager. The Manager is responsible for reviewing and investigating the Bidder's written protest and may meet with agency staff or the agency program that was involved in the solicitation. The Manager may consider the record and all reasonably available facts and will issue a protest determination in writing within fifteen (15) business days from receipt of the protest. If additional time is needed, the Manager will notify the protesting party of the need for additional time within 15 business days from receipt of the protest.

In the event a protest may affect the interest of another Bidder that submitted a response, the Agency may reach out to that Bidder, may provide an unedited copy of the protest to that Bidder, and may invite that Bidder to submit its views and any relevant information on the protest to the Manager.

G. PROTEST DETERMINATION AND FINDINGS AND DISSEMINATION:

The Manager's protest determination may:

- Find the protest lacking in merit and reject the protest;
- Find only technical or harmless errors in the Agency's acquisition process and determine the Agency to be in substantial compliance and reject the protest; OR
- Find merit in the protest and provide THE AGENCY options which may include:
    - Correcting the errors and re-evaluating all responses;
    - Canceling the solicitation and possibly for a new solicitation to take place; OR
    - Making other findings and determining other courses of action as appropriate.

If the Agency rejects the protest, the Agency will enter into a contract with the Apparent Successful Bidder no sooner than two (2) business days after issuance of the protest determination by email to the protesting party at the email address indicated on the party's bid documents. For the purposes of timing, the date the protest determination is sent to the protesting party shall not count.

Dissemination: The Agency will disseminate the decision to all interested Bidders vie email/email attachment to the email address provided by the Bidder in the Bidder's bid response.

H. AGENCY DECISION IS FINAL:

The Manager's protest determination constitutes the agency's final decision regarding the protest. If the protesting party disagrees with the protest determination, the Bidder may seek judicial relief in the Washington Superior Court for Thurston County within two (2) business days of the issuance of the protest determination.

I. STRICT COMPLIANCE

Strict compliance with these protest procedures is essential in furtherance of the public interest. Any aggrieved party that fails to comply strictly with these protest procedures is deemed, by such failure, to have waived and relinquished forever any right or claim with respect to alleged irregularities in connection with the solicitation or award of the Contract. No person or party may pursue any judicial or administrative proceedings challenging the solicitation or award of this Contract, without first exhausting the administrative procedures specified herein.

J. REPRESENTATION

An aggrieved party may participate personally or, if a corporation or other artificial person, by a duly authorized representative. Whether or not participating in person, an aggrieved party may be represented, at the party's own expense, by counsel.

K. COMPUTATION OF TIME

In computing any period of time prescribed by this procedure, the day of the act or event from which the designated period of time begins to run is not included. The last day of the period is included. The term "business day" does not include Sunday, Saturday, or Washington State recognized holiday.

L. ACKNOWLEDGEMENT

By submitting a bid in response to this solicitation, the Bidder acknowledges that it has reviewed and acquainted itself with the bid protest procedures herein and agrees to be bound by such procedures as a condition of submitting a bid.

10.1 EXECUTION OF CONTRACT

A. The successful bidder will be required to execute the contract and furnish performance bond and insurance certificate satisfactory to the Agency within 15 days after receiving properly prepared contract documents from the Agency.

11.1 RECIPROCAL PREFERENCE FOR RESIDENT CONTRACTORS

A. In accordance with RCW 39.04.380 the State of Washington is enforcing a Reciprocal Preference for Resident Contractors. Any public works bid received from a nonresident contractor from a state that provides an in-state percentage bidding preference, a comparable percentage disadvantage must be applied to the bid of that nonresident contractor.

A nonresident contractor from a state that provides a percentage bid preference means a contractor that:

a) is from a state that provides a percentage bid preference to its resident contractors bidding on public works contracts.

b) at the time of bidding on a public works project, does not have a physical office located in Washington.

The state of residence for a nonresident contractor is the state in which the contractor was incorporated or, if not a corporation, the state where the contractor's business entity was formed, and for an individual, the individual's state of residence.

All nonresident contractors will be evaluated for out of state bidder preference. If the state of the nonresident contractor provides an in-state contractor preference, a comparable percentage disadvantage will be applied to their bid prior to contract award.

This section does not apply to public works procured pursuant to RCW 39.04.155, 39.04.280, or any other procurement exempt from competitive bidding.

B. A Comparable Percentage Disadvantage (CPD) will be applied to the bid of that nonresident contractor. The CPD is the in-state contractor percent advantage provided by the contractor's home state. For the purpose of determining the successful bidder, multiply the Nonresident Contractor bid amount by the CPD. The "bid amount" is be the total of the base bid and all accepted alternate bid items. The CPD is added to the Nonresident Contractor bid amount which equates to the Nonresident Disadvantage Total. The Nonresident Disadvantage Total is compared to the Washington contractor bid amounts. The bidder with the lowest total is the successful bidder. See example below.

Alaska Nonresident Contractor Bid Amount	$100,000
Multiplied by the Alaska CPD	x 0.05
Alaska CPD Total	$ 5,000
Alaska Nonresident Contractor Bid Amount	$100,000
Alaska CPD Total	$ 5,000
Nonresident Disadvantage Total	$105,000*

* Note – If the Nonresident Disadvantage Total is lower than all other Washington contractor bid amounts, the Alaska Nonresident Contractor is the successful bidder and will be awarded a contract for the bid amount of $100,000.

If the Nonresident Disadvantage Total is higher than a Washington contractor bid amount, the successful Washington bidder will be awarded a contract for the bid amount.

12.1 MINORITY AND WOMEN'S BUSINESS ENTERPRISE (MWBE) UTILIZATION

In accordance with the legislative findings and policies set forth in Chapter 39.19 RCW, the State of Washington encourages participation in contracts by MWBE firms certified by the Office of Minority and Women's Business Enterprises (OMWBE). Participation may be either on a direct basis in response to this solicitation/invitation or as a subcontractor to a Bidder. However, unless required by federal statutes, regulations, grants, or contract terms referenced in the contract documents, no preference will be included in the evaluation of bids, no minimum level of MWBE participation is required as a condition for receiving an award, and bids will not be rejected or considered non-responsive on that basis. Any affirmative action requirements set forth in federal regulations or statutes included or referenced in the contract documents will apply.

WASHINGTON STATE PARK AND RECREATION COMMISSION
PUBLIC WORKS PROJECT

A. VOLUNTARY MWBE GOALS

1. The following voluntary numerical MWBE participation goals have been established for this solicitation:

   MBE 10% WBE 6%

2. These goals are voluntary, but achievement of the goals is encouraged. Bidders may contact OMWBE at http://omwbe.wa.gov/ to obtain information on certified firms.

B. REPORTING REQUIREMENTS

1. If any part of the contract, (including the supply of materials and equipment) is subcontracted using certified MWBE firms during completion of the work, then prior to final acceptance or completion of the contract or as otherwise indicated in the contract documents the Bidder shall submit a statement of participation indicating that MWBEs were used and the dollar value of their subcontracts.

2. The provisions of this section are not intended to replace or otherwise change the requirements of RCW 39.30.060. If said statute is applicable to this contract then the failure to comply with RCW 39.30.060 will still render a bid non-responsive.

C. RECORD KEEPING

1. The Bidder shall maintain, for at least three years after completion of this contract, relevant records and information necessary to document the level of utilization of MWBEs and other businesses as subcontractors and suppliers in this contract as well as any efforts the Bidder makes to increase the participation of MWBEs. The Bidder shall also maintain, for at least three years after completion of this contract, a record of all quotes, bids, estimates, or proposals submitted to the Bidder by all businesses seeking to participate as subcontractors or suppliers in this contract. The State shall have the right to inspect and copy such records. If this contract involves federal funds, Bidder shall comply with all record keeping requirements set forth in any federal rules, regulations, or statutes included or referenced in the contract documents

D. SUGGESTED EFFORTS TO INCREASE PARTICIPATION BY MWBEs

1. Bidders are encouraged to advertise opportunities for subcontractors or suppliers in a manner reasonably designed to provide MWBEs capable of performing the work with timely notice of such opportunities, and all advertisements shall include a provision encouraging participation by MWBE firms. Advertising may be done through general advertisement (e.g., newspapers, journals, etc.) or by soliciting bids directly from MWBEs.

2. Additional Voluntary Efforts. Bidders are encouraged to:

   (a) Break down total requirements into smaller tasks or quantities, where economically feasible, in order to permit maximum participation by MWBEs and other small businesses.

   (b) Provide interested MWBEs with adequate and timely information about plans, specifications, and requirements of the Contract.

(c) Establish delivery schedules, where the requirements of this contract permit, that encourage participation by MWBEs and other small businesses.

(d) Reduce bonding requirements where practicable.

(e) Utilize the services of available minority community organizations, minority contractor groups, local minority assistance offices, and organizations that provide assistance in the recruitment and placement of MWBEs and other small businesses.

3. The actions described in this section should supplement efforts to provide information to all qualified firms, and nothing in this section is intended to prevent or discourage the Bidders from inviting proposals for participation from non-MWBE firms as well as MWBE firms.

E. NON-DISCRIMINATION

1. Bidders shall not create barriers to open and fair opportunities for all businesses including MWBEs to participate in all State contracts and to obtain or compete for contracts and subcontracts as sources of supplies, equipment, construction and services. In considering offers from and doing business with subcontractors and suppliers, the Bidder shall not discriminate on the basis of race, color, creed, religion, sex, age, nationality, marital status, or the presence of any mental or physical disability in an otherwise qualified disabled person.

F. SANCTIONS

1. Any violation of the mandatory requirements of this part of the contract shall be a material breach of contract for which the Bidder may be subject to a requirement of specific performance, or damages and sanctions provided by contract, by RCW 39.19.090, or by other applicable laws.

12.2 VETERAN-OWNED BUSINESS AND SMALL, MINI, AND MICRO BUISNESS UTILIZATION

The State of Washington encourages participation in all of its contracts by Veteran-owned businesses (defined in RCW 43.60A.010) and located at:

http://www.dva.wa.gov/program/certified-veteran-and-servicemember-owned-businesses and Small, Mini and Micro businesses (defined in RCW 39.26.010) which have registered in WEBS at https://pr-webs-vendor.des.wa.gov/.

1. The following voluntary numerical WDVA and Small Business participation goals have been established for this solicitation:

   WDVA 5% Small Business 5%

2. These goals are voluntary, but achievement of the goals is encouraged. Bidders may search Washington Small Businesses registered in WEBS at:

   https://pr-webs-vendor.des.wa.gov/ and WA Veteran-owned Businesses at https://www.dva.wa.gov/veterans-their-families/veteran-ownedbusinesses/vob-search to obtain information on registered firms.

12.3 SUBCONTRACTOR PARTICIPATION MONITORING AND REPORTING

A. Once a contract is awarded through the solicitation or proposal process, the awarded Prime Contractor is obligated to complete the vendor registration in Access Equity. Access Equity is a secure online vendor management system (B2GNow). Confidential information (Tax ID, etc.) will not be published. Prime Contractors that have previously registered with B2Gnow for any public entity, must verify the system has updated information. Contractors can access the system at:

https://omwbe.diversitycompliance.com/ or through a direct link on the Office of Minority and Women's Business Enterprises (OMWBE) website at: https://omwbe.wa.gov/.

B. Each month during the contract, the Prime Contractor will report payments to ALL Subcontractors through the Access Equity system. This monthly reporting information includes total payment in dollars made to the Subcontractor, payment dates, and any additional information required to verify payment to Subcontractors. The Prime Contractor will enter this payment information into the Access Equity system, and the Subcontractors will verify this payment information in the system. Online training is available through the Access Equity/B2Gnow system. This requirement applies to both Prime Contractors and Subcontractors.

END OF INSTRUCTIONS TO BIDDERS

/ / / / /

Nisqually State Park
Phase 3A Maintenance Building and Wastewater Treatment Facility
NW-C1218B
https://mrscrosters.bonfirehub.com/portal
The Bidder will submit the Bid to State Parks Public Opportunities
MRSC Bonfire Procurement Portal

Bidder Compliance Form

Contractor Information

Person Signing Bid		**Firm Name**	
Title Person Signing		**Physical Address**	
Contractor Registration #		**City, State, ZIP**	
Taxpayer Identification #		**Phone #**	
Washington UBI #		**Cellular Phone #**	
WA ESD #		**Email Address**	

The Bidder Compliance Form verifies compliance with State of Washington Public Works Bid Laws and associated Project Documents. It highlights key project components and ensures acknowledgment. Failure to acknowledge this form within the Bid Form, as directed, will render the bid non-responsive. Acknowledging the form does not alter the bidder's obligation to comply with all contract documents if awarded the project.

Bidder's Declaration

The Bidder declares that they have carefully examined the site of the proposed work, the Drawings, Specifications and all of the conditions affecting the work. Therefore, the Bidder proposes to provide all labor, equipment, materials, and permits and to perform all work as required by, and in strict accordance with the Contract Documents as shown on the bid proposal form.

Bid Acceptance and Agency Discretion

The Agency reserves the right to accept or reject all bids and to waive informalities. The Bidder will allow 60 days from bid opening date for acceptance of its bid by the Agency.

Registration and Required Licenses

The Bidder is a registered contractor in compliance with Chapter 18.27 RCW. If applicable, as the prime contractor, the Bidder self-performing plumbing work holds the required licensure under Chapter 18.106 RCW. Similarly, if self-performing elevator work, the Bidder holds the necessary license in accordance with Chapter 70.87 RCW. Additionally, if the Bidder is self-performing electrical work, they are properly licensed under Chapter 19.28 RCW.

Time for Completion

Bidder agrees to complete project (including accepted alternates) in accordance with drawings and specifications within **365** calendar days from the date provided on the Notice to Proceed letter.

Liquidaded Damages

It is agreed that liquidated damages, in the amount of **$500.00**, shall be levied for each and every calendar day by which the completion of the work is delayed beyond the time fixed for completion or extension of the contract.

Nisqually State Park
Phase 3A Maintenance Building and Wastewater Treatment Facility
NW-C1218B
https://mrscrosters.bonfirehub.com/portal
The Bidder will submit the Bid to State Parks Public Opportunities
MRSC Bonfire Procurement Portal

Bid Form

Unit prices and estimated quantities shall be used to determine the Base Bid

These prices shall also be used to adjust the Contract in the event there is an increase or decrease in the estimated quantities. All costs shall be "in place" costs and complete, **excluding State Sales Tax**. In the event of an irregularity, the unit price prevails. The Agency reserves the right to make mathematical corrections of multiplication or addition errors on the bid form.

Trench Excavation Safety Provisions

If the contract contains any work which requires trenching exceeding a depth of four (4) feet, all costs for adequate trench safety systems shall be identified as a separate bid item in compliance with Chapter 39.04 RCW. The purpose of this provision is to ensure that the bidder agrees to comply with all relevant trench safety requirements of Chapter 49.17 RCW. This bid amount shall be considered part of the total base bid. **Include a lump sum dollar amount (even if the value is $0.00) to be considered responsive to the bid solicitation.**

Wage Certification

The bidder certifies under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct: within the three-year period immediately preceding the bid solicitation date, the bidder has not been a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

Base Bid Items (Be sure to include unit prices)

Schedule A — Maintenance Building Pumphouse and Utilities

Item No.	Description	Est Qty	Unit Type	Unit Price	Total Amount
A1	Trench Excavation Safety Provisions	1	L.S.		$0.00
A2	Mobilization	1	L.S.		$0.00
A3	Maintenance Building Pumphouse and Utilities	1	L.S.		$0.00
A4	Gravel Borrow	1313	C.Y.		$0.00
				Total Base Bid	**$0.00**

Schedule B — Wastewater Treatment Facility

Item No.	Description	Est Qty	Unit Type	Unit Price	Total Amount
B1	Trench Excavation Safety Provisions	1	L.S.		$0.00
B2	Mobilization	1	L.S.		$0.00
B3	Procurement of MBR Equipment Supply and System Start-Up	1	L.S.		$0.00

Item No.	Description	Est Qty	Unit Type	Unit Price	Total Amount
B4	Wastewater Treatment Facility	1	L.S.		$0.00
B5	Gravel Borrow	2963	C.Y.		$0.00
				Total Base Bid	**$0.00**

Apprentice Utilization Requirements

The apprentice labor hours required for this project are 15% of the total labor hours. The undersigned agrees to utilize this level of apprentice participation. A monetary incentive of $1,000.00 will be paid to the contractor meeting the apprentice utilization requirement. A monetary penalty will be applied to the contractor failing to meet the utilization requirement and failing to demonstrate a Good Faith Effort. The penalty will be $100.00 per percentage point not utilized.

Expected Apprenticeship Utilization cost value to be included in the bid associated with meeting the goals: $

Receipt of Addenda

List all addenda received, separated by commas (e.g., "1, 2, 3, 4"). Do not list only the final number (e.g., "4"). If no addenda, type "N/A." Failure to follow this may render your bid non-responsive.

Bid Acknowledgment and Compliance Certification

By signing and returning this form, you acknowledge compliance with the bid requirements. Failure to sign and submit this form will result in the bid being considered non-responsive.

/s/ Signature of Authorized Official
Typing your name can count as a signature.

Date

Nisqually State Park
Phase 3A Maintenance Building and Wastewater Treatment Facility
NW-C1218B
https://mrscrosters.bonfirehub.com/portal
The Bidder will submit the Bid to State Parks Public Opportunities - MRSC Bonfire Procurement Portal

MWBE, WA Small Business, Veteran-Owned Business Utilization Certification

The bidder certifies good faith efforts to provide opportunities to MWBEs, Small Businesses, and Veteran-Owned Businesses. If awarded, the bidder commits to utilizing these firms or approved substitutes on the project. If no such firms will be used, enter **"N.A." on the first line**.

	Firm Name, Address	Federal I.D. #	Type of Work	Certificate Number	MBE%	WBE%	Small Business%	Veteran Business%
1								
2								
3								
4								
				Totals	0.00%	0.00%	0.00%	0.00%

The bidder may add rows for additional MWBE/WA Small and Veteran-Owned Business Utilization Certifications.

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MRSC Bonfire Procurement Portal

Subcontractor Utilization List

Subcontractor Utilization List (If Applicable)

In compliance with the contract documents, the following subcontractor list is submitted:

SUBCONTRACTOR LISTING - RCW 39.30.060

If the base bid and the sum of the additive alternates is **ONE MILLION DOLLARS OR MORE**, the Bidder shall provide names of the subcontractors with whom the Bidder will directly subcontract for performance of the following work. If the Bidder intends to perform the work, the Bidder must enter its name for that category of work.

A. Submission Deadline: **The completed and signed Subcontractors List must be submitted with bid.**

B. List Subcontractors: The Bidder shall indicate on the Subcontractors List the names of the subcontractors with whom the Bidder, if awarded the contract, will directly subcontract for performance of the work of heating, ventilation, and air conditioning, plumbing as described in Chapter 18.106 RCW, electrical as described in Chapter 19.28 RCW, structural steel installation, and rebar installation.

C. List Bidder if Bidder Performing Work: If the Bidder will self-perform the work in any of the five areas required, the Bidder shall name itself for the work on the Subcontractors List.

D. Name Only One Firm for Each Category of Work: The Bidder shall not list more than one firm (subcontractor or Bidder) for each category of work identified, unless subcontractors vary with bid Alternatives or Additives, in which case the Bidder must indicate which firm will be used for which Alternate or Additive.

E. Substitution of Subcontractors: Substitution of any listed subcontractor may only be according to the procedure and parameters set forth in RCW 39.30.060.

F. Factors Relating to Non-Responsiveness: **Failure of the Bidder to submit the names of such subcontractors or to name itself to perform such work or the naming of two or more firms (subcontractors or Bidder) to perform the same work, or failure to sign the form shall render the Bidder's bid non-responsive and, therefore, VOID**.

G. The Subcontractor Utilization List is intended to discourage bid shopping, not to verify subcontractor qualifications. The Agency does not use the Subcontractor Utilization List as a tool to disqualify or qualify bidders.

H. Applicable to Direct Subcontractors: The requirement of this section to name the Bidders' proposed heating, ventilation and air conditioning, plumbing, electrical, structural steel installation, and rebar installation subcontractors applies only to proposed heating, ventilation and air conditioning, plumbing, electrical, structural steel installation, and rebar installation subcontractors who will contract directly with the Bidder.

1 HVAC. Electrical, Plumbing: The requirement of this section to name the bidder's proposed heating, ventilation and air conditioning, plumbing and electrical subcontractors applies only to proposed heating, ventilation, and air conditioning, plumbing and electrical subcontractors who will contract directly with the

Category of Work	Bidder MUST check one box for each Category of Work. If subcontracting the work, bidder must name the subcontractor
HVAC (Heating, Ventilation & Air Conditioning)	☐ Name of Subcontractor: _____ ☐ Bidder will self-perform this work, or the project does not include this work.
Electrical	☐ Name of Subcontractor: _____ ☐ Bidder will self-perform this work, or the project does not include this work.
Plumbing	☐ Name of Subcontractor: _____ ☐ Bidder will self-perform this work, or the project does not include this work.

Bidder may attach a separate sheet for additional alternate bid subcontractors

2 Structural Steel Installation and Rebar Installation: The requirement of this section to name the bidder's proposed names of the subcontractors with whom the bidder, if awarded, will subcontract for performance of the work of structural steel installation and rebar installation.

Category of Work	Bidder MUST check one box for each Category of Work. If subcontracting the work, bidder must name the subcontractor
Structural Steel Installation	☐ Name of Subcontractor: _____ ☐ Bidder will self-perform this work, or the project does not include this work.
Rebar Installation	☐ Name of Subcontractor: _____ ☐ Bidder will self-perform this work, or the project does not include this work.

Bidder may attach a separate sheet for additional alternate bid subcontractors

/s/ Signature of Authorized Official
Typing your name can count as a signature.

Nisqually State Park
Phase 3A Maintenance Building and Wastewater Treatment Facility
NW-C1218B
https://mrscrosters.bonfirehub.com/portal
The Bidder will submit the Bid Bond (if Applicable) to State Parks Public Opportunities MRSC Bonfire Procurement Portal

Bid Bond Requirements

Bid Guarantee: See Instructions to Bidders 11.1 Bid Bond. No particular bid bond form is required. Failure of the Bidder to provide bid guarantee when required shall render the bid non-responsive.

Bid Bond Threshold

1. A bid bond is not required if the total bid amount, including all additive alternates, is $35,000 or less.
2. For bids exceeding $35,000, a bid bond of 5% of the total bid amount is mandatory.

Acceptable Forms

1. Acceptable forms of bid guarantee: A bid bond, and must be submitted as part of the bid response.
2. Scanned copies of the bid bond (e.g., PDF) are acceptable and should be included with the electronic bid submission

Submission Process

1. Include the bid bond in a single PDF file.
2. At the time of bid, the bidder must upload an electronic copy of the acceptable bid guarantee to the State Parks Oportunities via MRSC Portal Bonfire https://mrscrosters.bonfirehub.com/portal

Retention and Forfeiture

1. Bid bonds for the three lowest bidders will be retained for 30 days or until a contract is executed with the successful bidder.
2. All other bid bonds will be released within 15 days of the bid opening.
3. If the successful bidder fails to execute the contract or provide a performance bond within 15 days of receiving the contract forms, the bid bond may be forfeited as liquidated damages.

Bid Validity Period

1. Bidders must allow for a 60-day acceptance period from the bid opening date.

Important Reminder

1. Review all bid documents thoroughly to ensure compliance with submission requirements, including proper completion and inclusion of the bid bond when applicable.

For further details or clarification, refer to Section 11.1 of the "Instructions to Bidders" in the project manual. If you have questions, contact contracts@parks.wa.gov

☐ **Check the box to the left if the total bid, including all additive alternates, is $35,000 or less**, and include this statement with your bid response. No bid bond is required for bids at or below this amount. For bids exceeding $35,000, a bid bond must be submitted instead. Failure to provide a required bid bond will render the bid non-responsive.

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

The following list of major items of construction has been included for Bidder's convenience in preparing a bid proposal. Exclusion of items from this summary does not indicate exclusion from project. For lump sum items, the bidder is cautioned that the drawings are the only source for measurement of project quantities, and drawings have been detailed for this purpose. In preparing a bid proposal, Bidder should note apparent discrepancies between the list below and the drawings and consult with Landscape Architect for verification.

SCHEDULE A MAINTENANCE BUILDING PUMPHOUSE AND UTILITIES

BID ITEM	DESCRIPTION	ESTIMATED QUANTITY	PAYMENT
A1.	**TRENCH EXCAVATION SAFETY PROVISIONS**	**1**	**PER LUMP SUM**

See instructions on Bid Proposal Form. This Bid Item applies to all work in Phase 3A - Schedule A Maintenance Building Pumphouse and Utilities.

A2. MOBILIZATION **1** **PER LUMP SUM**

This Bid Item shall comply with WSDOTSS 1-09.7 Mobilization. This Bid Item applies to all work in Phase 3A – Schedule A Maintenance Building Pumphouse and Utilities.

A3. MAINTENANCE BUILDING PUMPHOUSE AND UTILITIES **1** **PER LUMP SUM**

This Bid Item includes all work in the Contract Document to provide the Maintenance Building, Pump house, utilities, improvements in place, complete, and operational.

This Bid Item includes, but is not limited to, all materials, labor, equipment, overhead, profit for the construction of the Maintenance Building, Pump House, Utility improvements and host camp site. Including but not limited to survey, clearing, selective clearing, grubbing, excavation, grading, on/off site haul, temporary and permanent erosion control, aggregates, gates, fencing, Maintenance Building, Pump House, hot mix asphalt paving, boulder processing & placement, electrical improvements, utility improvements, site furnishings, concrete blocks, signage/striping, concrete paving, access barriers, topsoil, plants, wood chips, mulch, and all work described in the Plans and Project Manual.

Clearing and Grubbing the Borrow Pit, and any Borrow Pit Haul Route restoration shall be paid for under the Lump Sum Bid Item “Maintenance Building Pumphouse and Utilities”. This Bid Item will be measured and paid for on a Lump Sum basis under the Bid Item “Maintenance Building Pumphouse and Utilities”.

A4. GRAVEL BORROW **1,313** **PER CUBIC YARD**

Includes all work to provide and place Gravel Borrow within the Work area of the Bid Item “Maintenance Building, Pump House and Utility Improvements**”**. Gravel Borrow will be measured on a Neat Line Per Cubic Yard in place basis. Measurement will be based upon the Contractor provided topographical survey of the Post Grubbing/Pre-Fill subgrade surface elevations and the design elevations of the Gravel Borrow subgrade. The Contractor is required to conduct Post Grubbing/Pre-Fill survey and provide the survey file to a third-party earthwork

calculation firm as determined by Owner who will calculate the earthwork calculations which will used for as the basis for measurement and payment. This Bid Item will be measured and paid for on a per Cubic Yard basis under the Bid Item "Gravel Borrow".

SCHEDULE B WASTEWATER TREATMENT FACILITY

B1. TRENCH EXCAVATION SAFETY PROVISIONS 1 PER LUMP SUM

See instructions on Bid Proposal Form. This Bid Item applies to all work in Phase 3A – Schedule B Wastewater Treatment Facility.

B2. MOBILIZATION 1 PER LUMP SUM

This Bid Item shall comply with WSDOTSS 1-09.7 Mobilization. This Bid Item applies to all work in Phase 3A – Schedule B Wastewater Treatment Facility.

B3. PROCUREMENT OF MBR EQUIPMENT SUPPLY AND SYSTEM START-UP 1 PER LUMP SUM

The lump sum price shall be full payment for all the work of this Contract Schedule related to purchase of MBR equipment and system start-up. The lump sum contract price included in the Bid Proposal shall be for Kubota (MBR Equipment Supplier) MBR System equipment, freight and delivery, installation instructions, system checkout and start-up, operation, and maintenance (O&M) manuals, and operator training. The Bidder shall include an amount as a fixed price that shall be full payment for MBR System equipment supply and system start-up provided by the MBR Equipment Supplier. Installation and start-up costs incurred by the Contractor related to the MBR System equipment shall be included in Bid Item 4 Documents.

B4. WASTEWATER TREATMENT FACILITY 1 PER LUMP SUM

The lump sum contract price shall be full payment for all the work of this Contract Schedule not included in the Bid Items 1, 2, 3, and 5 to construct the WWTF, that includes clearing, grading, landscaping, paving, piping, all buildings, all treatment plant process facilities, installation of MBR System equipment, testing, operator training, start-up, O&M manual preparation, and commissioning, all in accordance with the Contract Documents.

B5. GRAVEL BORROW 2,963 PER CUBIC YARD

Includes all work to provide and place Gravel Borrow within the Work area of the Bid Item "Wastewater Treatment Facility**"**. Gravel Borrow will be measured on a Neat Line Per Cubic Yard in place basis. Measurement will be based upon the Contractor provided topographical survey of the Post Grubbing/Pre-Fill subgrade surface elevations and the design elevations of the Gravel Borrow subgrade. The Contractor is required to conduct Post Grubbing/Pre-Fill survey and provide the survey file to a third-party earthwork calculation firm as determined by Owner who will calculate the earthwork calculations which will used for as the basis for measurement and payment. This Bid Item will be measured and paid for on a per Cubic Yard basis under the Bid Item "Gravel Borrow".

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PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA WITH INCLUSION PLAN AND APPRENTICESHIP REQUIREMENTS

Low Responsible Bidder
It is the intent of the Agency to award a contract to the lowest responsive and responsible Bidder. In determining the Bidder's responsibility, the Agency shall consider an overall accounting of the items listed below. Potential Bidders may request the Agency modify the Bidder responsibility criteria. The request must be in writing and submitted at least 7 days prior to the bid opening.

The apparent low bidder shall submit the required information within **two (2)** business days of receiving request from the Agency. This request may be made in the form of a telephone call or email message. The required information shall be provided on the referenced forms bound herein. Electronic copies may be made available upon request. Failure to submit such information to the satisfaction of the Agency within the time provided may render the Bidder as not responsible.

1.1 REQUIRED INFORMATION/CRITERIA

A. For the purposes of the Supplemental Bidder Responsibility evaluation process, the scope of this project generally involves:
- Construction of a maintenance building addition, utility improvements, and well house.
- Construction of a Waste Water Treatment Facility.

B. Experience Of Contractor On Projects Of Similar Size And Complexity: Contractor is required to have successfully completed at least **three (3)** projects of similar type, size and complexity to this project, each with a contract amount of at least **$1,000,000**, within the last **seven (7)** years.

C. List of Completed Projects (Use Form 1, Contractor Experience Detail): Provide a list of all the construction contracts **$1,000,000** and above your firm has completed within the past **three (3)** years, giving the name of the project; name, address, and phone numbers of Owner and architect representatives; final contract amount; date of completion; and percentage of the cost of the work performed with your firm's own forces. This information will be used for reference reviews.

2.1 EXPERIENCE OF KEY PERSONNEL

A. Experience of Project Manager (Use Form 2, Résumé of Key Personnel for Proposed Contract): Submit resume and references for the proposed Project Manager. This person shall have managed, as lead project manager, a minimum of **three (3)** projects of similar type, size and complexity to this project, and successfully completed those projects within the last **ten (10)** years.

B. Experience of Superintendent (Use Form 2, Résumé of Key Personnel for Proposed Contract): Submit resume and references for the proposed project Superintendent. This person shall have performed as the lead Superintendent for a minimum of **three (3)** projects of similar type, size and complexity to this project, and successfully completed those projects within the last **ten (10)** years.

3.1 DIVERSE BUSINESS INCLUSION PLAN (USE FORM 3)

A. Washington state goals are: Minority Business Enterprise (MBE) 10%, Women's Business Enterprise (WBE) 6%, WA Small Business 5% and WA Veterans 5%. The apparent low bidder is required to submit a Diverse Businesses Inclusion Plan for all projects with a Maximum Allowable Construction Cost (MACC) over $1M.

The Diverse Business Inclusion plan shall include the apparent low bidder's anticipated participation goals, the subcontractors anticipated to be used on this project, a list of diverse businesses near the project, the project's diverse expert, and past performance using diverse businesses.

4.1 APPRENTICESHIP (USE FORMS 1 & 4)

A. For each public works project with an apprenticeship utilization goal that was completed by the Bidder within three (3) years of the bid submittal date for this project, the Bidder shall submit the following:

- A list of such projects;
- The owner and contact information for the owner's representative;
- The apprenticeship utilization percentage goal for the project:
- The actual utilization percentage by the Bidder; and
- An explanation of any extenuating circumstances that contributed to the Bidder not meeting the goals.

(Use Form 4 for projects not listed on Form 1)

The Agency may contact previous owners to validate the information provided by the Bidder and shall consider whether the goals were mandatory or voluntary, and the validity of any explanation of extenuating circumstances.

5.1 REFERENCES FROM OWNERS AND ARCHITECTS FOR PREVIOUS PROJECTS (AGENCY USES FORM 5, REFERENCE EVALUATION QUESTIONNAIRE)

A. The Agency may check references by contacting owners and architects of the bidder's previous projects regarding the bidder's performance and that of key staff. A reference score sheet will be utilized and the rating shall be satisfactory or better on a five-category scale with "satisfactory" at mid-scale.

6.1 OVERALL SCORING (FORM 6, RESPONSIBILITY CRITERIA EVALUATION SCORE SHEET)

A. The Agency will use this form to complete and document the overall evaluation process.

END OF SECTION

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

Supplemental Bidder Responsibility
Form 1 - Contractor Experience Detail

Contractor Information:			
Contractor Legal Name:			Contact Person and their Position/Title:
Project Superintendent:			Project Manager:
Physical Address (Physical and Mailing Addresses are the Same ☐) :			Mailing Address:
Telephone:	Cell Phone:	Email Address:	

Project Information: Is this project relevant to the proposed project? Yes ☐ No ☐		
Project:		Location:
Project Description:		As Prime: ☐ As Sub: ☐
Original Contract Amount: $ Final Contract Amount: $		Original Contract Days: Final Contract Days:

Owner Information:		
Owner's Business Name:		Contact Person and their Position/Title:
Mailing Address :		Telephone: Email Address:

Architect/Engineering Information:		
Owner's Business Name:		Contact Person and their Position/Title:
Mailing Address :		Telephone: Email Address:

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MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

Supplemental Bidder Responsibility
Form 2 - Resume of Key Personnel

Name:	Role in this Contract:	Years Experience	
		Total	With Current Firm
Firm Name and Location (City and State):			
Training/Education/Specialization:			
Years of Experience in the Proposed Role:			

RELEVANT PROJECTS			
Project Title:			Year Completed
Project Owner:			
Brief Description (Brief scope, size, cost, etc.) and specific role:			Check if project performed with current firm. ☐ If performed with different firm list the firm name
Reference Name & Contact Information:			
Project Owner:		Project Architect:	
Name:		Name:	
Phone:		Phone:	
E-mail		E-mail:	

RELEVANT PROJECTS			
Project Title:			Year Completed
Project Owner:			
Brief Description (Brief scope, size, cost, etc.) and specific role:			Check if project performed with current firm. ☐ If performed with different firm list the firm name
Reference Name & Contact Information:			
Project Owner:		Project Architect:	
Name:		Name:	
Phone:		Phone:	
E-mail		E-mail:	

RELEVANT PROJECTS			
Project Title:			Year Completed
Project Owner:			
Brief Description (Brief scope, size, cost, etc.) and specific role:			Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:			
Project Owner:		Project Architect:	
Name:		Name:	
Phone:		Phone:	

E-mail		E-mail:

RELEVANT PROJECTS			
Project Title:			Year Completed
Project Owner:			
Brief Description (Brief scope, size, cost, etc.) and specific role:			Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:			
Project Owner:		Project Architect:	
Name:		Name:	
Phone:		Phone:	
E-mail		E-mail:	

RELEVANT PROJECTS			
Project Title:			Year Completed
Project Owner:			
Brief Description (Brief scope, size, cost, etc.) and specific role:			Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:			
Project Owner:		Project Architect:	
Name:		Name:	
Phone:		Phone:	
E-mail		E-mail:	

RELEVANT PROJECTS			
Project Title:			Year Completed
Project Owner:			
Brief Description (Brief scope, size, cost, etc.) and specific role:			Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:			
Project Owner:		Project Architect:	
Name:		Name:	
Phone:		Phone:	
E-mail		E-mail:	

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

Supplemental Bidder Responsibility
Form 3 - Prime Contractor Diverse Business Inclusion Plan

Prime Contractor Name: _____

For the purposes of this form, Washington State-certified diverse businesses are defined as follows:

- *Minority Business Enterprise (MBE), Women's Business Enterprise (WBE)*, or combination of the two. Certified by the Office of Minority and Women's Business Enterprises (OMWBE): http://omwbe.wa.gov/
- *Veteran-owned Business*. Certified by the Department of Veteran's Affairs (DVA): http://dva.wa.gov/
- *Small Business* (includes Mini and Micro businesses). Certified through the Washington Electronic Business Solution (WEBS): https://fortress.wa.gov/ga/webs/home.html

Anticipated Certified Diverse Business Participation Goals

Subcontracting means direct performance of commercially useful work through subcontracting as part of the proposed project team. Of the total contract work, what are the diverse business participation goals proposed for subcontracting on your team? Please only include the above-listed Washington State certification types in your "Contractor-defined Anticipated Percent of Contract Amount (Goals)" estimate. Zero percent (0%) is not a goal.

Anticipated Certified Diverse Business Participation Goals	Washington State Goals	Contractor-defined Anticipated Percent of Contract Amount (Goals)
Minority-owned business (MBE)	**10%**	**%**
Women-owned business (WBE)	**6%**	**%**
Veteran-owned business (DVA)	**5%**	**%**
Small business	**5%**	**%**

Subcontracting Team

List the names of the diverse businesses you anticipate using on this project. Generally describe the work you expect the diverse business to perform and identify the percent of total contract value intended for each diverse business. Please include the above-listed Washington State certification types. *If necessary, add more rows below.*

Name of Diverse Business	Specify Diverse Business Certification (circle one or more)	Describe Trade or Task	Anticipated Percent of Contract Amount
	MBE, WBE, DVA, Small		%
	MBE, WBE, DVA, Small		%
	MBE, WBE, DVA, Small		%
	MBE, WBE, DVA, Small		%
	MBE, WBE, DVA, Small		%

Attach a list of diverse businesses near the project location to this form:

1. Go to https://omwbe.wa.gov/directory-certified-firms
2. Click on "OMWBE DIRECTORY"
3. Click on "Search Certified Firm Directory"
4. Select MBE, MWBE, SBE, and WBE certifications.
5. Enter a City, Zip Code, or County near the project site address and then press "Search" at the bottom of the page. If you do not have many results, please expand your search to include nearby locations.
6. Print and attach the results to this form with your submittal

Diverse Expert:

Diverse Expert responsibilities would typically include, but are not limited to:

- Outreach to qualified diverse businesses.
- Submit and discuss updates on a regular basis to the state project manager regarding Diverse Business utilization and progress.

- Ongoing outreach to diverse businesses for required contract work, including any changes in scope.
- Assist diverse businesses with successful contract performance.

A qualified Diverse Expert brings knowledge of the identity, capabilities and capacities of diverse business subcontractors and suppliers; experience recruiting and working with diverse businesses for construction; and assisting diverse businesses to develop working relationships with contractors.

Identify the person within your team to manage your diverse inclusion responsibility.

Diverse Expert Name:
____

Diverse Expert Contact Information:
____

Diverse Expert Firm (if another firm is managing participation):
____

<u>Past Performance</u>
Please select **five (5) of your projects** with Washington State-certified diverse business participation (MBE, WBE, DVA, and/or Small/Mini/Micro) and list them below **for the last five (5) years**. If you do not have any projects that tracked or reported diverse business participation, you may leave this section blank. In that case, please attach an additional sheet with explanation.

You may have projects with diverse business participation for an organization or entity that required *different* diverse business categories (including self-certification). If so, please attach a sheet with the same column data and information, but include percentages for the categories that were tracked during the project.

Contract Name	Contracting Agency or Entity	Contract Amount	Year	Percent of Contract Amount	
				Minority-owned business:	%
				Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%
Contract Name	**Contracting Agency or Entity**	**Contract Amount**	**Year**	**Percent of Contract Amount**	
		$		Minority-owned business:	%
				Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%
Contract Name	**Contracting Agency or Entity**	**Contract Amount**	**Year**	**Percent of Contract Amount**	
		$		Minority-owned business:	%
				Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%
Contract Name	**Contracting Agency or Entity**	**Contract Amount**	**Year**	**Percent of Contract Amount**	
		$		Minority-owned business:	%
				Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%
Contract Name	**Contracting Agency or Entity**	**Contract Amount**	**Year**	**Percent of Contract Amount**	
		$		Minority-owned business:	%
				Women-owned business:	%

				Veteran-owned business:	%
				Small/mini/micro business:	%

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

Supplemental Bidder Responsibility
Form 4 – Apprenticeship Utilization

Contractor Information:			
Contractor Legal Name:			Contact Person and their Position/Title:
Project Superintendent:			Project Manager:
Physical Address (Physical and Mailing Addresses are the Same ☐) :			Mailing Address:
Telephone:	Cell Phone:	Email Address:	

Project Information: Is this project relevant to the proposed project? Yes ☐ No ☐		
Project:		Location:
Project Description:		As Prime: ☐ As Sub: ☐
Original Contract Amount: $ Final Contract Amount: $		Original Contract Days: Final Contract Days:

Owner Information:		
Owner's Business Name:		Contact Person and their Position/Title:
Mailing Address :		Telephone: Email Address:

Architect/Engineering Information:		
Owner's Business Name:		Contact Person and their Position/Title:
Mailing Address :		Telephone: Email Address:

1. Did this project require Apprenticeship Participation? Yes ☐ No ☐ (If NO, stop here)

2. If yes, what was the Apprenticeship percentage? _____ %

3. What was the actual percentage achieved? _____ %

4. Was the apprenticeship requirement met? Yes ☐ No ☐

5. If NO to question 4, explain Why.

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

Supplemental Bidder Responsibility
Form 5 - Reference Evaluation Questionnaire

Evaluated Firm :
Project Manager:
Superintendent:
Evaluated Project Name:

☐ Prime
☐ Subcontractor

Approx. Start Date	Approx. End Date	Approx. Final Project Cost

PERFORMANCE EVALUATION

Rating Criteria - Rate on a scale of 1 to 5

- **5** = **Superior** based on performance (would hire this firm/individual again)
- **4** = **More than Satisfactory**
- **3** = **Satisfactory** based on performance (would hire this firm/individual again)
- **2** = **Less than Satisfactory**
- **1**= **Totally Unsatisfactory** based on performance (would never hire the firm/individual again)

	Criteria	Rating		
		Company	PM	Super
1	Ability to meet client's expectations			
2	Quality of workmanship			
3	Ability to manage project costs and minimize change orders			
4	Ability to maintain project schedule			
5	Ability to manage subcontractors			
6	Professionalism, leadership and communication in issues management (RFI, shop drawing submittal, timely resolution of issues/questions)			
7	Ability to follow the owner's rules, regulations, and requirements (housekeeping, safety, etc.)			
8	Ability to manage closeout process (Prompt submittal of punch list, warranty, as-builts, operation manuals, tax clearances, etc.)			
9	Comfort level in hiring firm or individual again based on performance			
	Total Score			
	Average Score			

Evaluator Information

Name of Evaluator: Title:

Firm/Company Name:

Firm Address:

Phone: Email:

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

Form 6 – Supplemental Responsibility Criteria Evaluation Score Sheet

Project Location _____
Project Name _____
Contract Number _____
Project Representative _____

1. Experience of Contractor - On projects of similar size & complexity (Form 1)	Pass or Fail

2. Experience of Key Personnel (Form 2)	
Superintendent	Pass or Fail
Project Manager	Pass or Fail
Other(s) if specified in Division 00	Pass or Fail

3. Diverse Business Inclusion Plan (Form 3) *(Applies only to projects with Diverse Business Plan Inclusion requirements; i.e. MACC over $1M)*	Pass, Fail, or N/A

4. Contractor Compliance with Apprenticeship Requirements - Requirements were met or if not, a good faith effort was demonstrated (Forms 1 & 4) *Applies only to projects with apprenticeship participation requirements; i.e. MACC over $1M*	Not Scored

5. References from Previous Projects (Form 5) Evaluate contractor's references information and using the rating numbers: 1 = NOT Satisfactory (requires a written comment below) 2 = Less THAN Satisfactory 3 = Satisfactory 4 = More THAN Satisfactory 5 = Superior	Rating **Score 1-5** (3 is Satisfactory)
Company	
Project Manager	
Superintendent	
Total Score:	
Average score (divide total score by number of ratings)	

In determining the bidder responsibility, an overall accounting of the ratings shall be made. A score of "Pass" is required for categories 1 - 4 and an average score of 3.0 or higher is required to meet the minimum Supplemental Bidder Responsibility requirements.

Comments _____

Determination ☐ Responsible
☐ Not Responsible (Preliminary Determination)

Evaluated by _____ Date _____
State Parks Project Representative

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

_____

Signature

GENERAL CONDITIONS FOR CONSTRUCTION AT WASHINGTON STATE PARKS

GENERAL CONDITIONS FOR CONSTRUCTION AT WASHINGTON STATE PARKS

PART 1 - GENERAL PROVISIONS

1.01 DEFINITIONS

A. "Application for Payment" means a written request submitted by Contractor to A/E for payment of Work completed in accordance with the Contract Documents and approved Schedule of Values, supported by such substantiating data as Owner or A/E may require.

B. “Architect,” “Engineer,” or “A/E" shall mean that person designated by the State Parks and Recreation Commission to be in charge of the work covered by this contract.

C. "Change Order" means a written instrument signed by Owner and Contractor stating their agreement upon all of the following: (1) a change in the Work; (2) the amount of the adjustment in the Contract Sum, if any, and (3) the extent of the adjustment in the Contract Time, if any.

D. "Claim" means Contractor's exclusive remedy for resolving disputes with Owner regarding the terms of a Change Order or a request for equitable adjustment, as more fully set forth in part 8.

E. “Contract Award Amount” is the sum of the Base Bid and any accepted Alternates.

F. "Contract Documents" means the Advertisement for Bids, Instructions for Bidders, completed Form of Proposal, General Conditions, Modifications to the General Conditions, Supplemental Conditions, Public Works Contract, other Special Forms, Drawings and Specifications, and all addenda and modifications thereof.

G. "Contract Sum" is the total amount payable by Owner to Contractor for performance of the Work in accordance with the Contract Documents, including all taxes imposed by law and properly chargeable to the Work, except Washington State sales tax.

H. "Contract Time" is the number of calendar days allotted in the Contract Documents for achieving Substantial Completion of the Work.

I. "Contractor" means the person or entity who has agreed with Owner to perform the Work in accordance with the Contract Documents.

J. "Drawings" are the graphic and pictorial portions of the Contract Documents showing the design, location, and dimensions of the Work, and may include plans, elevations, sections, details, schedules, and diagrams.

K. "Final Acceptance" means the written acceptance issued to Contractor by Owner after Contractor has completed the requirements of the Contract Documents, as more fully set forth in Section 6.09 B.

L. "Final Completion" means that the Work is fully and finally completed in accordance with the Contract Documents, as more fully set forth in Section 6.09 A.

M. "Force Majeure" means those acts entitling Contractor to request an equitable adjustment in the Contract Time, as more fully set forth in paragraph 3.05 A.

N. "Notice" means a written notice which has been delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended or, if delivered or sent by registered or certified mail, to the last business address known to the party giving notice.

O. "Notice to Proceed" means a notice from Owner to Contractor that defines the date on which the Contract Time begins to run.

P. "Owner" shall mean the Washington State Parks and Recreation Commission and its authorized representative with the authority to enter into, administer and/or terminate contracts and make related determinations and findings.

Q. "Person" means a corporation, partnership, business association of any kind, trust, company, or individual.

R. "Prior Occupancy" means Owner's use of all or parts of the Project before Substantial Completion, as more fully set forth in Section 6.08 A.

S. "Progress Schedule" means a schedule of the Work, in a form satisfactory to Owner, as further set forth in section 3.02.

T. "Project" means the total construction of which the Work performed in accordance with the Contract Documents may be the whole or a part and which may include construction by Owner or by separate contractors.

U. "Project Manual" means the volume usually assembled for the Work which may include the bidding requirements, sample forms, and other Contract Documents.

V. "Project Record" means the separate set of Drawings and Specifications as further set forth in paragraph 4.02A.

W. "Schedule of Values" means a written breakdown allocating the total Contract Sum to each principle category of Work, in such detail as requested by Owner.

X. "Specifications" are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, and workmanship for the Work, and performance of related services.

Y. "Subcontract" means a contract entered into by Subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind for or in connection with the Work.

Z. "Subcontractor" means any person, other than Contractor, who agrees to furnish or furnishes any supplies, materials, equipment, or services of any kind in connection with the Work.

AA. "Substantial Completion" means that stage in the progress of the Work where Owner has full and unrestricted use and benefit of the facilities for the purposes intended, as more fully set forth in section 6.07.

AB. "Work" means the construction and services required by the Contract Documents, and includes, but is not limited to, labor, materials, supplies, equipment, services, permits, and the manufacture and fabrication of components, performed, furnished, or provided in accordance with the Contract Documents.

1.02 ORDER OF PRECEDENCE

Any conflict or inconsistency in the Contract Documents shall be resolved by giving the documents precedence in the following order.

1. Signed Public Works Contract, including any Change Orders, and any Special Forms.
2. Supplemental Conditions.
3. General Conditions.
4. Addenda
5. Specifications--provisions in Division 1 shall take precedence over provisions of any other Division.
6. Drawings--in case of conflict within the Drawings, large scale drawings shall take precedence over small scale drawings.
7. Signed and Completed Form of Proposal.
8. Instructions to Bidders.
9. Advertisement for Bids.

1.03 EXECUTION AND INTENT

Contractor makes the following representations to Owner:

1. The Contract Sum is reasonable compensation for the Work and the Contract Time is adequate for the performance of the Work, as represented by the Contract Documents;

2. Contractor has carefully reviewed the Contract Documents, visited and examined the Project site, become familiar with the local conditions in which the Work is to be performed, and satisfied itself as to the nature, location, character, quality and quantity of the Work, the labor, materials, equipment, goods, supplies, work, services and other items to be furnished and all other requirements of the Contract Documents, as well as the surface and subsurface conditions and other matters that may be encountered at the Project site or affect performance of the Work or the cost or difficulty thereof;

3. Contractor is financially solvent, able to pay its debts as they mature, and possesses sufficient working capital to complete the Work and perform Contractor's obligations required by the Contract Documents; and

4. Contractor is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform the obligations required by the Contract Documents and has sufficient experience and competence to do so.

PART 2 - INSURANCE AND BONDS

2.01 CONTRACTOR'S LIABILITY INSURANCE

Prior to commencement of the Work, Contractor shall obtain all the insurance required by the Contract Documents and provide evidence satisfactory to Owner that such insurance has been procured. Review of the Contractor's insurance by Owner shall not relieve or decrease the liability of Contractor. Companies writing the insurance to be obtained by this part shall be licensed to do business under Chapter 48 RCW or comply with the Surplus Lines Law of the State of Washington. Contractor shall include in its bid the cost of all insurance and bond costs required to complete the base bid work and accepted alternates. Insurance carriers providing insurance in accordance with the Contract Documents shall be acceptable to Owner, and its A. M. Best rating shall be indicated on the insurance certificates.

A. Contractor shall maintain the following insurance coverage during the Work and for one year after Final Acceptance. Contractor shall also maintain the following insurance coverage during the performance of any corrective Work required by section 5.16.

    1. Commercial General Liability (CGL) on an Occurrence Form:

        a. Completed operations/products liability;

        b. Explosion, collapse, and underground; and

        c. Employer's liability coverage.

    2. Automobile liability

B. Contractor shall comply with the Washington State Industrial Insurance Act and, if applicable, the Federal Longshoremen's and Harbor Workers' Act and the Jones Act.

C. All insurance coverages shall protect against claims for damages for personal and bodily injury or death, as well as claims for property damage, which may arise from operations in connection with the Work whether such operations are by Contractor or any Subcontractor.

D. All insurance coverages shall be endorsed to include Owner as an additional named insured for Work performed in accordance with the Contract Documents, and all insurance certificates shall evidence the Owner as an additional insured.

2.02 COVERAGE LIMITS INSURANCE COVERAGE CERTIFICATES

A. Insurance Coverage Certificates
The Contractor shall furnish acceptable proof of insurance coverage on the State of Washington Certificate of Insurance form SF500A dated 07/02/92 or an acceptable ACORD form.

B. Required Coverages
1. For a contract less than $100,000.00, the coverage required is:
   a. Public Liability Insurance – The Contractor shall at all times during the term of this contract, at its cost and expense, carry and maintain general public liability insurance, including contractual liability, against claims for bodily injury, personal injury, death or property damage occurring or arising out of services provided under this contract. This insurance shall cover claims caused by any act, omission, or negligence of the Contractor or its officers, agents, representatives, assigns or servants. The limits of liability insurance, which may be increased as deemed necessary by the contracting parties, shall be:

Each Occurrence	$1,000,000.00
General Aggregate Limits (other than products – commercial operations)	$1,000,000.00
Products – Commercial Operations Limit	$1,000,000.00
Personal and Advertising Injury Limit	$1,000,000.00
Fire Damage Limit (any one fire)	$50,000.00
Medical Expense Limit (any one person)	$5,000.00

   b. If the contract is for underground utility work, then the Contractor shall provide proof of insurance for that above in the form of Explosion, Collapse and Underground (XCU) coverage.

   c. Employers Liability on an occurrence basis in an amount not less than $1,000,000.00 per occurrence.

2. For contracts over $100,000.00 but less than $5,000,000.00 the contractor shall obtain the coverage limits as listed for contracts below $100,000.00 and General Aggregate and Products – Commercial Operations Limit of not less than $2,000,000.00.

3. Coverage for Comprehensive General Bodily Injury Liability Insurance for a contract over $5,000,000.00 is:

Each Occurrence	$2,500,000.00
General Aggregate Limits (other than products – commercial operations)	$5,000,000.00
Products – Commercial Operations limit	$5,000,000.00
Personal and Advertising Injury Limit	$2,500,000.00
Fire Damage Limit (any one fire)	$50,000.00
Medical Expense Limit (any one Person)	$5,000.00

4. For all Contracts – Automobile Liability: in the event that services delivered pursuant to this contract involve the use of vehicles or the transportation of clients, automobile liability insurance shall be required. If Contractor-owned personal vehicles are used, a Business Automobile Policy covering at a minimum Code 2 “owned autos only” must be secured. If Contractor employee’s vehicles are used, the Contractor must also include under the Business Automobile Policy Code 9, coverage for non-owned autos. The minimum limits for automobile liability is: $1,000,000.00 per occurrence, using a combined single limit for bodily injury and property damage.

5. For Contracts for Hazardous Substance Removal (Asbestos Abatement, PCB Abatement, etc.)
   a. In addition to providing insurance coverage for the project as outlined above, the Contractor shall provide Environmental Impairment Liability insurance for the hazardous substance removal as follows:

EACH OCCURRENCE	AGGREGATE
$500,000.00	$1,000,000.00

   or $1,000,000.00 each occurrence/aggregate bodily injury and property damage combined single limit.

1) Insurance certificate must state that the insurer is covering hazardous substance removal.
2) Should this insurance be secured on a “claims made” basis, the coverage must be continuously maintained for one year following the project’s “final completion” through official completion of the project, plus one year following.

For Contracts where hazardous substance removal is a subcomponent of contracted work, the general contractor shall provide to the Owner a certificate of insurance for coverage as defined in 5a. above. The State of Washington must be listed as an additional insured. This certificate of insurance must be provided to the Owner prior to commencing work.

2.03 INSURANCE COVERAGE CERTIFICATES

A. Prior to commencement of the Work, Contractor shall furnish to Owner a completed certificate of insurance coverage.

B. All insurance certificates shall name Owner's Project number and Project title.

C. All insurance certificates shall specifically require 45 (forty-five) days prior notice to Owner of cancellation or any material change, except 30 (thirty) days for surplus line insurance.

2.04 PAYMENT AND PERFORMANCE BONDS

AIA Payment and Performance Bonds, form A312, or equivalent, is required by the Owner for the work of this contract. The forms shall be obtained from the Contractor’s bonding company. The Payment Bond shall cover payment to laborers and mechanics, including payments to Employee Benefit Funds, and payments to subcontractors, material suppliers, and persons who shall supply such person or persons, or subcontractors with materials and supplies.

2.05 ALTERNATIVE SURETY

Contractor shall promptly furnish alternative security required to protect Owner and persons supplying labor or materials required by the Contract Documents if:

A. Owner has a reasonable objection to the surety; or

B. Any surety fails to furnish reports on its financial condition if requested by Owner.

2.06 BUILDER'S RISK

A. Contractor shall purchase and maintain property insurance in the amount of the Contract Sum including all Change Orders for the Work on a replacement cost basis until Substantial Completion. The insurance shall cover the interest of Owner, Contractor, and any Subcontractors, as their interests may appear. For projects not involving New Building Construction, ‘Installation Floater’ is an acceptable substitute for the Builder’s Risk Insurance.

B. Contractor property insurance shall be placed on an "all risk" basis and insure against the perils of fire and extended coverage and physical loss or damage including theft, vandalism, malicious mischief, collapse, false work, temporary buildings, debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for A/E's services and expenses required as a result of an insured loss.

C. Owner and Contractor waive all subrogation rights against each other, any Subcontractors, A/E, A/E's subconsultants, separate contractors described in section 5.20, if any, and any of their subcontractors, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this section or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by Owner as fiduciary. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

PART 3 - TIME AND SCHEDULE

3.01 PROGRESS AND COMPLETION

A. Contractor shall diligently prosecute the Work, with adequate forces, achieve Substantial Completion within the Contract Time, and achieve Final Completion within 30 (thirty) calendar days thereafter, unless otherwise noted in Division 1 of the specifications.

B. The Contractor shall notify the Engineer at least two (2) weekdays in advance if work is to be performed on a Saturday, Sunday, or legal holiday. No excavation work will be allowed on Saturdays, Sundays, or legal holidays unless specifically authorized by the Engineer.

3.02 CONSTRUCTION SCHEDULE

A. Unless otherwise provided in Division 1, Contractor shall, within 14 (fourteen) calendar days after issuance of the Notice to Proceed, submit a preliminary Progress Schedule. The Progress Schedule shall show the sequence in which Contractor proposes to perform the Work, and the dates on which Contractor plans to start and finish major portions of the Work, including dates for shop drawings and other submittals, and for acquiring materials and equipment.

B. The Progress Schedule shall be in the form of a Critical Path Method (CPM) logic network or, with the approval of the Owner, a bar chart schedule may be submitted. The scheduling of construction is the responsibility of the Contractor and is included in the contract to assure adequate planning and execution of the work. The schedule will be used to evaluate progress of the work for payment based on the Schedule of Values. The schedule shall show the Contractor's planned order and interdependence of activities, and sequence of work. As a minimum the schedule shall include:

1. Date of Notice to Proceed;
2. Activities (resources, durations, individual responsible for activity, early starts, late starts, early finishes, late finishes, etc.);
3. Utility Shutdowns;
4. Interrelationships and dependence of activities;
5. Planned vs. actual status for each activity;
6. Substantial completion;
7. Punch list;
8. Final inspection;
9. Final completion, and
10. Float time

The Schedule Duration shall be based on the Contract Time of Completion listed on the Bid Proposal form. The Owner shall not be obligated to accept any Early Completion Schedule suggested by the Contractor. The Contract Time for Completion shall establish the Schedule Completion Date.

If the Contractor feels that the work can be completed in less than the Specified Contract Time, then the Surplus Time shall be considered Project Float. This Float time shall be shown on the Project Schedule. It shall be available to accommodate changes in the work and unforeseen conditions.

Neither the Contractor nor the Owner have exclusive right to this Float Time. It belongs to the project.

C. Owner shall return comments on the preliminary Progress Schedule to Contractor within 14 (fourteen) days of receipt. Review by Owner of Contractor's schedule does not constitute an approval or acceptance of Contractor's construction means, methods, or sequencing, or its ability to complete the Work within the Contract Time. Contractor shall revise and resubmit its schedule, as necessary. Owner may withhold a portion of progress payments until a Progress Schedule has been submitted which meets the requirements of this section.

D. Contractor shall utilize and comply with the Progress Schedule. On a monthly basis, or as otherwise directed by Owner, Contractor shall submit an updated Progress Schedule at its own expense to Owner indicating actual progress. If, in the opinion of Owner, Contractor is not in conformance with the Progress Schedule for reasons other than acts of Force Majeure as identified in section 3.05, Contractor shall take

such steps as are necessary to bring the actual completion dates of its work activities into conformance with the Progress Schedule, or revise the Progress Schedule to reconcile with the actual progress of the Work.

E. Contractor shall promptly notify Owner in writing of any actual or anticipated event which is delaying or could delay achievement of any milestone or performance of any critical path activity of the Work. Contractor shall indicate the expected duration of the delay, the anticipated effect of the delay on the Progress Schedule, and the action being or to be taken to correct the problem. Provision of such notice does not relieve Contractor of its obligation to complete the Work within the Contract Time.

3.03 OWNER'S RIGHT TO SUSPEND THE WORK FOR CONVENIENCE

A. Owner may, at its sole discretion, order Contractor, in writing, to suspend all or any part of the Work for up to 90 (ninety) days, or for such longer period as mutually agreed.

B. Upon receipt of a written notice suspending the Work, Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of cost of performance directly attributable to such suspension. Within a period up to 90 (ninety) days after the notice is delivered to Contractor, or within any extension of that period to which the parties shall have agreed, Owner shall either:

1. Cancel the written notice suspending the Work; or

2. Terminate the Work covered by the notice as provided in the termination provisions as more fully set forth in Part 9.

C. If a written notice suspending the Work is cancelled or the period of the notice or any extension thereof expires, Contractor shall resume Work.

D. Contractor shall be entitled to an equitable adjustment in the Contract Time, or Contract Sum, or both, for increases in the time or cost of performance directly attributable to such suspension, provided Contractor complies with all requirements set forth in Part 7.

3.04 OWNER'S RIGHT TO STOP THE WORK FOR CAUSE

A. If Contractor fails or refuses to perform its obligations in accordance with the Contract Documents, Owner may order Contractor, in writing, to stop the Work, or any portion thereof, until satisfactory corrective action has been taken.

B. Contractor shall not be entitled to an equitable adjustment in the Contract Time or Contract Sum for any increased cost or time of performance attributable to Contractor's failure or refusal to perform or from any reasonable remedial action taken by Owner based upon such failure.

3.05 DELAY

A. Any delay in or failure of performance by Owner or Contractor, other than the payment of money, shall not constitute a default hereunder if and to the extent the cause for such delay or failure of performance was unforeseeable and beyond the control of the party ("Force Majeure"). Acts of Force Majeure include, but are not limited to:

1. Acts of God or the public enemy;

2. Acts or omissions of any government entity;

3. Fire or other casualty for which Contractor is not responsible;

4. Quarantine or epidemic;

5. Strike or defensive lockout;

6. Unusually severe weather, in excess of weather conditions which could not have been reasonably anticipated; and

7. Unusual delay in receipt of supplies or products which were ordered and expedited and for which no substitute reasonably acceptable to Owner was available.

B. Contractor shall be entitled to an equitable adjustment in the Contract Time for changes in the time of performance directly attributable to an act of Force Majeure, provided it makes a request for equitable adjustment according to section 7.03. Contractor shall not be entitled to an adjustment in the Contract Sum resulting from an act of Force Majeure.

C. Contractor shall be entitled to an equitable adjustment in Contract Time, and may be entitled to an equitable adjustment in Contract Sum, if the cost or time of Contractor's performance is changed due to the fault or negligence of Owner, provided the Contractor makes a request according to sections 7.02 and 7.03.

D. Contractor shall not be entitled to an adjustment in Contract Time or in the Contract Sum for any delay or failure of performance to the extent such delay or failure was caused by Contractor or anyone for whose acts Contractor is responsible.

E. To the extent any delay or failure of performance was concurrently caused by the Owner and Contractor, Contractor shall be entitled to an adjustment in the Contract Time for that portion of the delay or failure of performance that was concurrently caused, provided it makes a request for equitable adjustment according to section 7.03, but shall not be entitled to an adjustment in Contract Sum.

F. Contractor shall make all reasonable efforts to prevent and mitigate the effects of any delay, whether occasioned by an act of Force Majeure or otherwise.

G. The Owner has acquired ownership and/or easement of lands for the construction, as indicated on the drawings, without cost to the Contractor. The Contractor understands and agrees that, should it appear at any time that the Owner has not acquired title to all of the right-of-ways and lands necessary for the performance of the work under the provisions of this contract, and that if any delay in the performance of said work occasioned by the failure of the Owner, its officers, or employees to acquire a title of any of said lands or right-of-way, such failure shall extend the contract completion date the number of days equal to the period of such delay. The Contractor waives any and all claims for damages against the Owner which the Contractor may sustain by reason of this delay in the work.

3.06 NOTICE TO OWNER OF LABOR DISPUTES

A. If Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay timely performance in accordance with the Contract Documents, Contractor shall immediately give notice, including all relevant information, to Owner.

B. Contractor agrees to insert a provision in its Subcontracts and to require insertion in all sub-subcontracts, that in the event timely performance of any such contract is delayed or threatened by delay by any actual or potential labor dispute, the Subcontractor or Sub-subcontractor shall immediately notify the next higher tier Subcontractor or Contractor, as the case may be, of all relevant information concerning the dispute.

3.07 DAMAGES FOR FAILURE TO ACHIEVE TIMELY COMPLETION

A. Liquidated Damages

1. Timely performance and completion of the Work is essential to Owner and time limits stated in the Contract Documents are of the essence. Owner will incur serious and substantial damages if Substantial Completion of the Work does not occur within the Contract Time. However, it would be difficult if not impossible to determine the exact amount of such damages. Consequently, provisions for liquidated damages are included in the Contract Documents.

2. The liquidated damage amounts set forth in the Contract Documents will be assessed not as a penalty, but as liquidated damages for breach of the Contract Documents. This amount is fixed and agreed upon by and between the Contractor and Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain. This amount shall be construed as the actual amount of damages sustained by the Owner, and may be retained by the Owner and deducted from periodic payments to the Contractor.

3. Assessment of liquidated damages shall not release Contractor from any further obligations or liabilities pursuant to the Contract Documents.

B. Actual Damages

Actual damages will be assessed for failure to achieve Final Completion within the time provided. Actual damages will be calculated on the basis of direct architectural, administrative, and other related costs attributable to the Project from the date when Final Completion should have been achieved, based on the date Substantial Completion is actually achieved, to the date Final Completion is actually achieved. Owner may offset these costs against any payment due Contractor.

PART 4 - SPECIFICATIONS, DRAWINGS, AND OTHER DOCUMENTS

4.01 DISCREPANCIES AND CONTRACT DOCUMENT REVIEW

A. The intent of the Specifications and Drawings is to describe a complete Project to be constructed in accordance with the Contract Documents. Contractor shall furnish all labor, materials, equipment, tools, transportation, permits, and supplies, and perform the Work required in accordance with the Drawings, Specifications, and other provisions of the Contract Documents.

B. The Contract Documents are complementary. What is required by one part of the Contract Documents shall be binding as if required by all. Anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both.

C. Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by Owner. If, during the performance of the Work, Contractor finds a conflict, error, inconsistency, or omission in the Contract Documents, it shall promptly and before proceeding with the Work affected thereby, report such conflict, error, inconsistency, or omission to A/E in writing.

D. Contractor shall do no Work without applicable Drawings, Specifications, or written modifications, or Shop Drawings where required, unless instructed to do so in writing by Owner. If Contractor performs any construction activity, and it knows or reasonably should have known that any of the Contract Documents contain a conflict, error, inconsistency, or omission, Contractor shall be responsible for the performance and shall bear the cost for its correction.

E. Contractor shall provide any work or materials the provision of which is clearly implied and is within the scope of the Contract Documents even if the Contract Documents do not mention them specifically.

F. Questions regarding interpretation of the requirements of the Contract Documents shall be referred to the A/E.

4.02 PROJECT RECORD

A. Contractor shall legibly mark in ink on a separate set of the Drawings and Specifications all actual construction, including depths of foundations, horizontal and vertical locations of internal and underground utilities and appurtenances referenced to permanent visible and accessible surface improvements, field changes of dimensions and details, actual suppliers, manufacturers and trade names, models of installed equipment, and Change Order Proposals (COP). This separate set of Drawings and Specifications shall be the "Project Record."

B. The Project Record shall be maintained on the project site throughout the construction and shall be clearly labeled "PROJECT RECORD". The Project Record shall be updated at least weekly noting all changes and shall be available to Owner at all times.

C. Contractor shall submit the completed and finalized Project Record to A/E prior to Final Acceptance.

4.03 SUBMITTALS

A. "Submittals" means documents and other information required to be submitted to A/E by Contractor pursuant to the Contract Documents, showing in detail: the proposed fabrication and assembly of structural

elements; and the installation (i.e. form, fit, and attachment details) of materials and equipment. Submittals include, but are not limited to, drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, samples, and similar materials furnished by Contractor to explain in detail specific portions of the Work required by the Contract Documents. For materials and equipment to be incorporated into the Work, Contractor submittal shall include the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the item. When directed, Contractor shall submit all samples at its own expense. Owner may duplicate, use, and disclose Submittals provided in accordance with the Contract Documents.

B. Contractor shall coordinate all Shop Drawings, and review them for accuracy, completeness, and compliance with the Contract Documents and shall indicate its approval thereon as evidence of such coordination and review. Where required by law, Shop Drawings shall be stamped by an appropriate professional licensed by the state of Washington. Shop Drawings submitted to A/E without evidence of Contractor's approval shall be returned for resubmission. Contractor shall review, approve, and submit Shop Drawings with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of Owner or separate contractors. Contractor's submittal schedule shall allow a reasonable time for A/E review. A/E will review, approve, or take other appropriate action on the Shop Drawings. Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings until the respective submittal has been reviewed and the A/E has approved or taken other appropriate action. Owner and A/E shall respond to Shop Drawing submittals with reasonable promptness. Any Work by Contractor shall be in accordance with reviewed Shop Drawings. Submittals made by Contractor which are not required by the Contract Documents may be returned without action.

C. Approval, or other appropriate action with regard to Submittals, by Owner or A/E shall not relieve Contractor of responsibility for any errors or omissions in such Submittals, nor from responsibility for compliance with the requirements of the Contract Documents. Unless specified in the Contract Documents, review by Owner or A/E shall not constitute an approval of the safety precautions employed by Contractor during construction, or constitute an approval of Contractor's means or methods of construction. If Contractor fails to obtain approval before installation and the item or work is subsequently rejected, Contractor shall be responsible for all costs of correction.

D. If Shop Drawings show variations from the requirements of the Contract Documents, Contractor shall describe such variations in writing, separate from the Shop Drawings, at the time it submits the Shop Drawings containing such variations. If A/E approves any such variation, an appropriate Change Order will be issued. If the variation is minor and does not involve an adjustment in the Contract Sum or Contract Time, a Change Order need not be issued; however, the modification shall be recorded upon the Project Record.

E. Unless otherwise provided in Division I, Contractor shall submit to A/E for approval 5 (five) copies of all Submittals. Unless otherwise indicated, 3 (three) sets of all Submittals shall be retained by A/E and 2 (two) sets shall be returned to Contractor.

4.04 ORGANIZATION OF SPECIFICATIONS

Specifications are prepared in sections which conform generally with trade practices. These sections are for Owner and Contractor convenience and shall not control Contractor in dividing the Work among the Subcontractors or in establishing the extent of the Work to be performed by any trade.

4.05 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS, AND OTHER DOCUMENTS

A. The Drawings, Specifications, and other documents prepared by A/E are instruments of A/E's service through which the Work to be executed by Contractor is described. Neither Contractor nor any Subcontractor shall own or claim a copyright in the Drawings, Specifications, and other documents prepared by A/E, and A/E shall be deemed the author of them and will, along with any rights of Owner, retain all common law, statutory, and other reserved rights, in addition to the copyright. All copies of these documents, except Contractor's set, shall be returned or suitably accounted for to A/E, on request, upon completion of the Work.

B. The Drawings, Specifications, and other documents prepared by the A/E, and copies thereof furnished to Contractor, are for use solely with respect to this Project. They are not to be used by Contractor or any

Subcontractor on other projects or for additions to this Project outside the scope of the Work without the specific written consent of Owner and A/E. Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications, and other documents prepared by A/E appropriate to and for use in the execution of their Work.

C. Contractor and all Subcontractors grant a non-exclusive license to Owner, without additional cost or royalty, to use for its own purposes (including reproduction) all Shop Drawings, together with the information and diagrams contained therein, prepared by Contractor or any Subcontractor. In providing Shop Drawings, Contractor and all Subcontractors warrant that they have authority to grant to Owner a license to use the Shop Drawings, and that such license is not in violation of any copyright or other intellectual property right. Contractor agrees to defend and indemnify Owner pursuant to the indemnity provisions in section 5.03 and 5.23 from any violations of copyright or other intellectual property rights arising out of Owner's use of the Shop Drawings hereunder, or to secure for Owner, at Contractor's own cost, licenses in conformity with this section.

D. The Shop Drawings and other submittals prepared by Contractor, Subcontractors of any tier, or its or their equipment or material suppliers, and copies thereof furnished to Contractor, are for use solely with respect to this Project. They are not to be used by Contractor or any Subcontractor of any tier, or material or equipment supplier, on other projects or for additions to this Project outside the scope of the Work without the specific written consent of Owner. The Contractor, Subcontractors of any tier, and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Shop Drawings and other submittals appropriate to and for use in the execution of their Work under the Contract Documents.

PART 5 - PERFORMANCE

5.01 CONTRACTOR CONTROL AND SUPERVISION

A. Contractor shall supervise and direct the Work, using its best skill and attention, and shall perform the Work in a skillful manner. Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work, unless the Contract Documents give other specific instructions concerning these matters. Contractor shall disclose its means and methods of construction when requested by Owner.

B. Performance of the Work shall be directly supervised by a competent superintendent who is satisfactory to Owner and has authority to act for Contractor. The superintendent shall not be changed without the prior written consent of Owner. Owner may require Contractor to remove the superintendent from the Work or Project site, if Owner reasonably deems the superintendent incompetent, careless, or otherwise objectionable, provided Owner has first notified Contractor in writing and allowed a reasonable period for transition. The superintendent shall be on-site at all times while the Work is being performed, unless approved in writing by owner, in advance.

C. Contractor shall be responsible to Owner for acts and omissions of Contractor, Subcontractors, and their employees and agents.

D. Contractor shall enforce strict discipline and good order among Contractor's employees and other persons performing the Work. Contractor shall not permit employment of persons not skilled in tasks assigned to them. Contractor's employees shall at all times conduct business in a manner which assures fair, equal, and nondiscriminatory treatment of all persons. Owner may, by written notice, request Contractor to remove from the Work or Project site any employee Owner reasonably deems incompetent, careless, or otherwise objectionable.

E. Contractor shall, at all times, keep on the Project site a copy of the Drawings, Specifications, addenda, reviewed Shop Drawings, permits, and permit drawings.

F. Contractor shall ensure that its owner(s) and employees, and those of its Subcontractors, comply with the Ethics in Public Service Act RCW 42.52, which, among other things, prohibits state employees from having an economic interest in any public works contract that was made by, or supervised by, that employee. Contractor shall remove, at its sole cost and expense, any of its, or its Subcontractors', employees, if they are in violation of this act.

5.02 PERMITS, FEES, AND NOTICES

A. The Owner has obtained a Shorelines Substantial Development Permit and/or other environmental permits as required for this project. The permits with provisions which affect the construction methods or schedule have been incorporated into these specifications. The Contractor shall abide by all restrictions noted in these permits as the construction is in progress.

B. All other permits or fees required by local, state or federal governmental agencies necessary for the construction of this project shall be obtained and paid by the Contractor. Only the cost for the building permit will be reimbursed by the Owner.

C. The Contractor shall conform to all local, State and National Codes in all phases of this project. Where conflicts arise between plans, specifications and code requirements, the code shall prevail unless the plans or specifications are more stringent.

5.03 PATENTS AND ROYALTIES

Contractor is responsible for, and shall pay, all royalties and license fees. Contractor shall defend, indemnify, and hold Owner harmless from any costs, expenses, and liabilities arising out of the infringement by Contractor of any patent, copyright, or other intellectual property right used in the Work; however, provided that Contractor gives prompt notice, Contractor shall not be responsible for such defense or indemnity when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents. If Contractor has reason to believe that use of the required design, process, or product constitutes an infringement of a patent or copyright, it shall promptly notify Owner of such potential infringement.

5.04 PREVAILING WAGES

A. Contractor and all subcontractors shall pay the prevailing rate of wages to all workers, laborers, or mechanics employed in the performance of any part of the Work in accordance with RCW 39.12 and the rules and regulations of the Department of Labor and Industries. The schedule of prevailing wage rates for the locality or localities of the Work is determined by the Industrial Statistician of the Department of Labor and Industries. It is the Contractor's responsibility to verify the applicable prevailing wage rate.

B. Before payment is made by the Owner to the Contractor for any work performed by the Contractor and subcontractors whose work is included in the application for payment, the Contractor shall submit, or shall have previously submitted to the Owner for the Project, a Statement of Intent to Pay Prevailing Wages, approved by the Department of Labor and Industries, certifying the rate of hourly wage paid and to be paid each classification of laborers, workers, or mechanics employed upon the Work by Contractor and Subcontractors. Such rates of hourly wage shall not be less than the prevailing wage rate.

C. Prior to release of retainage, the Contractor shall submit to the Owner an Affidavit of Wages Paid, approved by the Department of Labor and Industries, for the Contractor and every subcontractor, of any tier, that performed work on the Project.

D. Disputes regarding prevailing wage rates shall be referred for arbitration to the Director of the Department of Labor and Industries. The arbitration decision shall be final and conclusive and binding on all parties involved in the dispute as provided for by RCW 39.12.060.

E. Each Application for Payment submitted by Contractor shall state that prevailing wages have been paid in accordance with the prefiled statement(s) of intent, as approved. Copies of the approved intent statement(s) shall be posted on the job site with the address and telephone number of the Industrial Statistician of the Department of Labor and Industries where a complaint or inquiry concerning prevailing wages may be made.

F. In compliance with chapter 296-127 WAC, Contractor shall pay to the Department of Labor and Industries the currently established fee(s) for each statement of intent and/or affidavit of wages paid submitted to the Department of Labor and Industries for certification.

G. Copies of approved Intents to Pay Prevailing Wages for the Contractor and all subcontractors shall be submitted with the Contractor's first application for payment. As additional subcontractors perform work on

the project, their approved Intent forms shall be submitted with the Contractor's next application for payment.

H. The Contractor or subcontractor directly contracting for "Off-Site, Prefabricated, Non-Standard, Project Specific Items" shall identify and report information required on the affidavit of wages paid form filed with the Department of Labor and Industries. The Contractor shall include language in its subcontracts requiring subcontractors and lower-tier subcontractors to comply with the reporting requirements for "Off-Site, Prefabricated, Non-Standard, Project Specific Item(s)" on the affidavit of wages paid.

The reporting requirement for Items shall apply for all public works contracts estimated to cost over $1 million entered into by the Owner and Contractor between September 1, 2010 and December 31, 2013.

"Off-site, prefabricated, nonstandard, project specific item(s)" means products or items that are:

1. Made primarily of architectural or structural precast concrete, fabricated steel, pipe and pipe systems, or sheet metal and sheet metal duct work;
2. Produced specifically for the public work and not considered to be regularly available shelf items;
3. Produced or manufactured by labor expended to assemble or modify standard items; and
4. Produced at an off-site location outside Washington.

The Contractor or subcontractor shall comply with the reporting requirements and instructions on the affidavit of wages paid form, and shall report the following information on the affidavit of wages paid form submitted to the Department of Labor and Industries in order to comply with the reporting requirements for use of "Off-Site, Prefabricated, Non-Standard, Project Specific item(s)":

1. The estimated cost of the public works project;
2. The name of the awarding agency and the project title;
3. The contract value of the off-site, prefabricated, nonstandard, project specific item(s) produced outside of Washington State, including labor and materials; and
4. The name, address, and federal employer identification number of the contractor that produced the off-site, prefabricated, nonstandard, project specific item(s).

The owner may direct the contractor, at no additional cost to the owner, to remove and substitute any subcontractor(s) found to be out of compliance with the "Off-Site Prefabricated Non-Standard Project Specific Item(s)" reporting requirements more than one time as determined by the Department of Labor and Industries.

I. The Contractor and all subcontractors shall promptly submit to the Owner certified payroll copies if requested.

5.05 HOURS OF LABOR

A. Contractor shall comply with all applicable provisions of RCW 49.28 and they are incorporated herein by reference. Pursuant to that statute, no laborer, worker, or mechanic employed by Contractor, any Subcontractor, or any other person performing or contracting to do the whole or any part of the Work, shall be permitted or required to work more than eight (8) hours in any one calendar day, provided, that in cases of extraordinary emergency, such as danger to life or property, the hours of work may be extended, but in such cases the rate of pay for time employed in excess of eight (8) hours of each calendar day shall be not less than one and one-half times (x1.5) the rate allowed for this same amount of time during eight (8) hours service.

B. Notwithstanding the preceding paragraph, RCW 49.28 permits a contractor or subcontractor in any public works contract subject to those provisions, to enter into an agreement with its employees in which the employees work up to ten (10) hours in a calendar day. No such agreement may provide that the employees work ten-hour days for more than four (4) calendar days a week. Any such agreement is subject to approval by the employees. The overtime provisions of RCW 49.28 shall not apply to the hours, up to forty (40) hours per week, worked pursuant to any such agreement.

5.06 NONDISCRIMINATION

A. Discrimination in all phases of employment is prohibited by, among other laws and regulations, Title VII of the Civil Rights Act of 1964, the Vietnam Era Veterans Readjustment Act of 1974, sections 503 and 504 of the Vocational Rehabilitation Act of 1973, the Equal Employment Act of 1972, the Age Discrimination Act of

1967, the Americans with Disabilities Act of 1990, the Civil Rights Act of 1991, Presidential Executive Order 11246, Executive Order 11375, the Washington State Law Against Discrimination, RCW 49.60, and Gubernatorial Executive Order 85-09. These laws and regulations establish minimum requirements for affirmative action and fair employment practices which Contractor must meet.

B. During performance of the Work:

1. Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability, Vietnam era veteran status, or disabled veteran status, nor commit any other unfair practices as defined in RCW 49.60.

2. Contractor shall, in all solicitations or advertisements for employees placed by or for it, state that the contractor is an “equal opportunity employer”.

3. Contractor shall send to each labor union, employment agency, or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice advising the labor union, employment agency, or workers' representative of Contractor's obligations according to the Contract Documents and RCW 49.60.

4. Contractor shall permit access to its books, records, and accounts, and to its premises by Owner, and by the Washington State Human Rights Commission, for the purpose of investigation to ascertain compliance with this section of the Contract Documents.

5. Contractor shall include the provisions of this section in every Subcontract.

C. Nondiscrimination Requirement. During the term of this Contract, Contractor, including any subcontractor, shall not discriminate on the bases enumerated at RCW 49.60.530(3). In addition, Contractor, including any subcontractor, shall give written notice of this nondiscrimination requirement to any labor organizations with which Contractor, or subcontractor, has a collective bargaining or other agreement.

D. Obligation to Cooperate. Contractor, including any subcontractor, shall cooperate and comply with any Washington state agency investigation regarding any allegation that Contractor, including any subcontractor, has engaged in discrimination prohibited by this Contract pursuant to RCW 49.60.530(3).

E. Default. Notwithstanding any provision to the contrary, Owner may suspend Contractor, including any subcontractor, upon notice of a failure to participate and cooperate with any state agency investigation into alleged discrimination prohibited by this Contract, pursuant to RCW 49.60.530(3). Any such suspension will remain in place until Owner receives notification that Contractor, including any subcontractor, is cooperating with the investigating state agency. In the event Contractor, or subcontractor, is determined to have engaged in discrimination identified at RCW 49.60.530(3), Owner may terminate this Contract in whole or in part, and Contractor, subcontractor, or both, may be referred for debarment as provided in RCW 39.26.200. Contractor or subcontractor may be given a reasonable time in which to cure this noncompliance, including implementing conditions consistent with any court-ordered injunctive relief or settlement agreement.

F. Remedies for Breach. Notwithstanding any provision to the contrary, in the event of Contract termination or suspension for engaging in discrimination, Contractor, subcontractor, or both, shall be liable for contract damages as authorized by law including, but not limited to, any cost difference between the original contract and the replacement or cover contract and all administrative costs directly related to the replacement contract, which damages are distinct from any penalties imposed under Chapter 49.60, RCW. Owner shall have the right to deduct from any monies due to Contractor or subcontractor, or that thereafter become due, an amount for damages Contractor or subcontractor will owe Owner for default under this provision.

5.07 SAFETY PRECAUTIONS

A. In performing this contract, the Contractor shall provide for protecting the lives and health of employees and other persons; preventing damage to property, materials, supplies, and equipment; and avoid work interruptions. For these purposes, the Contractor shall:

1. Follow Washington Industrial Safety and Health Act (WISHA) regional directives and provide a site-specific safety program that will require an accident prevention and hazard analysis plan for the contractor and each subcontractor on the work site. The Contractor shall submit a site-specific safety plan to the Owner's representative prior to the initial scheduled construction meeting.

2. Provide adequate safety devices and measures including, but not limited to, the appropriate safety literature, notice, training, permits, placement and use of barricades, signs, signal lights, ladders, scaffolding, staging, runways, hoist, construction elevators, shoring, temporary lighting, grounded outlets, wiring, hazardous materials, vehicles, construction processes, and equipment required by Chapter 19.27 RCW, State Building Code (International Building, Electrical, Mechanical, Fire, and Uniform Plumbing Codes); Chapter 212-12 WAC, Fire Marshal Standards, Chapter 49.17 RCW, WISHA; Chapter 296-155 WAC, Safety Standards for Construction Work; Chapter 296-65 WAC; WISHA Asbestos Standard; WAC 296-62-071, Respirator Standard; WAC 296-62, General Occupation Health Standards, WAC 296-24, General Safety and Health Standards, WAC 296-24, General Safety and Health Standards, Chapter 49.70 RCW, and Right to Know Act.

3. Comply with the State Environmental Policy Act (SEPA), Clean Air Act, Shoreline Management Act, and other applicable federal, state, and local statutes and regulations dealing with the prevention of environmental pollution and the preservation of public natural resources.

4. Post all permits, notices, and/or approvals in a conspicuous location at the construction site.

5. Provide any additional measures that the Owner determines to be reasonable and necessary for ensuring a safe environment in areas open to the public. Nothing in this part shall be construed as imposing a duty upon the Owner or A/E to prescribe safety conditions relating to employees, public, or agents of the Contractors.

6. The Contractor shall make available a list of hazardous products being used on the project, and their respective Material Safety Data Sheets (MSDS) to the Engineer. This information will be required at the pre-construction conference.

B. In carrying out its responsibilities according to the Contract Documents, Contractor shall protect the lives and health of employees performing the Work and other persons who may be affected by the Work; prevent damage to materials, supplies, and equipment whether on site or stored off-site; and prevent damage to other property at the site or adjacent thereto. Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss; shall erect and maintain all necessary safeguards for such safety and protection; and shall notify owners of adjacent property and utilities when prosecution of the Work may affect them.

C. Contractor shall maintain an accurate record of exposure data on all incidents relating to the Work resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment. Contractor shall immediately report any such incident to Owner. Owner shall, at all times, have a right of access to all records of exposure.

D. Contractor shall provide all persons working on the Project site with information and training on hazardous chemicals in their work at the time of their initial assignment, and whenever a new hazard is introduced into their work area.

1. Information. At a minimum, Contractor shall inform persons working on the Project site of:

   a. The requirements of chapter 296-62 WAC, General Occupational Health Standards;
   b. Any operations in their work area where hazardous chemicals are present; and
   c. The location and availability of written hazard communication programs, including the required list(s) of hazardous chemicals and material safety data sheets required by chapter 296-62 WAC.

2. Training. At a minimum, Contractor shall provide training for persons working on the Project site which includes:

a. Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);
b. The physical and health hazards of the chemicals in the work area;
c. The measures such persons can take to protect themselves from these hazards, including specific procedures Contractor, or its Subcontractors, or others have implemented to protect those on the Project site from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and
d. The details of the hazard communications program developed by Contractor, or its Subcontractors, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

E. Contractor's responsibility for hazardous, toxic, or harmful substances shall include the following duties:

1. Contractor shall not keep, use, dispose, transport, generate, or sell on or about the Project site, any substances now or hereafter designated as, or which are subject to regulation as, hazardous, toxic, dangerous, or harmful by any federal, state or local law, regulation, statute or ordinance (hereinafter collectively referred to as "hazardous substances", in violation of any such law, regulation, statute, or ordinance, but in no case shall any such hazardous substance be stored more than 90 days on the Project site.

2. Contractor shall promptly notify Owner of all spills or releases of any hazardous substances which are otherwise required to be reported to any regulatory agency and pay the cost of cleanup. Contractor shall promptly notify Owner of all failures to comply with any federal, state, or local law, regulation, or ordinance; all inspections of the Project site by any regulatory entity concerning the same; all regulatory orders or fines; and all responses or interim cleanup actions taken by or proposed to be taken by any government entity or private party on the Project site.

F. All Work shall be performed with due regard for the safety of the public. Contractor shall perform the Work so as to cause a minimum of interruption of vehicular traffic or inconvenience to pedestrians. All arrangements to care for such traffic shall be Contractor's responsibilities. All expenses involved in the maintenance of traffic by way of detours shall be borne by Contractor.

G. In an emergency affecting the safety of life or the Work or of adjoining property, Contractor is permitted to act, at its discretion, to prevent such threatened loss or injury, and Contractor shall so act if so authorized or instructed.

H. Nothing provided in this section shall be construed as imposing any duty upon Owner or A/E with regard to, or as constituting any express or implied assumption of control or responsibility over, Project site safety, or over any other safety conditions relating to employees or agents of Contractor or any of its Subcontractors, or the public.

5.08 OPERATIONS, MATERIAL HANDLING, AND STORAGE AREAS

A. Contractor shall confine all operations, including storage of materials, to Owner-approved areas.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be provided by Contractor only with the consent of Owner and without expense to Owner. The temporary buildings and utilities shall remain the property of Contractor and shall be removed by Contractor at its expense upon completion of the Work.

C. Contractor shall use only established roadways or temporary roadways authorized by Owner. When materials are transported in prosecuting the Work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by federal, state, or local law or regulation.

D. Ownership and control of all materials or facility components to be demolished or removed from the Project site by Contractor shall immediately vest in Contractor upon severance of the component from the facility or severance of the material from the Project site. Contractor shall be responsible for compliance with all

laws governing the storage and ultimate disposal. Contractor shall provide Owner with a copy of all manifests and receipts evidencing proper disposal when required by Owner or applicable law.

E. Contractor shall be responsible for the proper care and protection of its materials and equipment delivered to the Project site. Materials and equipment may be stored on the premises subject to approval of Owner. When Contractor uses any portion of the Project site as a shop, Contractor shall be responsible for any repairs, patching, or cleaning arising from such use.

F. Contractor shall protect and be responsible for any damage or loss to the Work, or to the materials or equipment until the date of Substantial Completion, and shall repair or replace without cost to Owner any damage or loss that may occur, except damages or loss caused by the acts or omissions of Owner. Contractor shall also protect and be responsible for any damage or loss to the Work, or to the materials or equipment, after the date of Substantial Completion, and shall repair or replace without cost to Owner any such damage or loss that might occur, to the extent such damages or loss are caused by the acts or omissions of Contractor, or any Subcontractor.

G. Any removed item shall be salvaged without undue damage and stockpiled in a neat and orderly fashion in an area designated by the Engineer. All removed items shall remain the property of the Owner, unless, due to their condition, they are rejected by the Engineer. All materials of whatever nature that are rejected shall be properly disposed by the Contractor in compliance with all laws and regulations.

H. If designated campsites or emergency overflow areas are approved for use, the Contractor shall comply with all campground rules and regulations of the Washington State Parks and Recreation Commission and the park manager.

5.09 PRIOR NOTICE OF EXCAVATION

A. "Excavation" means an operation in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means, except the tilling of soil less than 12 (twelve) inches in depth for agricultural purposes, or road ditch maintenance that does not change the original road grade or ditch flow line. Before commencing any excavation, Contractor shall provide notice of the scheduled commencement of excavation to all owners of underground facilities or utilities, through locator services.

5.10 UNFORESEEN PHYSICAL CONDITIONS

A. If Contractor encounters conditions at the site which are subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents, or unknown physical conditions of an unusual nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then Contractor shall give written notice to Owner promptly and in no event later than 7 (seven) days after the first observance of the conditions. Conditions shall not be disturbed prior to such notice.

B. If such conditions differ materially and cause a change in Contractor's cost of, or time required for, performance of any part of the Work, the Contractor may be entitled to an equitable adjustment in the Contract Time or Contract Sum, or both, provided it makes a request therefore as provided in part 7.

5.11 PROTECTION OF EXISTING STRUCTURES, EQUIPMENT, VEGETATION, UTILITIES, AND IMPROVEMENTS

A. Contractor shall protect from damage all existing structures, equipment, improvements, utilities, and vegetation: at or near the Project site; and on adjacent property of a third party, the locations of which are made known to or should be known by Contractor. Contractor shall repair any damage, including that to the property of a third party, resulting from failure to comply with the requirements of the Contract Documents or failure to exercise reasonable care in performing the Work. If Contractor fails or refuses to repair the damage promptly, Owner may have the necessary work performed and charge the cost to Contractor.

B. Contractor shall only remove trees when specifically authorized to do so, and shall protect vegetation that will remain in place.

C. In general, the locations of existing major utilities and equipment, whether above ground or underground, are indicated on the drawings. This information has been obtained from utility maps and verbal

descriptions. The Engineer does not guarantee the accuracy or completeness of this information. Other above ground or underground facilities not shown on the drawings may be encountered during the course of the work for which the Contractor is fully responsible to properly locate and identify within the construction area.

D. Existing above ground and underground facilities and appurtenant structures, which includes but is not limited to, power transmission and distribution, telephone, alarm systems, sanitary sewers, gas services, water service and house or yard drains and fences, shall be located, protected, maintained, relocated, rerouted, removed and restored as may be necessary by the Contractor for completion of the work, but in a manner satisfactory to their respective owners and operators of the services and to the Engineer with the least possible interruption to existing services.

E. The Contractor shall be responsible for location and maintenance of existing utilities and improvements. Under no circumstances will errors or omissions in location of utilities or improvements, whether they be visible from the surface, buried, or otherwise obscured, be considered as a basis for a claim for additional compensation by the Contractor.

F. All utilities shall be protected and maintained in continuous operation except where special arrangements have been made with the appropriate utility owner. All damaged utilities shall be restored to original condition, subject to the approval of its owner and at the Contractor's own expense.

G. If requested, the Contractor shall provide record information about locations, depths, and dimensions of lines, appurtenances, and structures, and any other relevant information about electrical power, water, sewer, and other utilities.

H. The Contractor shall provide the Engineer with the data required to make a detailed set of record plans. This data will be obtained and recorded by the Contractor during construction on plans supplied by the Engineer. The Contractor shall ensure that the data is obtained. Typical information to be gathered includes the locations of:

1. Buried utilities
2. Junctions of sewer wyes
3. Junctions of electrical taps
4. Clean-outs
5. Deflection points of utilities
6. Valves

I. Procedure for obtaining this information will be developed by the Engineer working with the Contractor.

J. Contractor shall protect all existing facilities using whatever methods are necessary, subject to the Engineer's approval. Trees, shrubs, vegetation, or lawn shall not be damaged, scarred, or destroyed unless deemed necessary for work on this contract. All trees damaged during construction shall be immediately repaired using SEAL AND HEAL or other materials as directed by the Engineer. Any damage to the above-mentioned items shall be repaired at the Contractor's expense and to the Engineer's satisfaction.

K. In the event that archaeological resources are found or unearthed on public land during the performance of this contract, the Contractor shall be required to comply with RCW 27.44 and RCW 27.53 and the rules and regulations of the office of Archaeology and Historic Preservation, including compliance with all archaeological excavation permit requirements.

5.12 LAYOUT OF WORK

A. Contractor shall plan and lay out the Work in advance of operations so as to coordinate all work without delay or revision.

B. Contractor shall lay out the Work from Owner-established baselines and bench marks indicated on the Drawings, and shall be responsible for all field measurements in connection with the layout. Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the Work. Contractor shall be responsible for executing the Work to the lines

and grades that may be established. Contractor shall be responsible for maintaining or restoring all stakes and other marks established.

C. The indicated limits of work shall be the controlling factor in the Contractor's scope of operation and no payment shall be due for work done out of the limits. Damage to areas not in the Contractor's work area shall be repaired at the Contractor's expense. Questions of what constitutes the work area shall be determined by the Engineer. Only the best methods of construction will be allowed.

D. The Engineer may adjust or relocate any portion of the system to meet site requirements or to improve the system without additional compensation to the Contractor, provided such adjustments do not represent appreciable costs for additional labor and materials.

5.13 MATERIAL AND EQUIPMENT

A. All equipment, material, and articles incorporated into the Work shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in the Contract Documents. References in the Specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard quality and shall not be construed as limiting competition. Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of A/E, is equal to that named in the specifications, unless otherwise specifically provided in the Contract Documents.

B. Contractor shall do all cutting, fitting, or patching that may be required to make its several parts fit together properly, or receive or be received by work of others set forth in, or reasonably implied by, the Contract Documents. Contractor shall not endanger any work by cutting, excavating, or otherwise altering the Work and shall not cut or alter the work of any other contractor unless approved in advance by Owner.

C. Should any of the Work be found defective, or in any way not in accordance with the Contract Documents, this work, in whatever stage of completion, may be rejected by Owner.

D. The Contractor shall furnish proof of equality in all respects to the specified items when proposing alternate brands or materials. Any significant deviations from specifications, drawings, or equality must be noted by the Contractor when submitting alternate products or materials for approval. The Engineer shall be the sole judge of the equality and suitability of any products, materials, or components proposed by the Contractor as alternates to specified items. The Contractor shall bear all costs and make all secondary changes required to incorporate an approved substitute or alternate into the work. No offers for substitution will be acknowledged from suppliers, distributors, manufacturers, or subcontractors.

5.14 AVAILABILITY AND USE OF UTILITY SERVICES

A. Owner shall make all reasonable utilities available to Contractor from existing outlets and supplies, as specified in the Contract Documents. Unless otherwise provided in the Contract Documents, the utility service consumed shall be charged to or paid for by Contractor at prevailing rates charged to Owner or, where the utility is produced by Owner, at reasonable rates determined by Owner. Contractor will carefully conserve any utilities furnished.

B. Contractor shall, at its expense and in a skillful manner satisfactory to Owner, install and maintain all necessary temporary connections and distribution lines, together with appropriate protective devices, and all meters required to measure the amount of each utility used for the purpose of determining charges. Prior to the date of Final Acceptance, Contractor shall remove all temporary connections, distribution lines, meters, and associated equipment and materials.

5.15 TESTS AND INSPECTION

A. Contractor shall maintain an adequate testing and inspection program and perform such tests and inspections as are necessary or required to ensure that the Work conforms to the requirements of the Contract Documents. Contractor shall be responsible for inspection and quality surveillance of all its Work and all Work performed by any Subcontractor. Unless otherwise provided, Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. Contractor shall give Owner timely notice of when and where tests and

inspections are to be made. Contractor shall maintain complete inspection records and make them available to Owner.

B. Owner may, at any reasonable time, conduct such inspections and tests as it deems necessary to ensure that the Work is in accordance with the Contract Documents. Owner shall promptly notify Contractor if an inspection or test reveals that the Work is not in accordance with the Contract Documents. Unless the subject items are expressly accepted by Owner, such Owner inspection and tests are for the sole benefit of Owner and do not:

1. Constitute or imply acceptance;
2. Relieve Contractor of responsibility for providing adequate quality control measures;
3. Relieve Contractor of responsibility for risk of loss or damage to the Work, materials, or equipment;
4. Relieve Contractor of its responsibility to comply with the requirements of the Contract Documents; or
5. Impair Owner's right to reject defective or nonconforming items, or to avail itself of any other remedy to which it may be entitled.

C. Neither observations by an inspector retained by Owner, the presence or absence of such inspector on the site, nor inspections, tests, or approvals by others, shall relieve Contractor from any requirement of the Contract Documents, nor is any such inspector authorized to change any term or condition of the Contract Documents.

D. Contractor shall promptly furnish, without additional charge, all facilities, labor, material and equipment reasonably needed for performing such safe and convenient inspections and tests as may be required by Owner. Owner may charge Contractor any additional cost of inspection or testing when Work is not ready at the time specified by Contractor for inspection or testing, or when prior rejection makes re-inspection or retest necessary. Owner shall perform its inspections and tests in a manner that will cause no undue delay in the Work.

E. The Owner shall have the right to appoint an Inspector who will have the authority to reject materials or workmanship which does not fulfill the requirements of these specifications. In case of dispute, the Contractor may appeal to the Engineer whose decision shall be final. The acceptance of any material by the Inspector shall not hinder its subsequent rejection if found defective. Rejected materials and workmanship shall be replaced promptly or be made good by the Contractor without additional cost to the Owner.

F. Contractor shall deliver one (1) key for each type of lock installed on the project to the Engineer to enable the Engineer to enter all facilities under construction for the purpose of inspection. This includes temporary as well as State Parks' key-coded locks. All keys for key-coded locks shall be delivered to the Engineer as they are made available to the Contractor. These coded keys shall then be signed out to the Contractor on an accountable basis for security purposes.

5.16 CORRECTION OF NONCONFORMING WORK

A. If a portion of the Work is covered contrary to the requirements in the Contract Documents, it must, if required in writing by Owner, be uncovered for Owner's observation and be replaced at the Contractor's expense and without change in the Contract Time.

B. If, at any time prior to Final Completion, Owner desires to examine the Work, or any portion of it, which has been covered, Owner may request to see such Work and it shall be uncovered by Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an adjustment in the Contract Sum for the costs of uncovering and replacement, and, if completion of the Work is thereby delayed, an adjustment in the Contract Time, provided it makes a request therefore as provided in part 7. If such Work is not in accordance with the Contract Documents, the Contractor shall pay the costs of examination and reconstruction.

C. Contractor shall promptly correct Work found by Owner not to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed, or completed. Contractor shall bear all costs of correcting such nonconforming Work, including additional testing and inspections.

D. If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or within one year after the date for commencement of any system warranties established under section 6.08, or within the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, Contractor shall correct it promptly after receipt of written notice from Owner to do so. Owner shall give such notice promptly after discovery of the condition. This period of one year shall be extended, with respect to portions of Work first performed after Substantial Completion, by the period of time between Substantial Completion and the actual performance of the Work. Contractor's duty to correct with respect to Work repaired or replaced shall run for one year from the date of repair or replacement. Obligations under this paragraph shall survive Final Acceptance.

E. Contractor shall remove from the Project site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by Contractor nor accepted by Owner.

F. If Contractor fails to correct nonconforming Work within a reasonable time after written notice to do so, Owner may replace, correct, or remove the nonconforming Work and charge the cost thereof to the Contractor.

G. Contractor shall bear the cost of correcting destroyed or damaged Work, whether completed or partially completed, caused by Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

H. Nothing contained in this section shall be construed to establish a period of limitation with respect to other obligations which Contractor might have according to the Contract Documents. Establishment of the time period of one (1) year as described in paragraph 5.16D relates only to the specific obligation of Contractor to correct the Work, and has no relationship to the time within which the Contractor's obligation to comply with the Contract Documents may be sought to be enforced, including the time within which such proceedings may be commenced.

I. If Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, Owner may do so instead of requiring its removal and correction, in which case the Contract Sum may be reduced as appropriate and equitable.

5.17 CLEAN UP

Contractor shall at all times keep the Project site, including hauling routes, infrastructures, utilities, and storage areas, free from accumulations of waste materials. Before completing the Work, Contractor shall remove from the premises its rubbish, tools, scaffolding, equipment, and materials. Upon completing the Work, Contractor shall leave the Project site in a clean, neat, and orderly condition satisfactory to Owner. If Contractor fails to clean up as provided herein, and after reasonable notice from Owner, Owner may do so and the cost thereof shall be charged to Contractor.

5.18 ACCESS TO WORK

Contractor shall provide Owner and A/E access to the Work in progress wherever located.

5.19 OTHER CONTRACTS

Owner may undertake or award other contracts for additional work at or near the Project site. Contractor shall reasonably cooperate with the other contractors and with Owner's employees and shall carefully adapt scheduling and perform the Work in accordance with these Contract Documents to reasonably accommodate the other work.

5.20 SUBCONTRACTORS AND SUPPLIERS

A. The Contractor shall include the language of this paragraph in each of its first tier subcontracts, and shall require each of its subcontractors to include the same language of this section in each of their subcontracts, adjusting only as necessary the terms used for the contracting parties. Upon request of the Owner, the Contractor shall promptly provide documentation to the Owner demonstrating that the subcontractor meets the subcontractor responsibility criteria below. The requirements of this paragraph apply to all subcontractors regardless of tier. At the time of subcontract execution, the Contractor shall verify that each of its first tier subcontractors meets the following bidder responsibility criteria:

1. Have a current certificate of registration as a contractor in compliance with chapter 18.27 RCW, which must have been in effect at the time of subcontract bid submittal;
2. Have a current Washington Unified Business Identifier (UBI) number;
3. If applicable, have:

    a. Industrial Insurance (workers' compensation) coverage for the subcontractor's employees working in Washington, as required in Title 51 RCW;
    b. A Washington Employment Security Department number, as required in Title 50 RCW;
    c. A Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
    d. An electrical contractor license, if required by Chapter 19.28 RCW;
    e. An elevator contractor license, if required by Chapter 70.87 RCW.

4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065 (3).
5. On a project subject to the apprenticeship utilization requirements in RCW 39.04.320, not have been found out of compliance by the Washington state apprenticeship and training council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under chapter 49.04 RCW for the one-year period immediately preceding the date of the Owner's first advertisement of the project.

B. Prior to submitting the first Application for Payment, Contractor shall furnish in writing to Owner, on Owner provided form(s), the names, addresses, telephone numbers, and Tax Identification Numbers (TIN) of all subcontractors, as well as suppliers providing materials in excess of $2,500.00 which Contractor believes to be MBE or WBE owned businesses, or have identified themselves to the Contractor as MBE or WBE, or are Washington State OMWBE certified. The Contractor shall indicate the anticipated dollar value of each MWBE subcontract. Contractor shall utilize subcontractors and suppliers, which are experienced and qualified, and meet the requirements of the Contract Documents, if any. Contractor shall not utilize any subcontractor or supplier to whom the Owner has a reasonable objection, and shall obtain Owner's written consent before making any substitutions or additions. The Owner may direct the Contractor, at no additional cost to the Owner, to remove and substitute any subcontractor(s) found to be out of compliance with the "Off-Site Prefabricated Non-Standard Project Specific Items" reporting requirements more than one time as determined by the Department of Labor and Industries and as defined in EHB 2805 that amends RCW 39.04.

C. All Subcontracts must be in writing. By appropriate written agreement, Contractor shall require each Subcontractor, so far as applicable to the Work to be performed by the Subcontractor, to be bound to Contractor by terms of the Contract Documents, and to assume toward Contractor all the obligations and responsibilities which Contractor assumes toward Owner in accordance with the Contract Documents. Each Subcontract shall preserve and protect the rights of Owner in accordance with the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights. Where appropriate, Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. However, nothing in this paragraph shall be construed to alter the contractual relations between Contractor and its Subcontractors with respect to insurance or bonds.

D. Contractor shall schedule, supervise, and coordinate the operations of all Subcontractors. No Subcontracting of any of the Work shall relieve Contractor from its responsibility for the performance of the Work in accordance with the Contract Documents or any other obligations of the Contract Documents.

E. Each subcontract agreement for a portion of the Work is hereby assigned by Contractor to Owner provided that:

1. The assignment is effective only after termination by Owner for cause pursuant to section 9.01 and only for those Subcontracts which Owner accepts by notifying the Subcontractor in writing; and

2. After the assignment is effective, Owner will assume all future duties and obligations toward the Subcontractor which Contractor assumed in the Subcontract.

3. The assignment is subject to the prior rights of the surety, if any, obligated under any bond provided in accordance with the Contract Documents.

5.21 WARRANTY OF CONSTRUCTION

A. In addition to any special warranties provided elsewhere in the Contract Documents, Contractor warrants that all Work conforms to the requirements of the Contract Documents and is free of any defect in equipment, material, or design furnished, or workmanship performed, by Contractor.

B. With respect to all warranties, express or implied, for Work performed or materials furnished according to the Contract Documents, Contractor shall:

1. Obtain all warranties that would be given in normal commercial practice;
2. Require all warranties to be executed, in writing, for the benefit of Owner;
3. Enforce all warranties for the benefit of Owner, if directed by Owner; and
4. Be responsible to enforce any subcontractor's, manufacturer's, or supplier's warranty should they extend beyond the period specified in the Contract Documents.

C. The obligations under this section shall survive Final Acceptance.

5.22 INDEMNIFICATION

A. Contractor shall defend, indemnify, and hold Owner and A/E harmless from and against all claims, demands, losses, damages, or costs, including but not limited to damages arising out of bodily injury or death to persons and damage to property, caused by or resulting from:

1. The sole negligence of Contractor or any of its Subcontractors;
2. The concurrent negligence of Contractor, or any Subcontractor, but only to the extent of the negligence of Contractor or such Subcontractor; and
3. The use of any design, process, or equipment which constitutes an infringement of any United States patent presently issued, or violates any other proprietary interest, including copyright, trademark, and trade secret.

B. In any action against Owner and any other entity indemnified in accordance with this section, by any employee of Contractor, its Subcontractors, Sub-subcontractors, agents, or anyone directly or indirectly employed by any of them, the indemnification obligation of this section shall not be limited by a limit on the amount or type of damages, compensation, or benefits payable by or for Contractor or any Subcontractor under RCW Title 51, the Industrial Insurance Act, or any other employee benefit acts. In addition, Contractor waives immunity as to Owner and A/E only, in accordance with RCW Title 51.

5.23 AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE

A. General Requirements
The Contractor and subcontractor shall ensure that all work performed under this Contract complies with the Americans with Disabilities Act (ADA), as codified in 28 C.F.R. § 35.151, and the 2010 ADA Standards for Accessible Design. The Contractor and subcontractor shall construct and maintain all accessible features in operable condition and correct any identified deficiencies in a timely manner.

B. Accessibility in New Construction and Alterations
1. All new facilities and alterations to existing facilities shall be designed and constructed in a manner that ensures accessibility and usability for individuals with disabilities, consistent with ADA accessibility standards.
2. Alterations shall, to the maximum extent feasible, ensure the altered area and the associated path of travel comply with accessibility requirements.
3. If technical infeasibility prevents full compliance, the Contractor and subcontractor shall notify the Owner’s Representative and submit a written request for determination of technical infeasibility.

4. The Contractor and subcontractor shall coordinate with the Owner to ensure that all public notices related to temporary accessibility interruptions are posted on the project site and on designated agency communication channels.

C. Maintenance and Inspection of Accessible Features
1. The Contractor and subcontractor shall be responsible for maintaining accessible routes, parking, restrooms, and other accessible features in operable condition throughout the duration of the Work.
2. Any temporary disruptions affecting accessibility shall be scheduled in a manner that minimizes impact and includes reasonable alternative accommodations where feasible.
3. The Contractor and subcontractor shall notify the Owner immediately if any accessibility feature is found to be non-compliant or requires repair.

D. Historic Structures
If the Work involves historic structures or landscapes that are listed or eligible for listing in the National Register of Historic Places, modifications shall be made in compliance with ADA requirements to the maximum extent feasible. The State Historic Preservation Officer (SHPO) must approve any exemptions for alterations that may impact the historic significance of a structure or landscape.

E. Compliance and Documentation
1. The Contractor and subcontractor shall comply with all applicable local, state, and federal accessibility requirements.
2. Any non-compliant work shall be corrected at the Contractor's expense prior to final acceptance.

F. Submission of Progress Reports – Americans with Disabilities Act (ADA) Compliance
The Contractor shall submit regular progress reports to the Owner, which shall include the following:

1. Status of Accessible Features – Updates on the construction, installation, and maintenance of all accessibility-related features in accordance with ADA standards.
2. Compliance Issues – Identification of any non-compliance issues encountered, including deviations from ADA accessibility standards, technical infeasibility determinations, or unforeseen site conditions affecting accessibility.
3. Corrective Actions – Description of corrective actions taken or proposed to address any identified accessibility deficiencies, including timelines for remediation and any required approvals from the Owner.
4. Temporary Disruptions – Notification of any planned or unplanned interruptions to accessibility features, including measures taken to minimize impacts and alternative accommodations provided.
5. Final Verification – Prior to Substantial Completion, the Contractor shall provide documentation verifying that all constructed and altered elements comply with applicable ADA requirements, subject to inspection and approval by the Owner.

Failure to comply with the provisions of this section may result in suspension of the Work, withholding of payment or other remedies as deemed necessary by the Owner.

PART 6 - PAYMENTS AND COMPLETION

6.01 CONTRACT SUM

Owner shall pay Contractor the Contract Sum for performance of the Work, in accordance with the Contract Documents. The Contract Sum shall include all taxes imposed by law and properly chargeable to the Project, including sales tax.

6.02 SCHEDULE OF VALUES

Before submitting its first Application for Payment, Contractor shall submit to Owner for approval a breakdown allocating the total Contract Sum to each principle category of work, in such detail as requested by Owner ("Schedule of Values"). The approved Schedule of Values shall include appropriate amounts for demobilization, record drawings, O&M manuals, and any other requirements for Project closeout, and shall be used by Owner as the basis for progress payments. Payment for Work shall be made only for and in accordance with those items included in the Schedule of Values.

6.03 APPLICATION FOR PAYMENT

A. At monthly intervals, unless determined otherwise by Owner, Contractor shall submit to Owner an itemized Application for Payment for Work completed in accordance with the Contract Documents and the approved Schedule of Values. Each application shall be supported by such substantiating data as Owner may require.

B. By submitting an Application for Payment, Contractor is certifying that all Subcontractors have been paid, less earned retainage in accordance with RCW 60.28.010, as their interests appeared in the last preceding certificate of payment. By submitting an Application for Payment, Contractor is recertifying that the representations set forth in section 1.03 are true and correct, to the best of Contractor's knowledge, as of the date of the Application for Payment.

C. At the time it submits an Application for Payment, Contractor shall analyze and reconcile, to the satisfaction of Owner, the actual progress of the Work with the Progress Schedule.

D. If authorized by Owner, the Application for Payment may include request for payment for material delivered to the Project site and suitably stored, or for completed preparatory work. Payment may similarly be requested for material stored off the Project site, provided Contractor complies with or furnishes satisfactory evidence of the following:

1. The material will be placed in a warehouse that is structurally sound, dry, lighted, and suitable for the materials to be stored;

2. The warehouse is located within a 10-mile radius of the Project. Other locations may be utilized, if approved in writing, by Owner;

3. Only materials for the Project are stored within the warehouse (or a secure portion of a warehouse set aside for the Project);

4. Contractor furnishes Owner a certificate of insurance extending Contractor's insurance coverage for damage, fire, and theft to cover the full value of all materials stored, or in transit;

5. The warehouse (or secure portion thereof) is continuously under lock and key, and only Contractor's authorized personnel shall have access;

6. Owner shall at all times have the right of access in company of Contractor;

7. Contractor and its surety assume total responsibility for the stored materials; and

8. Contractor furnishes to Owner certified lists of materials stored, bills of lading, invoices, and other information as may be required, and shall also furnish notice to Owner when materials are moved from storage to the Project site.

6.04 PROGRESS PAYMENTS

A. Owner shall make progress payments, in such amounts as Owner determines are properly due, within 30 days after receipt of a properly executed Application for Payment. Owner shall notify Contractor in accordance with RCW 39.76 if the Application for Payment does not comply with the requirements of the Contract Documents.

B. Owner shall retain 5% (five percent) of the amount of each progress payment until forty-five (45) days after Final Acceptance and receipt of all documents required by law or the Contract Documents, including, at Owner's request, consent of surety to release of the retainage. In accordance with RCW 60.28, Contractor may request that monies reserved be retained in a fund by Owner, deposited by Owner in a bank or savings and loan, or placed in escrow with a bank or trust company to be converted into bonds and securities to be held in escrow with interest to be paid to Contractor. Owner may permit Contractor to provide an appropriate bond in lieu of the retained funds.

C. Title to all Work and materials covered by a progress payment shall pass to Owner at the time of such payment free and clear of all liens, claims, security interests, and encumbrances. Passage of title shall not,

however, relieve Contractor from any of its duties and responsibilities for the Work or materials, or waive any rights of Owner to insist on full compliance by Contractor with the Contract Documents.

D. Payments due and unpaid in accordance with the Contract Documents shall bear interest as specified in RCW 39.76.

6.05 PAYMENTS WITHHELD

A. Owner may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any payment to such extent as may be necessary to protect Owner from loss or damage for reasons including but not limited to:

1. Work not in accordance with the Contract Documents;
2. Reasonable evidence that the Work required by the Contract Documents cannot be completed for the unpaid balance of the Contract Sum;
3. Work by Owner to correct defective Work or complete the Work in accordance with section 5.17;
4. Failure to perform in accordance with the Contract Documents; or
5. Cost or liability that may occur to Owner as the result of Contractor's fault or negligent acts or omissions.

B. In any case where part or all of a payment is going to be withheld for unsatisfactory performance, Owner shall notify Contractor in accordance with RCW 39.76.

6.06 RETAINAGE AND BOND CLAIM RIGHTS

A. Prior to release of the contract retainage, an "Affidavit of Wages Paid", approved by the Washington State Department of Labor and Industries, must be on file in the Owner's office. Contracts over $20,000, including tax, necessitate a clearance from the Washington State Department of Revenue and the Washington State Department of Employment Security. The Owner shall initiate action for the releases from the Departments of Revenue and Employment Security.

B. RCW chapters 39.08 and 60.28, concerning the rights and responsibilities of Contractor and Owner with regard to the performance and payment bonds and retainage, are made a part of the Contract Documents by reference as though fully set forth herein.

C. In accordance with RCW 60.28, the lien period for filing liens against the contract retainage shall be forty-five (45) days. Persons performing labor or furnishing supplies toward the completion of the contract who intend to file a lien against the contract retainage must do so within forty-five (45) days from the date of Final Acceptance of the contract by the Owner and in the manner as described in RCW 39.08.030.

6.07 SUBSTANTIAL COMPLETION

Substantial Completion is the stage in the progress of the Work (or portion thereof designated and approved by Owner) when the construction is sufficiently complete, in accordance with the Contract Documents, so Owner can fully occupy the Work (or the designated portion thereof) for the use for which it is intended. All Work other than incidental corrective or punch list work shall be completed. Substantial Completion shall not have been achieved if all systems and parts are not functional, if utilities are not connected and operating normally, if all required occupancy permits have not been issued, or if the Work is not accessible by normal vehicular and pedestrian traffic routes. The date Substantial Completion is achieved shall be established in writing by Owner. Contractor may request an early date of Substantial Completion which must be approved by Change Order. Owner's occupancy of the Work or designated portion thereof does not necessarily indicate that Substantial Completion has been achieved.

6.08 PRIOR OCCUPANCY

A. Owner may, upon written notice thereof to Contractor, take possession of or use any completed or partially completed portion of the Work ("Prior Occupancy") at any time prior to Substantial Completion. Unless otherwise agreed in writing, Prior Occupancy shall not: be deemed an acceptance of any portion of the

Work; accelerate the time for any payment to Contractor; prejudice any rights of Owner provided by any insurance, bond, guaranty, or the Contract Documents; relieve Contractor of the risk of loss or any of the obligations established by the Contract Documents; establish a date for termination or partial termination of the assessment of liquidated damages; or constitute a waiver of claims.

B. Notwithstanding anything in the preceding paragraph, Owner shall be responsible for loss of or damage to the Work resulting from Prior Occupancy. Contractor's one (1) year duty to repair and any system warranties shall begin on building systems activated and used by Owner as agreed in writing by Owner and Contractor.

6.09 FINAL COMPLETION, ACCEPTANCE, AND PAYMENT

A. Final Completion shall be achieved when the Work is fully and finally complete in accordance with the Contract Documents. The date Final Completion is achieved shall be established by Owner in writing.

B. Final Acceptance is the formal action of Owner acknowledging Final Completion. Prior to Final Acceptance, Contractor shall, in addition to all other requirements in the Contract Documents, submit to Owner a written notice of any outstanding disputes or claims between Contractor and any of its Subcontractors, including the amounts and other details thereof. Neither Final Acceptance, nor final payment, shall release Contractor or its sureties from any obligations of these Contract Documents or the Public Works Bond, or constitute a waiver of any claims by Owner arising from Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Acceptance of final payment by Contractor, or any Subcontractor, shall constitute a waiver and release to Owner of all claims by Contractor, or any such Subcontractor, for an increase in the Contract Sum or the Contract Time, and for every act or omission of Owner relating to or arising out of the Work, except for those Claims made in accordance with the procedures, including the time limits, set forth in part 8.

PART 7 - CHANGES

7.01 CHANGES IN THE WORK

A. Owner may, at any time and without notice to Contractor's surety, order additions, deletions, revisions, or other changes in the Work. These changes in the Work shall be incorporated into the Contract Documents through the execution of Change Orders. If any change in the Work ordered by Owner causes an increase or decrease in the Contract Sum or the Contract Time, an equitable adjustment shall be made as provided in section 7.02 or 7.03, respectively, and such adjustment(s) shall be incorporated into a Change Order.

B. If Owner desires to order a change in the Work, it may request a written Change Order Proposal (COP) from Contractor. Contractor shall submit a Change Order Proposal within 14 (fourteen) days of the request from Owner, or within such other period as mutually agreed. Contractor's Change Order Proposal shall be full compensation for implementing the proposed change in the Work, including any adjustment in the Contract Sum or Contract Time, and including compensation for all delays in connection with such change in the Work and for any expense or inconvenience, disruption of schedule, or loss of efficiency or productivity occasioned by the change in the Work.

C. Upon receipt of the Change Order proposal, or a request for equitable adjustment in the Contract Sum or Contract Time, or both, as provided in sections 7.02 and 7.03, Owner may accept or reject the proposal, request further documentation, or negotiate acceptable terms with Contractor. Pending agreement on the terms of the Change Order, Owner may direct Contractor to proceed immediately with the Change Order Work. Contractor shall not proceed with any change in the Work until it has obtained Owner's approval. All Work done pursuant to any Owner-directed change in the Work shall be executed in accordance with the Contract Documents.

D. If Owner and Contractor reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, such agreement shall be incorporated in a Change Order. The Change Order shall constitute full payment and final settlement of all claims for time and for direct, indirect, and consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity, related to any Work either covered or affected by the Change Order, or related to the events giving rise to the request for equitable adjustment.

E. If Owner and Contractor are unable to reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, Contractor may at any time in writing, request a final offer from Owner. Owner shall provide Contractor with its written response within 30 (thirty) days of Contractor's request. Owner may also provide Contractor with a final offer at any time. If Contractor rejects Owner's final offer, or the parties are otherwise unable to reach agreement, Contractor's only remedy shall be to file a Claim as provided in part 8.

F. Field Authorization

1. The Field Authorization (FA) is executed as a directive to proceed with work when the processing time for an approved change order would impact the project.

2. A scope of work must be defined, a maximum not to exceed cost agreed upon, and any estimated modification to the contract completion time determined. The method of final cost verification must be noted and supporting cost data must be submitted in accordance with the requirements of Part 7 of the General Conditions. Upon satisfactory submittal and approval of supporting cost data, the completed FA will be processed into a change order. No payment will be made to the Contractor for FA work until that FA is converted to a Change Order.

7.02 CHANGES IN THE CONTRACT SUM

A. General Application

1. The Contract Sum shall only be changed by a Change Order. Contractor shall include any request for a change in the Contract Sum in its Change Order Proposal.

2. If the cost of Contractor's performance is changed due to the fault or negligence of Owner, or anyone for whose acts Owner is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Sum in accordance with the following procedure. No change in the Contract Sum shall be allowed to the extent: Contractor's changed cost of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible; the change is concurrently caused by Contractor and Owner; or the change is caused by an act of Force Majeure as defined in Section 3.05.

a. A request for an equitable adjustment in the Contract Sum shall be based on written notice delivered to Owner within 7 (seven) days of the occurrence of the event giving rise to the request. For purposes of this part, "occurrence" means when Contractor knew, or in its diligent prosecution of the Work should have known, of the event giving rise to the request. If Contractor believes it is entitled to an adjustment in the Contract Sum, Contractor shall immediately notify Owner and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Owner access to any such records and, if requested shall promptly furnish copies of such records to Owner.

b. Contractor shall not be entitled to any adjustment in the Contract Sum for any occurrence of events or costs that occurred more than 7 (seven) days before Contractor's written notice to Owner. The written notice shall set forth, at a minimum, a description of: the event giving rise to the request for an equitable adjustment in the Contract Sum; the nature of the impacts to Contractor and its Subcontractors of any tier, if any; and to the extent possible the amount of the adjustment in Contract Sum requested. Failure to properly give such written notice shall, to the extent Owner’s interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

c. Within 30 (thirty) days of the occurrence of the event giving rise to the request, unless Owner agrees in writing to allow an additional period of time to ascertain more accurate data, Contractor shall supplement the written notice provided in accordance with subparagraph a. above with additional supporting data. Such additional data shall include, at a minimum: the amount of compensation requested, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the damages claimed, but that the damages claimed were actually a result of the act, event, or condition complained of and that the Contract Documents provide entitlement to an equitable adjustment to Contractor for

such act, event, or condition; and documentation sufficiently detailed to permit an informed analysis of the request by Owner. When the request for compensation relates to a delay, or other change in Contract Time, Contractor shall demonstrate the impact on the critical path, in accordance with section 7.03C. Failure to provide such additional information and documentation within the time allowed or within the format required shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

d. Pending final resolution of any request made in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

e. Any requests by Contractor for an equitable adjustment in the Contract Sum and in the Contract Time that arise out of the same event(s) shall be submitted together.

3. The value of any Work covered by a Change Order, or of any request for an equitable adjustment in the Contract Sum, shall be determined by one of the following methods:

   a. On the basis of a fixed price as determined in paragraph 7.02B.
   b. By application of unit prices to the quantities of the items involved as determined in paragraph 7.02C.
   c. On the basis of time and material as determined in paragraph 7.02D.

4. When Owner has requested Contractor to submit a Change Order proposal, Owner may direct Contractor as to which method in subparagraph 3 above to use when submitting its proposal. Otherwise, Contractor shall determine the value of the Work, or a request for an equitable adjustment, on the basis of the fixed price method.

B. Change Order Pricing -- Fixed Price

When the fixed price method is used to determine the value of any Work covered by a Change Order or a request for an equitable adjustment in the Contract Sum, the following procedures shall apply:

1. Contractor's Change Order Proposal, or request for adjustment in the Contract Sum, shall be accompanied by a complete itemization of the costs, including labor, material, subcontractor costs, and overhead and profit. The costs shall be itemized in the manner set forth below, and shall be submitted on breakdown sheets in a form approved by Owner.

2. All costs shall be calculated based upon appropriate industry standard methods of calculating labor, material quantities, and equipment costs.

3. If any of Contractor's pricing assumptions are contingent upon anticipated actions of Owner, Contractor shall clearly state them in the proposal or request for an equitable adjustment.

4. The cost of any additive or deductive changes in the Work shall be calculated as set forth below, except that overhead and profit shall not be included on deductive changes in the Work. Where a change in the Work involves additive and deductive work by the same Contractor or Subcontractor, small tools, overhead, profit, bond, and insurance markups will apply to the net difference.

5. If the total cost of the change in the Work or request for equitable adjustment does not exceed $1,000, Contractor shall not be required to submit a breakdown if the description of the change in the Work or request for equitable adjustment is sufficiently definitive for Owner to determine fair value.

6. If the total cost of the change in the Work or request for equitable adjustment is between $1,000 and $2,500, Contractor may submit a breakdown in the following level of detail if the description of the change in the Work or if the request for equitable adjustment is sufficiently definitive to permit the Owner to determine fair value:

   a. lump sum labor;
   b. lump sum material;
   c. lump sum equipment usage;
   d. overhead and profit as set forth below; and
   e. insurance and bond costs as set forth below.

7. Any request for adjustment of Contract Sum based upon the fixed price method shall include only the following items:

   a. Craft labor costs: These are the labor costs determined by multiplying the estimated or actual additional number of craft hours needed to perform the change in the Work by the hourly labor costs. Craft hours should cover direct labor, as well as indirect labor due to trade inefficiencies. The hourly costs shall be based on the following:

      1) Basic wages and benefits: Hourly rates and benefits as stated on the Department of Labor and Industries approved "statement of intent to pay prevailing wages." Direct supervision shall be a reasonable percentage not to exceed 15% (fifteen percent) of the cost of direct labor. No supervision markup shall be allowed for a working supervisor's hours.

      2) Worker's insurance: Direct contributions to the state of Washington for industrial insurance; medical aid; and supplemental pension, by the class and rates established by the Department of Labor and Industries.

      3) Federal insurance: Direct contributions required by the Federal Insurance Compensation Act; Federal Unemployment Tax Act; and the State Unemployment Compensation Act.

      4) Travel allowance: Travel allowance and/or subsistence, if applicable, not exceeding those allowances established by regional labor union agreements, which are itemized and identified separately.

      5) Safety: Cost incurred due to the Washington Industrial Safety and Health Act, which shall be a reasonable percentage not to exceed 2% (two percent) of the sum of the amounts calculated in (1), (2), and (3) above.

   b. Material costs: This is an itemization of the quantity and cost of materials needed to perform the change in the Work. Material costs shall be developed first from actual known costs, second from supplier quotations or if these are not available, from standard industry pricing guides. Material costs shall consider all available discounts. Freight costs, express charges, or special delivery charges, shall be itemized.

   c. Equipment costs: This is an itemization of the type of equipment and the estimated or actual length of time the construction equipment appropriate for the Work is or will be used on the change in the Work. Costs will be allowed for construction equipment only if used solely for the changed Work, or for additional rental costs actually incurred by the Contractor. Equipment charges shall be computed on the basis of actual invoice costs or if owned, from the current edition of one of the following sources:

      1) Associated General Contractors - Washington State Department of Transportation (AGC-WSDOT) Equipment Rental Agreement; current edition, on the Contract execution date.

      2) The state of Washington Utilities and Transportation Commission for trucks used on highways.

      3) The National Electrical Contractors Association for equipment used on electrical work.

      4) The Mechanical Contractors Association of America for equipment used on mechanical work.

      The Data Quest Rental Rate (Blue Book) shall be used as a basis for establishing rental rates of equipment not listed in the above sources. The maximum rate for standby equipment shall not exceed that shown in the AGC WSDOT Equipment Rental Agreement, current edition, on the Contract execution date.

   d. Allowance for small tools, expendables, and consumable supplies: Small tools consist of tools which cost $250 or less and are normally furnished by the performing contractor. The maximum rate for small tools shall not exceed the following:

1) For Contractor, 3% (three percent) of direct labor costs.

2) For Subcontractors, 5% (five percent) of direct labor costs.

Expendables and consumable supplies directly associated with the change in Work must be itemized.

e. Subcontractor costs: This is defined as payments Contractor makes to Subcontractors for changed Work performed by Subcontractors of any tier. The Subcontractors' cost of Work shall be calculated and itemized in the same manner as prescribed herein for Contractor.

f. Allowance for overhead: This is defined as costs of any kind attributable to direct and indirect delay, acceleration, or impact, added to the total cost to Owner of any change in the Contract Sum but not to the cost of any change in the Contract Time for which contractor has been compensated pursuant to the conditions set forth in Section 7.03. This allowance shall compensate Contractor for all non-craft labor, temporary construction facilities, field engineering, schedule updating, record drawings, home office cost, B&O taxes, office engineering, estimating costs, additional overhead because of extended time, and any other cost incidental to the change in the Work. It shall be strictly limited in all cases to a reasonable amount, mutually acceptable, or if none can be agreed upon to an amount not to exceed the rates below:

1) For projects where the Contract Award Amount is under $3 million, the following shall apply:

a) For Contractor, for any Work actually performed by Contractor's own forces, 16% (sixteen percent) of the first $50,000 of the cost, and 4% (four percent) of the remaining cost, if any.

b) For each Subcontractor (including lower tier subcontractors), for any Work actually performed by its own forces, 16% (sixteen percent) of the first $50,000 of the cost, and 4% (four percent) of the remaining cost, if any.

c) For Contractor, for any work performed by its Subcontractor(s), 6% (six percent) of the first $50,000 of the amount due each Subcontractor, and 4% (four percent) of the remaining amount if any.

d) For each Subcontractor, for any Work performed by its Subcontractor(s) of any lower tier, 4% (four percent) of the first $50,000 of the amount due the sub-Subcontractor, and 2% (two percent) of the remaining amount if any.

e) The cost to which overhead is to be applied shall be determined in accordance with subparagraphs a.-e. above.

2) For projects where the Contract Award Amount is equal to or exceeds $3 million, the following shall apply:

a) For Contractor, for any Work actually performed by Contractor's own forces, 12% (twelve percent) of the first $50,000 of the cost, and 4% (four percent) of the remaining cost, if any.

b) For each Subcontractor (including lower tier subcontractors), for any Work actually performed by its own forces, 12% (twelve percent) of the first $50,000 of the cost, and 4% (four percent) of the remaining cost, if any.

c) For Contractor, for any Work performed by its Subcontractor(s), 4% (four percent) of the first $50,000 of the amount due each Subcontractor, and 2% (two percent) of the remaining amount if any.

d) For each Subcontractor, for any Work performed by its Subcontractor(s) of any lower tier, 4% (four percent) of the first $50,000 of the amount due the sub-Subcontractor, and 2% (two percent) of the remaining amount if any.

e) The cost to which overhead is to be applied shall be determined in accordance with subparagraphs a.- e. above.

g. Allowance for profit: This is an amount to be added to the cost of any change in contract sum, but not to the cost of change in Contract Time for which contractor has been compensated pursuant to the conditions set forth in section 7.03. It shall be limited to a reasonable amount, mutually acceptable, or if none can be agreed upon, to an amount not to exceed the rates below:

1) For Contractor or Subcontractor of any tier for work performed by their forces, 6% (six percent) of the cost developed in accordance with Section 7.02 b. 7a.- e.

2) For Contractor or Subcontractor of any tier for work performed by a subcontractor of a lower tier, 4% (four percent) of the Subcontractor cost developed in accordance with Section 7.02 b. 7a. - h.

h. Cost of change in insurance or bond premium: This is defined as:

1) Contractor's liability insurance: The cost of any changes in Contractor's liability insurance arising directly from execution of the Change Order; and

2) Public works bond: The cost of the additional premium for Contractor's bond arising directly from the changed Work.

The costs of any change in insurance or bond premium shall be added after overhead and allowance for profit are calculated in accordance with subparagraph f. and g. above.

C. Change Order Pricing -- Unit Prices

1. Whenever Owner authorizes Contractor to perform Work on a unit-price basis, Owner's authorization shall clearly state:

a. Scope of work to be performed;
b. Type of reimbursement including pre-agreed rates for material quantities; and
c. Cost limit of reimbursement.

2. Contractor shall:

a. Cooperate with Owner and assist in monitoring the Work being performed. As requested by Owner, Contractor shall identify workers assigned to the Change Order Work and areas in which they are working;
b. Leave access as appropriate for quantity measurement; and
c. Not exceed any cost limit(s) without Owner's prior written approval.

3. Contractor shall submit costs in accordance with paragraph 7.02B. and satisfy the following requirements:

a. Unit prices shall include reimbursement for all direct and indirect costs of the Work, including overhead and profit, and bond and insurance costs; and
b. Quantities must be supported by field measurement statements signed by Owner.

D. Change Order Pricing -- Time-and-Material Prices

1. Whenever Owner authorizes Contractor to perform Work on a time-and-material basis, Owner's authorization shall clearly state:

a. Scope of Work to be performed;
b. Type of reimbursement including pre-agreed rates, if any, for material quantities or labor; and
c. Cost limit of reimbursement.

2. Contractor shall:

a. Cooperate with Owner and assist in monitoring the Work being performed. As requested by Owner, identify workers assigned to the Change Order Work and areas in which they are working;
b. Identify on daily time sheets all labor performed in accordance with this authorization. Submit copies of daily time sheets within 2 working days for Owner's review;
c. Leave access as appropriate for quantity measurement;
d. Perform all Work in accordance with this section as efficiently as possible; and
e. Not exceed any cost limit(s) without Owner's prior written approval.

3. Contractor shall submit costs in accordance with paragraph 7.02B and additional verification supported by:

   a. Labor detailed on daily time sheets; and
   b. Invoices for material.

7.03 CHANGES IN THE CONTRACT TIME

A. The Contract Time shall only be changed by a Change Order. Contractor shall include any request for a change in the Contract Time in its Change Order Proposal.

B. If the time of Contractor's performance is changed due to an act of Force Majeure, or due to the fault or negligence of Owner or anyone for whose acts Owner is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Time in accordance with the following procedure. No adjustment in the Contract Time shall be allowed to the extent Contractor's changed time of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible.

1. A request for an equitable adjustment in the Contract Time shall be based on written notice delivered within 7 (seven) days of the occurrence of the event giving rise to the request. If Contractor believes it is entitled to adjustment of Contract Time, Contractor shall immediately notify Owner and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Owner access to any such record and if requested, shall promptly furnish copies of such record to Owner.

2. Contractor shall not be entitled to an adjustment in the Contract Time for any events that occurred more than 7 (seven) days before Contractor's written notice to Owner. The written notice shall set forth, at a minimum, a description of: the event giving rise to the request for an equitable adjustment in the Contract Time; the nature of the impacts to Contractor and its Subcontractors of any tier, if any; and to the extent possible the amount of the adjustment in Contract Time requested. Failure to properly give such written notice shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

3. Within 30 (thirty) days of the occurrence of the event giving rise to the request, unless Owner agrees in writing to allow an additional period of time to ascertain more accurate data, Contractor shall supplement the written notice provided in accordance with subparagraph 7.03B.2 with additional supporting data. Such additional data shall include, at a minimum: the amount of delay claimed, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the delay claimed, but that the delay claimed was actually a result of the act, event, or condition complained of, and that the Contract Documents provide entitlement to an equitable adjustment in Contract Time for such act, event, or condition; and supporting documentation sufficiently detailed to permit an informed analysis of the request by Owner. Failure to provide such additional information and documentation within the time allowed or within the format required shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

4. Pending final resolution of any request in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

C. Any change in the Contract Time covered by a Change Order, or based on a request for an equitable adjustment in the Contract Time, shall be limited to the change in the critical path of Contractor's schedule attributable to the change of Work or event(s) giving rise to the request for equitable adjustment. Any Change Order proposal or request for an adjustment in the Contract Time shall demonstrate the impact on the critical path of the schedule. Contractor shall be responsible for showing clearly on the Progress

Schedule that the change or event: had a specific impact on the critical path, and except in case of concurrent delay, was the sole cause of such impact; and could not have been avoided by resequencing of the Work or other reasonable alternatives.

D. Contractor may request compensation for the cost of a change in Contract Time in accordance with this paragraph, 7.03D, subject to the following conditions:

1. The change in Contract Time shall solely be caused by the fault or negligence of Owner or A/E;

2. Compensation under this paragraph is limited to changes in Contract Time for which Contractor is not entitled to be compensated under section 7.02;

3. Contractor shall follow the procedure set forth in paragraph 7.03B;

4. Contractor shall establish the extent of the change in Contract Time in accordance with paragraph 7.03C; and

5. The daily cost of any change in Contract Time shall be limited to the items below, less funds that may have been paid pursuant to a change in the Contract Sum that contributed to this change in Contract Time:

   a. cost of nonproductive field supervision or labor extended because of the delay;
   b. cost of weekly meetings or similar indirect activities extended because of the delay;
   c. cost of temporary facilities or equipment rental extended because of the delay;
   d. cost of insurance extended because of the delay;
   e. general and administrative overhead in an amount to be agreed upon, but not to exceed 3% (three percent) of Contract Sum divided by the Contract Time for each day of the delay.

PART 8 - CLAIMS AND DISPUTE RESOLUTION

8.01 CLAIMS PROCEDURE

A. If the parties fail to reach agreement on the terms of any Change Order for Owner-directed Work as provided in section 7.01, or on the resolution of any request for an equitable adjustment in the Contract Sum as provided in section 7.02 or the Contract Time as provided in section 7.03, Contractor's only remedy shall be to file a Claim with Owner as provided in this section.

B. Contractor shall file its Claim within the earlier of: 120 (one hundred twenty) days from Owner's final offer in accordance with either paragraph 7.01E or the date of Final Acceptance.

C. The Claim shall be deemed to cover all changes in cost and time (including direct, indirect, impact, and consequential) to which Contractor may be entitled. It shall be fully substantiated and documented. At a minimum, the Claim shall contain the following information:

1. A detailed factual statement of the Claim for additional compensation and time, if any, providing all necessary dates, locations, and items of Work affected by the Claim;

2. The date on which facts arose which gave rise to the Claim

3. The name of each employee of Owner or A/E knowledgeable about the Claim;

4. The specific provisions of the Contract Documents which support the Claim;

5. The identification of any documents and the substance of any oral communications that support the Claim;

6. Copies of any identified documents, other than the Contract Documents, that support the Claim;

7. If an adjustment in the Contract Time is sought: the specific days and dates for which it is sought; the specific reasons Contractor believes an extension in the Contract Time should be granted; and Contractor's analysis of its Progress Schedule to demonstrate the reason for the extension in Contract Time;

8. If an adjustment in the Contract Sum is sought, the exact amount sought and a breakdown of that amount into the categories set forth in, and in the detail required by, section 7.02; and

9. A statement certifying, under penalty of perjury, that the Claim is made in good faith, that the supporting cost and pricing data are true and accurate to the best of Contractor's knowledge and belief, that the Claim is fully supported by the accompanying data, and that the amount requested accurately reflects the adjustment in the Contract Sum or Contract Time for which Contractor believes Owner is liable.

D. After Contractor has submitted a fully documented Claim that complies with all applicable provisions of parts 7 and 8, Owner shall respond, in writing, to Contractor as follows:

1. If the Claim amount is less than $50,000, with a decision within 60 (sixty) days from the date the Claim is received; or

2. If the Claim amount is $50,000 or more, with a decision within 60 (sixty) days from the date the Claim is received, or with notice to Contractor of the date by which it will render its decision. Owner will then respond with a written decision in such additional time.

E. To assist in the review of Contractor's Claim, Owner may visit the Project site, or request additional information, in order to fully evaluate the issues raised by the Claim. Contractor shall proceed with performance of the Work pending final resolution of any Claim. Owner's written decision as set forth above shall be final and conclusive as to all matters set forth in the Claim, unless Contractor follows the procedure set forth in section 8.02.

F. Any Claim of the Contractor against the Owner for damages, additional compensation, or additional time, shall be conclusively deemed to have been waived by the Contractor unless timely made in accordance with the requirements of this section.

8.02 ARBITRATION

A. If Contractor disagrees with Owner's decision rendered in accordance with paragraph 8.01D, Contractor shall provide Owner with a written demand for arbitration. No demand for arbitration of any such Claim shall be made later than 30 (thirty) days after the date of Owner's decision on such Claim; failure to demand arbitration within said 30-day period shall result in Owner's decision being final and binding upon Contractor and its Subcontractors.

B. Notice of the demand for arbitration shall be filed with the American Arbitration Association (AAA), with a copy provided to Owner. The parties shall negotiate or mediate under the Voluntary Construction Mediation Rules of the AAA, or mutually acceptable service, before seeking arbitration in accordance with the Construction Industry Arbitration Rules of AAA as follows:

1. Disputes involving $30,000 or less shall be conducted in accordance with the Northwest Region Expedited Commercial Arbitration Rules; or

2. Disputes over $30,000 shall be conducted in accordance with the Construction Industry Arbitration Rules of the AAA, unless the parties agree to use the expedited rules.

C. All Claims arising out of the Work shall be resolved by arbitration. The judgment upon the arbitration award may be entered, or review of the award may occur, in the superior court having jurisdiction thereof. No independent legal action relating to or arising from the Work shall be maintained.

D. Claims between Owner and Contractor, Contractor and its Subcontractors, Contractor and A/E, and Owner and A/E shall, upon demand by Owner, be submitted in the same arbitration or mediation.

E. If the parties resolve the Claim prior to arbitration judgment, the terms of the resolution shall be incorporated in a Change Order. The Change Order shall constitute full payment and final settlement of the Claim, including all claims for time and for direct, indirect, or consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity.

8.03 CLAIMS AUDITS

A. All Claims filed against Owner shall be subject to audit at any time following the filing of the Claim. Failure of Contractor, or Subcontractors of any tier, to maintain and retain sufficient records to allow Owner to verify all or a portion of the Claim or to permit Owner access to the books and records of Contractor, or Subcontractors of any tier, shall constitute a waiver of the Claim and shall bar any recovery.

B. In support of Owner audit of any Claim, Contractor shall, upon request, promptly make available to Owner the following documents:

1. Daily time sheets and supervisor's daily reports;
2. Collective bargaining agreements;
3. Insurance, welfare, and benefits records;
4. Payroll registers;
5. Earnings records;
6. Payroll tax forms;
7. Material invoices, requisitions, and delivery confirmations;
8. Material cost distribution worksheet;
9. Equipment records (list of company equipment, rates, etc.);
10. Vendors', rental agencies', Subcontractors', and agents' invoices;
11. Contracts between Contractor and each of its Subcontractors, and all lower-tier Subcontractor contracts and supplier contracts;
12. Subcontractors' and agents' payment certificates;
13. Cancelled checks (payroll and vendors);
14. Job cost report, including monthly totals;
15. Job payroll ledger;
16. Planned resource loading schedules and summaries;
17. General ledger;
18. Cash disbursements journal;
19. Financial statements for all years reflecting the operations on the Work. In addition, the Owner may require, if it deems it appropriate, additional financial statements for 3 (three) years preceding execution of the Work;
20. Depreciation records on all company equipment whether these records are maintained by the company involved, its accountant, or others;
21. If a source other than depreciation records is used to develop costs for Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents;
22. All non-privileged documents which relate to each and every Claim together with all documents which support the amount of any adjustment in Contract Sum or Contract Time sought by each Claim;
23. Work sheets or software used to prepare the Claim establishing the cost components for items of the Claim including but not limited to labor, benefits and insurance, materials, equipment, Subcontractors,

all documents which establish the time periods, individuals involved, the hours for the individuals, and the rates for the individuals; and

24. Work sheets, software, and all other documents used by Contractor to prepare its bid.

C. The audit may be performed by employees of Owner or a representative of Owner. Contractor, and its Subcontractors, shall provide adequate facilities acceptable to Owner, for the audit during normal business hours. Contractor, and all Subcontractors, shall make a good faith effort to cooperate with Owner's auditors.

PART 9 - TERMINATION OF THE WORK

9.01 TERMINATION BY OWNER FOR CAUSE

A. Owner may, upon 7 (seven) days written notice to Contractor and to its surety, terminate (without prejudice to any right or remedy of Owner) the Work, or any part of it, for cause upon the occurrence of any one or more of the following events:

1. Contractor fails to prosecute the Work or any portion thereof with sufficient diligence to ensure Substantial Completion of the Work within the Contract Time;
2. Contractor is adjudged bankrupt, makes a general assignment for the benefit of its creditors or a receiver is appointed on account of its insolvency;
3. Contractor fails in a material way to replace or correct Work not in conformance with the Contract Documents;
4. Contractor repeatedly fails to supply skilled workers or proper materials or equipment;
5. Contractor repeatedly fails to make prompt payment due to Subcontractors or for labor;
6. Contractor materially disregards or fails to comply with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction; or
7. Contractor is otherwise in material breach of any provision of the Contract Documents.

B. Upon termination, Owner may at its option:

1. Take possession of the Project site and take possession of or use all materials, equipment, tools, and construction equipment and machinery thereon owned by Contractor to maintain the orderly progress of, and to finish, the Work;
2. Accept assignment of subcontracts pursuant to section 5.20; and
3. Finish the Work by whatever other reasonable method it deems expedient.

C. Owner's rights and duties upon termination are subject to the prior rights and duties of the surety, if any, obligated under any bond provided in accordance with the Contract Documents.

D. When Owner terminates the Work in accordance with this section, Contractor shall take the actions set forth in paragraph 9.02B, and shall not be entitled to receive further payment until the Work is accepted.

E. If the unpaid balance of the Contract Sum exceeds the cost of finishing the Work, including compensation for A/E's services and expenses made necessary thereby and any other extra costs or damages incurred by Owner in completing the Work, or as a result of Contractor's actions, such excess shall be paid to Contractor. If such costs exceed the unpaid balance, Contractor shall pay the difference to Owner. These obligations for payment shall survive termination.

F. Termination of the Work in accordance with this section shall not relieve Contractor or its surety of any responsibilities for Work performed.

G. If Owner terminates Contractor for cause, and it is later determined that none of the circumstances set forth in paragraph 9.01A exist, then such termination shall be deemed a termination for convenience pursuant to section 9.02.

9.02 TERMINATION BY OWNER FOR CONVENIENCE

A. Owner may, upon written notice, terminate (without prejudice to any right or remedy of Owner) the Work, or any part of it, for the convenience of Owner.

B. Unless Owner directs otherwise, after receipt of a written notice of termination for either cause or convenience, Contractor shall promptly:

1. Stop performing Work on the date and as specified in the notice of termination;

2. Place no further orders or subcontracts for materials, equipment, services or facilities, except as may be necessary for completion of such portion of the Work as is not terminated;

3. Cancel all orders and subcontracts, upon terms acceptable to Owner, to the extent that they relate to the performance of Work terminated;

4. Assign to Owner all of the right, title, and interest of Contractor in all orders and subcontracts;

5. Take such action as may be necessary or as directed by Owner to preserve and protect the Work, Project site, and any other property related to this Project in the possession of Contractor in which Owner has an interest; and

6. Continue performance only to the extent not terminated.

C. If Owner terminates the Work or any portion thereof for convenience, Contractor shall be entitled to make a request for an equitable adjustment for its reasonable direct costs incurred prior to the effective date of the termination, plus a reasonable allowance for overhead and profit on Work performed prior to termination, plus the reasonable administrative costs of the termination, but shall not be entitled to any other costs or damages, whatsoever, provided however, the total sum payable upon termination shall not exceed the Contract Sum reduced by prior payments. Contractor shall be required to make its request in accordance with the provisions of part 7.

D. If Owner terminates the Work or any portion thereof for convenience, the Contract Time shall be adjusted as determined by Owner.

PART 10 - MISCELLANEOUS PROVISIONS

10.01 GOVERNING LAW

The Contract Documents and the rights of the parties herein shall be governed by the laws of the state of Washington. Venue shall be in the county in which Owner's principal place of business is located, unless otherwise specified.

10.02 SUCCESSORS AND ASSIGNS

Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party hereto and to partners, successors, assigns, and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents. Neither party shall assign the Work without written consent of the other, except that Contractor may assign the Work for security purposes, to a bank or lending institution authorized to do business in the state of Washington. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations set forth in the Contract Documents.

10.03 MEANING OF WORDS

Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings. Reference to standard specifications, manuals, or codes of any technical society, organization, or association, or

to the code of any governmental authority, whether such reference be specific or by implication, shall be to the latest standard specification, manual, or code in effect on the date for submission of bids, except as may be otherwise specifically stated. Wherever in these Drawings and Specifications an article, device, or piece of equipment is referred to in the singular manner, such reference shall apply to as many such articles as are shown on the drawings, or required to complete the installation.

10.04 RIGHTS AND REMEDIES

No action or failure to act by Owner or A/E shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall such action or failure to act constitute approval of an acquiescence in a breach therein, except as may be specifically agreed in writing.

10.05 CONTRACTOR REGISTRATION

Pursuant to RCW 39.06, Contractor shall be registered or licensed as required by the laws of the State of Washington, including but not limited to RCW 18.27.

10.06 TIME COMPUTATIONS

When computing any period of time, the day of the event from which the period of time begins shall not be counted. The last day is counted unless it falls on a weekend or legal holiday, in which event the period runs until the end of the next day that is not a weekend or holiday. When the period of time allowed is less than 7 (seven) days, intermediate Saturdays, Sundays, and legal holidays are excluded from the computation.

10.07 RECORDS RETENTION

The wage, payroll, and cost records of Contractor, and its Subcontractors, and all records subject to audit in accordance with section 8.03, shall be retained for a period of not less than 6 (six) years after the date of Final Acceptance.

10.08 THIRD-PARTY AGREEMENTS

The Contract Documents shall not be construed to create a contractual relationship of any kind between: A/E and Contractor; Owner and any Subcontractor; or any persons other than Owner and Contractor.

10.09 ANTITRUST ASSIGNMENT

Owner and Contractor recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact usually borne by the purchaser. Therefore, Contractor hereby assigns to Owner any and all claims for such overcharges as to goods, materials, and equipment purchased in connection with the Work performed in accordance with the Contract Documents, except as to overcharges which result from antitrust violations commencing after the Contract Sum is established and which are not passed on to Owner under a Change Order. Contractor shall put a similar clause in its Subcontracts, and require a similar clause in its sub-Subcontracts, such that all claims for such overcharges on the Work are passed to Owner by Contractor.

10.10 MINORITY AND WOMEN'S BUSINESS ENTERPRISES (MWBE) PARTICIPATION

In Accordance with the legislative findings and policies set forth in Chapter 39.19 RCW the State of Washington encourages participation in all of its contracts by MWBE firms certified by the Office of Minority and Women's Business Enterprises (OMWBE). Participation may be either on a direct basis in response to this solicitation or as a subcontractor to a Bidder. Any affirmative action requirements set forth in federal regulations or statutes included or referenced in the contract documents will apply. Bidders may contact OMWBE to obtain information on certified firms for potential subcontractors/suppliers.

A. When referred to in this Contract, the terms Minority Business Enterprise (MBE) and Women's Business Enterprise (WBE) will be as defined by OMWBE, WAC 326-02-030.

B. The OMWBE has compiled a directory of certified firms. Copies of this directory may be obtained through the OMWBE. For information regarding the certification process or the certification status of a particular firm, contact:

OMWBE, 406 South Water Street, PO Box 41160, Olympia, WA 98504-1160, telephone (360) 753-9693.

C. Eligible MWBEs or M/W firms

MWBE firms utilized for this project for voluntary MWBE goals may be certified by Washington State OMWBE or self identified as minority or women owned (M/W firm).

D. MWBE Voluntary Goals

The Owner has established voluntary goals for MWBE participation for this project. The voluntary goals are set forth in the Advertisement for Bids.

E. If any part of the contract, including the supply of materials and equipment, is anticipated to be subcontracted, then prior to receipt of the first payment, Contractor shall submit, pursuant to Section 5.20 A, a list of all subcontractors/suppliers it intends to use, designate whether any of the subcontractors/suppliers are MWBE firms, indicate the anticipated dollar value of each MWBE subcontract, and provide Tax Identification Number (TIN).

F. If any part of the contract, including the supply of materials and equipment is actually subcontracted during completion of the work, then prior to final acceptance or completion of the contract or as otherwise indicated in the contract documents, the Contractor shall submit a statement of participation indicating what MWBEs were used and the dollar value of their subcontracts.

G. The provisions of this section are not intended to replace or otherwise change the requirements of RCW 39.30.060. If said statute is applicable to this contract then the failure to comply with RCW 39.30.060 will still render a bid non-responsive.

H. The Contractor shall maintain, for at least three years after completion of this contract, relevant records and information necessary to document the level of utilization of MWBEs and other businesses as subcontractors and suppliers in this contract, as well as any efforts the Contractor makes to increase the participation of MWBEs as listed in section I below. The Contractor shall also maintain, for at least three years after completion of this contract, a record of all quotes, bids, estimates, or proposals submitted to the Contractor by all businesses seeking to participate as subcontractors or suppliers in this contract. The state shall have the right to inspect and copy such records. If this contract involves federal funds, Contractor shall comply with all record keeping requirements set forth in any federal rules, regulations, or statutes included or referenced in the contract documents.

I. Bidders should advertise opportunities for subcontractors or suppliers in a manner reasonably designed to provide MWBEs capable of performing the work with timely notice of such opportunities, and all advertisements shall include a provision encouraging participation by MWBE firms. Advertising may be done through general advertisements (e.g. newspapers, journals, etc.) or by soliciting bids directly from MWBEs. Bidders shall provide MWBEs that express interest with adequate and timely information about plans, specifications, and requirements of the contract.

J. Contractors shall not create barriers to open and fair opportunities for all businesses including MWBEs to participate in all State contracts and to obtain or compete for contracts and subcontracts as sources of supplies, equipment, construction and services.

K. Any violation of the mandatory requirements of this part of the contract shall be a material breach of contract for which the Contractor may be subject to a requirement of specific performance, or damages and sanctions provided by contract, by RCW 39.19.090, or by other applicable laws.

10.11 MINIMUM LEVELS OF APPRENTICESHIP PARTICIPATION

In accordance with Executive Order 00-01 the State of Washington may require apprenticeship participation for projects of a certain cost. The bid advertisement and Bid Proposal form shall establish the minimum percentage of apprentice labor hours as compared to the total labor hours.

A. Voluntary workforce diversity goals have been established for the apprentice hours. These goals are that one-fifth (1/5) of the apprentice hours be performed by minorities, and one-sixth (1/6) of the apprentice hours be performed by women.

B. Apprentice participation, under this contract, may be counted towards the required percentage (%) only if the apprentices are from an apprenticeship program registered and approved by the Washington State Apprenticeship and Training Council (RCW 49.04 and WAC 296-04).

C. Bidders may contact the Department of Labor and Industries, Specialty Compliance Services Division, Apprenticeship Section, P.O. Box 44530, Olympia, WA 98504-4530 by phone at (360) 902-5320, and e-mail at Apprentice@Lni.wa.gov, to obtain information on available apprenticeship programs.

D. For each project that has apprentice requirements, the contractor shall submit a "Statement of Apprentice/Journeyman Participation" on forms provided by the Department of General Administration, with every request for progress payment. The Contractor shall submit consolidated and cumulative data collected by the Contractor and collected from all subcontractors by the Contractor. The data to be collected and submitted includes the following:

1. Contractor name and address
2. Contract number
3. Project name
4. Contract value
5. Reporting period "Notice to Proceed" through "Invoicing Date"
6. Craft/trade/occupation of all (contractor and subcontractor trades working on the project) apprentices and journeymen
7. Total number of apprentices and total number of hours worked by apprentices, both categorized by gender and ethnicity
8. Total number of journeymen and total number of hours worked by journeymen, both categorized by gender and ethnicity
9. Cumulative combined total of apprentice and journeymen labor hours.
10. Total percentage of apprentice hours worked
11. No changes to the required percentage (%) of apprentice participation shall be allowed without written approval of the Owner. In any request for the change the Contractor shall clearly demonstrate a good faith effort to comply with the requirements for apprentice participation.
12. Any substantive violation of the mandatory requirements of this part of the contract may be a material breach of the contract by the Contractor. The Owner may withhold payment pursuant to Part 6.05, stop the work for cause pursuant to Part 3.04, and terminate the contract for cause pursuant to Part 9.01.

10.12 HEADINGS AND CAPTIONS

Headings for convenience only: All headings and captions used in these General Conditions are only for convenience of reference and shall not be used in any way in connection with the meaning, effect, interpretation, construction, or enforcement of the General Conditions, and do not define the limit or describe the scope or intent of any provision of these General Conditions.

10.13 SUBCONTRACTOR PAYMENTS REPORTING REQUIREMENTS

This Contract is subject to compliance tracking using the State's business diversity management system, Access Equity (B2Gnow). Access Equity is web-based and can be accessed at the Office of Minority and Women's Business Enterprises at https://omwbe.diversitycompliance.com/. The Contractor and all Subcontractors shall report and confirm receipt of payments made to the Contractor and each Subcontractor through Access Equity.

The Contractor may contact the Owner at contracts@parks.wa.gov for technical assistance in using the Access Equity system. User guides and documentation related to Contractor and Subcontractor access to and use of Access Equity are available online at https://omwbe.wa.gov/access-equity-help-center. The Owner reserves the

right to withhold payments from the Contractor for non-compliance with this section. For purposes of this section, Subcontractor means any subcontractor working on the Contract, at any tier and regardless of status as certified WMBE or Non-WMBE.
The Contractor shall:

a. Register and enter all required Subcontractor information into Access Equity no later than 15 days after the Owner creates the Contract Record.

b. Complete the required user training (two (2) one-hour online sessions) no later than 20 days after the Owner creates the Contract Record.

c. Report the amount and date of all payments (i) received from the Owner, and (ii) paid to Subcontractors, no later than 30 days, issuance of each payment made by the Owner to the Contractor, unless otherwise specified in writing by the Owner, except that the Contractor shall mark as "Final" and report the final Subcontractor payments) into Access Equity no later than thirty (30) days after the final payment is due the Subcontractor(s) under the Contract, with all payment information entered no later than sixty (60) days after end of fiscal year.

d. Monitor contract payments and respond promptly to any requests or instructions from the Owner or system-generated messages to check or provide information in Access Equity.

e. Coordinate with Subcontractors, or Owner when necessary, to resolve promptly any discrepancies between reported and received payments.

f. Require each Subcontractor to: (i) register in Access Equity and complete the required user training; (ii) verify the amount and date of receipt of each payment from the Contractor or a higher tier Subcontractor, if applicable, through Access Equity; (iii) report payments made to any lower tier Subcontractors, if any, in the same manner as specified herein; (iv) respond promptly to any requests or instructions from the Contractor or system-generated messages to check or provide information in Access Equity; and (v) coordinate with Contractor, or Owner when necessary, to resolve promptly any discrepancies between reported and received payments.

END OF CONDITIONS

/ / / / /

Approved as to Form:
William Van Hook /s/
Asst. Attorney General
02/2007
08/2010 GA Updates – jrc
09/2010 to AAG Schwartz

PREVAILING WAGES

Instruction for Prevailing Wage Rates

The State of Washington prevailing wage rates for this public works project, which is located in Pierce County, may be found at the following website address of the Department of Labor and Industries:

https://secure.lni.wa.gov/wagelookup/rates/journey-level-rates

The prevailing wages for this project are those that are in effect on the date that the bids are due.

Contractor to Pay Prevailing Wages

The Contractor shall pay the prevailing rate of wages to all workers, laborers, or mechanics employed in the performance of any part of the Work in accordance with RCW 39.12 and the rules and regulations of the Department of Labor and Industries. The schedule of prevailing wage rates for the locality or localities of the Work is determined by the Industrial Statistician of the Department of Labor and Industries. It is the Contractor's responsibility to verify the applicable prevailing wage rate.

A copy of the applicable wage rates is available upon request. Please request a copy by email at: contracts@parks.wa.gov.

Geotechnical Engineering Services

Proposed Water Tank
Nisqually State Park
Pierce County, Washington

for
Robert W. Droll Landscape Architects

June 10, 2022

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

Proposed Water Tank
Nisqually State Park
Pierce County, Washington

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June 10, 2022

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Geotechnical Engineering Services

Proposed Water Tank
Nisqually State Park
Pierce County, Washington

File No. 2935-067-01

June 10, 2022

Prepared for:

Robert W. Droll Landscape Architects
4405 7th Avenue SE, Suite 203
Lacey, Washington 98503

Attention: Bob Droll

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Stephen W. Helvey, LG, LEG, LHG
Senior Geologic Engineer

Debra C. Overbay
State of Washington
29247
Registered
Professional Engineer
6/10/22

Debra Overbay, PE
Associate

SWH:DCO:leh

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APPENDICES

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services regarding a proposed concrete water tank at Nisqually State Park in Pierce County, Washington. The project site is located approximately as shown on the Vicinity Map, Figure 1. Our understanding of the project is based on information provided by KPFF Consulting Engineers (KPFF) and site visits in March and April 2022. Our services have been performed in general accordance with our proposal dated February 2, 2022. You authorized our services on March 4, 2022.

We understand the proposed water tank is to be of concrete construction and supported by a reinforced concrete mat foundation. We understand two tank configurations are being considered. If fire flow is not required, the tank will be about 26 feet in diameter and 20 feet tall. If fire flow is required, the tank will be about 30 feet in diameter and 45 feet tall.

The tank will be located generally west from the proposed site wastewater treatment plant (WWTP) and maintenance facility, as shown in Figure 2. A water well drilled in 2021 is located just northeast of the proposed tank area, as shown in Figure 3. A log of the well is included in Appendix A.

2.0 SCOPE OF SERVICES

The purpose of our services is to evaluate soil and groundwater conditions at the site as a basis for developing design criteria for geotechnical aspects of the proposed water tank. The specific scope of services completed for this project includes the following tasks:

1. Review existing geologic/geotechnical data for the site. This included the water well drilled northeast of the water tank site and explorations we advanced for the WWTP and Maintenance Building areas.
2. Subcontracting and observing the excavation of three test pits within the water tank area.
3. Logging soil and groundwater conditions observed in the test pit explorations. Collecting bulk soil samples from the test pits.
4. Performing moisture content and particle size distribution testing of the soil samples.
5. Evaluating pertinent physical and engineering characteristics of the site soils based on the results of the field explorations, laboratory tests and our experience.
6. Provide recommendations for water tank foundation support including:
    - Site preparation and subgrade improvements for the proposed mat foundation.
    - Allowable soil bearing pressure.
    - Settlement estimates.
    - Seismic design criteria based on International Building Code (IBC) considering the consistency of the deep borings completed at the park site.
    - Recommended lateral resistance design values.
    - Coefficient of base friction.
7. Provide recommendations for temporary and permanent cut and fill slope inclinations.
8. Discuss known or anticipated geotechnical issues that could influence construction, including wet weather considerations.

3.0 SITE CONDITIONS

3.1. Surface Conditions

The proposed water tank area is located west of the proposed WWTP area and south of the existing site water well. A gravel-surfaced access road is located east of the water tank site.

Water tank site topography is undulatory with a slight downward slope to the southwest and west. Undulations are likely due to the presence of near-surface boulders. The project area is currently covered in fir and alder trees and thick underbrush.

3.1.1. Geologic Conditions

Geologic conditions at the site and nearby area were evaluated by reviewing the Washington State Department of Natural Resources "Geologic Map of the Centralia Quadrangle, Washington, 1987." Materials mapped in the site area comprise Vashon Drift, Undifferentiated (map unit Qdv). This material is mapped over a broad area at and around the project site. These geologic materials are described as glacial outwash with silts, clays, lacustrine deposits, and some ice contact deposits.

Mashel Formation sedimentary rocks (Tmh) are mapped beneath the Qdv material in the Ohop River valley wall, generally west of the site. Mashel Formation rocks are described as varying from claystone, sandstone to poorly cemented basaltic gravel.

3.1.2. Previous Explorations

We completed test pits and borings for the WWTP and Maintenance areas in previous phases of the project. The approximate locations of these explorations are shown in Figure 2. The nearby water well was drilled in July to August 2021 to a depth of 275 feet. The well log and logs of other explorations are included in Appendix A.

A thick layer of "till" was reported in the water well from about 7 to 58 feet in the boring. This material may be Mashel Formation bedrock. Similar materials were encountered in test pits and borings completed for the WWTP project.

3.2. Subsurface Explorations

We completed three test pits at the site on May 24, 2022. The approximate locations of the explorations are shown on Figure 3.

The test pits were completed using a small track-mounted excavator and locations were mapped using a portable graphical interface system (GIS) unit. Our representative continuously monitored the explorations, maintained a log of the subsurface conditions, and obtained representative samples, as needed. The soils encountered were visually classified in general accordance with ASTM International (ASTM) D 2488. A key to the symbols used on the test pit logs is included as Figure 4. The exploration logs are included as Figures 5 through 7.

3.3. Laboratory Testing

Soil samples obtained from the test pits were transported to a GeoEngineers laboratory. Soil samples were selected for laboratory tests to evaluate the pertinent geotechnical engineering characteristics of site soils and to confirm our field classification.

Moisture content and grain-size analyses were performed on selected samples in general accordance with ASTM Test Method D 422. This test method covers the quantitative determination of the distribution of particle sizes in soils. The test results were used to check field soil classifications. The result of the grain size analyses are presented in Figure 8.

3.4. Soil Conditions

About 6 to 12 inches of forest duff was encountered in each test pit. An approximate 6- to 24-inch thick layer of loose to medium dense silty sand was encountered below the duff. We interpret this material to be outwash.

Beneath the outwash we encountered medium dense to very dense silty gravel with boulders. We interpret this material to be glacial till. Each test pit met practical refusal in the till or weathered Mashel Formation at depths ranging from about 4 to 6 feet.

3.5. Groundwater Conditions

Slow groundwater seepage was encountered at a depth of 4 feet in test pit WT-2. Groundwater was not encountered in WT-1 and WT-3. We expect the depth to groundwater will vary seasonally with precipitation.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1. General

Based on the project information and our investigation of subsurface conditions at the site, we conclude that the site is suitable for the proposed water tank. Dense to very dense glacial soils were encountered at shallow depths at the site. A summary of key geotechnical design issues is discussed below. The summary is presented for introductory purposes only and should be used in conjunction with the detailed recommendations presented in this report.

- We recommend Site Class D in accordance with International Building Code (IBC) 2018. Additional seismic design parameters are provided in a following section.
- The near-surface silty sand and silty gravel soils contain a moderate to high percentage of fines. These soils will be sensitive to small changes in moisture content and are susceptible to disturbance from construction traffic when the moisture content is more than a few percent above the optimum moisture content for compaction. These soils will be difficult, if not impossible, to work on or compact when wet and when earthwork is performed in wet weather. We recommend that earthwork only take place during extended periods of dry weather.
- Boulders were encountered in our explorations and were observed at the site and should be anticipated during grading activities and site excavations. Weakly cemented Mashel Formation bedrock (silt with sand/sand with silt) may also be encountered at depth at the site (below a depth of

about 4 to 5 feet). These materials are in a hard/very dense condition and the contractor should be prepared to remove this layer if deep excavations are required.

- Based on the results of laboratory tests the near-surface silty soils will not be suitable for re-use as structural fill without significant moisture conditioning. Clean gravel soils within the borrow pit may be suitable for fill during dry weather conditions.
- A minimum 6-inch-thick layer of crushed rock should be placed beneath the proposed mat foundation to provide a level foundation pad and prevent disturbance. A thicker layer will be appropriate to protect the subgrade if the subgrade becomes wet, to provide a level pad if considerable boulders are encountered and require removal, or to extend to the medium dense to dense native soils as recommended below. The subgrade should be clean and free of loose soil prior to placing the base rock.
- The proposed tank may be satisfactorily supported on a mat foundation supported on the medium dense to dense native soils or on crushed rock overlying these soils (anticipated to be encountered below a depth of 2 feet). As noted above, we recommend a minimum 6-inch base rock layer underlie the mat slab for uniform support. An allowable soil bearing pressure of 4,000 pounds per square foot (psf) can be used in design for the mat supported as recommended above. The contact depth of the supporting layer is interpreted from subsurface information obtained in our test pits. GeoEngineers should observe subgrade preparation to confirm that actual field conditions are consistent with our design recommendations.
- An allowable passive resistance on the face of embedded foundation elements may be computed using an equivalent fluid density of 250 pounds per cubic foot (pcf) for on-site medium dense native soils anticipated below a depth of 2 feet. This value can be increased to 350 pcf for the dense native soils encountered below a depth of 3 feet. The allowable frictional resistance may be computed using a coefficient of friction of 0.4 applied to vertical dead-load forces. The above passive equivalent fluid density values and coefficient of friction include a factor of safety of about 1.5.

4.2. Site Preparation and Earthwork

4.2.1. General

Site development will include removing existing trees and vegetation, stripping of forest duff/topsoil and root layer and removal of near-surface boulders. The site soils are moisture sensitive due to high fines content. Grading of these soils is only practical during the dry season (typically July through September). Moisture conditioning necessary to obtain proper compaction of these soils will likely not be practical during the cooler and wetter winter months and may still present challenges during the normally dry summer months. We recommend a contingency be included in the project budget and schedule for export of unsuitable wet on-site soil and import of select granular soil if earthwork will be performed during periods of wet weather.

The following sections provide our recommendations for earthwork, site development, and fill materials.

4.2.2. Stripping and Clearing

The existing trees, shrubs, topsoil, unsuitable soils, and boulders should be stripped and removed from the tank foundation area. Based on our explorations, the depth of stripping to remove unsuitable surface organic materials should generally vary between 6 and 12 inches. Greater stripping depths will be

required to remove localized zones of loose or organic-rich soil and tree roots and if large boulders are encountered. The primary root systems for trees and shrubs should be completely removed. Required stripping depths should be evaluated based on observations during the stripping operation. Stripped organic material should be transported off site for disposal or processed and used as fill in landscaping areas. Excavations for boulder depressions should be backfilled with structural fill compacted to the densities indicated in Section 4.3 "Fill Placement and Compaction" of this report.

4.2.3. Subgrade Evaluation

After stripping and excavation to planned subgrade is complete, we recommend the exposed soil be evaluated by the geotechnical engineer to confirm subsurface soils are consistent with the test pit explorations and our recommendations. The subgrade should expose the recommended foundation subgrade soils. If soft or otherwise unsuitable areas are encountered, these soils should be removed and replaced with compacted crushed rock as recommended by the engineer.

4.2.4. Excavation

Conventional earthmoving equipment in proper working order should be capable of making necessary excavations for utilities and the mat slab. We recommend that these excavations be performed using a smooth-blade bucket to prevent excessive disturbance of the excavation base.

Boulders were encountered in the explorations and were observed at the site and nearby areas and should be anticipated during grading and/or utility excavations. Accordingly, the contractor should be prepared to remove boulders, if encountered. Boulders may be removed from the site or buried in landscape areas. Voids caused by boulder removal must be backfilled with crushed rock structural fill.

4.2.5. Excavation Support

Shallow excavations (4 feet or less) in medium dense to dense deposits should stand at near vertical inclinations, provided groundwater seepage is not present in the cut face. Excavations deeper than 4 feet must be shored or laid back at a stable slope if workers are required to enter.

Shoring for utility excavations must conform with the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA). While this report describes certain approaches to excavation and dewatering, the contract documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and adjacent structures.

4.2.6. Weather Considerations

The native soils contain a sufficient percentage of fines (silt) to be moisture sensitive. When the moisture content of these soils is appreciably above the optimum moisture content, these soils become muddy and unstable, operation of equipment on these soils will be difficult, and it will be difficult if not impossible to meet the required compaction criteria. Disturbance of these near-surface soils should be expected if earthwork is completed during periods of wet weather.

The wet weather season generally begins in early November and continues through April in Western Washington; however, periods of wet weather may occur during any month of the year. The optimum earthwork period for these types of soils is typically June through October. If wet weather earthwork is unavoidable, we recommend that:

- Structural fill placed during the wet season or during periods of wet weather consist of gravel borrow (Section 9-03.14(1) of the 2021 Washington State Department of Transportation (WSDOT) Standard Specifications) with the added restriction that no more than 5 percent (of the material passing the U.S. No. 200 sieve). It may be desirable to place a geotextile over the native subgrades before placement of structural fill.
- The ground surface in and around the work areas be sloped so that surface water is directed away from the work areas. The ground surface should be graded such that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.

4.2.7. Erosion and Sedimentation Control

The site will be susceptible to erosion during wet weather conditions, particularly if large segments of exposed subgrades are exposed to rainfall. Development, implementation and adherence to an Erosion and Sedimentation Control Plan should reduce the project impact on erosion-prone areas. The Plan should be designed in accordance with applicable county and/or state standards. The Plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure.
- Re-vegetating or mulching denuded areas.
- Directing runoff away from exposed soils.
- Reducing the length and steepness of slopes with exposed soils.
- Decreasing runoff velocities.
- Preparing drainage ways and outlets to handle concentrated or increased runoff.
- Confining sediment to the project site.
- Inspecting and maintaining control measures frequently.

Some sloughing erosion and raveling of exposed or disturbed soil on slopes should be expected, particularly if the work is completed during the wet season. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until the permanent erosion protection is established, and the site is stabilized, site monitoring may be required by qualified personnel who will evaluate the effectiveness of the erosion control measures and recommend repairs and/or modifications as appropriate. Provision for modifications to the erosion control system based on monitoring observations should be included in the Erosion and Sedimentation Control Plan.

4.3. Fill Materials

The workability of material used as structural fill depends on the gradation and moisture content of the soil. As the amount of fines (material passing the U.S. No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult, if not impossible to achieve. As discussed previously, we recommend that select granular fill or crushed rock be used as structural fill during the rainy season. The following paragraphs summarize the material requirements for fill and backfill.

4.3.1. On-site Soils

The near-surface soils should not be considered for use as structural fill. The near-surface silty sand outwash soils are relatively thin. The glacial till soils will likely be above their optimum moisture content even during the normally dry summer months. We recommend that fill materials comprise either granular soils from the on-site gravel pit or an off-site source.

4.3.2. Borrow Pit Soils

Based on our previous work, we conclude that relatively clean sand and gravel soils from the on-site gravel pit can be considered for use as general purpose structural fill (utility backfill and drive areas).

4.3.3. Select Granular Fill

Select granular fill (pit run) must consist of imported well-graded sand, sandy gravel, or crushed rock with a maximum particle size of 3 inches and less than 5 percent passing a U.S. No. 200 sieve. Organic matter, debris, or other deleterious material must not be present. Granular fill used during periods of prolonged dry weather may have up to 12 percent passing a U.S. No. 200 sieve.

4.3.4. Crushed Rock Base Layer

As discussed in Section 4.6, base rock placed below the mat foundation should consist of either crushed surfacing base course, WSDOT 2021 Standard Specification 9-03.9(3) or coarse aggregate American Association of State Highway and Transportation Officials (AASHTO) Grading No. 67 (WSDOT 2021 Standard Specification 9-03.1(4)C.

4.3.5. Pipe Bedding

Trench backfill for the bedding and pipe zone should consist of well-graded granular material with a maximum particle size of ¾ inch and less than 5 percent passing the U.S. No. 200 sieve. The material must be free of roots, debris, organic matter, and other deleterious material.

4.4. Fill Placement and Compaction

4.4.1. General

Fill soils should be compacted at a moisture content near optimum. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Fill and backfill material should be placed in uniform, horizontal lifts, and uniformly densified with vibratory compaction equipment. Vibratory equipment should not be used if the subgrade material is wet.

The maximum lift thickness will vary depending on the material and compaction equipment used but should generally not exceed 10 inches in loose thickness. We recommend that density testing of the placed structural fill be completed by a qualified geotechnical engineer to check that the structural fill compaction requirements presented in this report are achieved.

4.4.2. Mat Foundation Base Rock

Base rock placed below the mat foundation should be placed in 6-inch or greater lift thickness and compacted to 95 percent of the maximum dry density (MDD) in accordance with ASTM D-1557.

4.4.3. Area Fills and Bases

Fill placed to raise site grades and aggregate base materials under parking/ driveway areas should be placed on a prepared subgrade that consists of firm, inorganic native soils or compacted fill. Fill must be compacted to at least 95 percent of the MDD determined by ASTM Test Method D 1557 (modified Proctor). In pavement areas, the compaction criteria can be reduced to 92 percent below a depth of 2 feet from finished grade.

During wet weather or in areas that are particularly sensitive to subgrade disturbance, we recommend placing a woven geotextile between the subgrade and the first lift of fill. For this application, the first lift must comprise select granular fill. We recommend a 10-inch lift thickness and densification by static rolling for the initial lift.

4.4.4. Trench Backfill

Backfill in the bedding and pipe zone should be compacted to 90 percent of the MDD as determined by ASTM Test Method D 1557, or as recommended by the pipe manufacturer.

In nonstructural areas, trench backfill above the pipe zone should be compacted to at least 85 percent of the MDD as determined by ASTM Test Method D 1557. Suitable native soils or select granular soils should be acceptable in non-structural areas.

Within structural areas, trench backfill placed above the pipe zone must be compacted to at least 92 percent of the MDD as determined by ASTM Test Method D 1557 at depths greater than 2 feet below the finished subgrade, and to 95 percent within 2 feet of finished subgrade. Trench backfill in structural areas should consist of select granular fill or crushed rock as described in the previous sections.

4.5. Temporary and Permanent Slopes

We recommend that permanent cut and fill slopes be inclined no steeper than 2H:1V (horizontal:vertical). Flatter cut slopes may be necessary in areas where persistent groundwater seepage or zones of soft or loose soils are encountered. Temporary cut slopes should be inclined no steeper than about 1½H:1V. Surface loads should be kept at a minimum distance of at least 5 feet or one-half the depth of the cut away from the top of the cut, whichever is greater.

As previously stated, temporary cut slopes and shoring must comply with the provisions of Title 296 WAC, Part N, “Excavation, Trenching and Shoring.” The contractor performing the work must have the primary responsibility for protection of workmen and adjacent improvements, determining whether shoring is required, and for establishing the safe inclination for open-cut slopes.

To reduce the potential for erosion, newly constructed slopes should be planted or hydroseeded shortly after completion of grading. Some sloughing and raveling of the slopes should be expected until the vegetation is established. This may require localized repairs and reseeding. Temporary covering, such as heavy plastic sheeting, jute fabric, loose straw, or excelsior matting should be used to protect unvegetated slopes during periods of rainfall.

4.6. Tank Mat Foundation

The proposed tank may be satisfactorily supported on a mat foundation supported on the medium dense to dense native soils or on crushed rock overlying these soils (anticipated to be encountered below a depth of 2 feet). A minimum 6-inch base rock layer should underlie the mat slab for uniform support as discussed below. An allowable soil bearing pressure of 4,000 psf can be used in design for the mat supported as recommended. The contact depth of the supporting layer is interpreted from subsurface information obtained in our test pits. GeoEngineers should observe subgrade preparation to confirm that actual field conditions are consistent with our design recommendations.

We recommend a minimum 6-inch-thick layer of crushed rock be placed beneath the proposed mat foundation to provide a level foundation pad and prevent disturbance. A thicker layer will be appropriate to protect the subgrade if the subgrade becomes wet, to provide a level pad if considerable boulders are encountered and require removal, or to extend to the depth of medium dense to dense native soils. The subgrade should be clean and free of loose soil prior to placing the base rock.

4.7. Subgrade Modulus

The modulus of subgrade reaction required to analyze a mat foundation will depend on a number of factors, including subsurface soils, the shape and rigidity of the mat foundation, the depth of the mat foundation below adjacent grade and loading configuration on the mat. We estimate that a modulus of subgrade reaction of about 125 pounds per cubic inch (pci) would be appropriate for evaluating a mat foundation, provided it is founded as recommended in this report.

4.8. Lateral Resistance

Lateral loads may be resisted by passive pressure on the sides of below-grade elements and as friction on the base of the foundation.

An allowable passive resistance on the face of embedded foundation elements may be computed using an equivalent fluid density of 250 pcf for on-site medium dense native soils anticipated below a depth of 2 feet. This value can be increased to 350 pcf for the dense native soils encountered below a depth of 3 feet. The allowable frictional resistance may be computed using a coefficient of friction of 0.4 applied to vertical dead-load forces. The above passive equivalent fluid density values and coefficient of friction include a factor of safety of about 1.5.

Seismic Design Parameters

We recommend the use of the following 2018 IBC parameters for seismic design:

TABLE 1. SEISMIC DESIGN PARAMETERS

2018 IBC (ASCE 7-16) Seismic Design Parameters	
Spectral Response Acceleration at Short Periods (S_S)	1.188g
Spectral Response Acceleration at 1-Second Periods (S_1)	0.424g
Site Class	D
Design Peak Ground Acceleration (PGA_M)	0.55g
Design Spectral Response Acceleration at Short Periods (S_{DS})	0.812g
Design Spectral Response Acceleration at 1-Second Periods (S_{D1})	null[1]

[1] A ground motion hazard analysis may be required in accordance with Section 11.4.8 of American Society of Civil Engineers (ASCE) 7-16 unless Exception 2 is utilized in design.

4.8.1. Liquefaction Potential

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in development of excess pore pressures in loose, saturated soils and subsequent loss of strength in the deposit of soil so affected. In general, soils that are susceptible to liquefaction include loose to medium dense "clean" to silty sands that are below the water table. Based on the conditions in our explorations, there is the potential for some of the sand ice contact/outwash soils to experience liquefaction. However, based on the consistency of the glacial soils and Mashel Formation, and depth to groundwater, it is our opinion the risk of liquefaction is low at the site.

5.0 LIMITATIONS

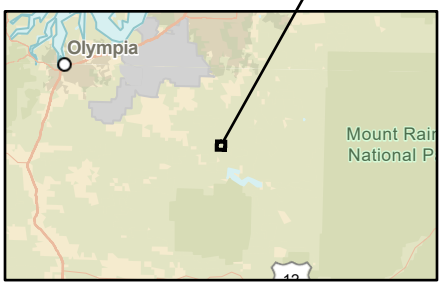
We have prepared this report for use by Robert W. Droll Landscape Architects and other members of the design and construction team for the proposed Water Tank at the Nisqually State Park site.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted engineering practices in this area at the time this report was prepared. No warranty or other conditions express or implied should be understood.

Please refer to Appendix B titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

FIGURES

GeoEngineers



N
W E
S

1,000 0 1,000

Feet

Vicinity Map

Nisqually State Park Proposed Water Tank
Pierce County, Washington

GeoEngineers

Figure 1

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 UTM Zone 10N

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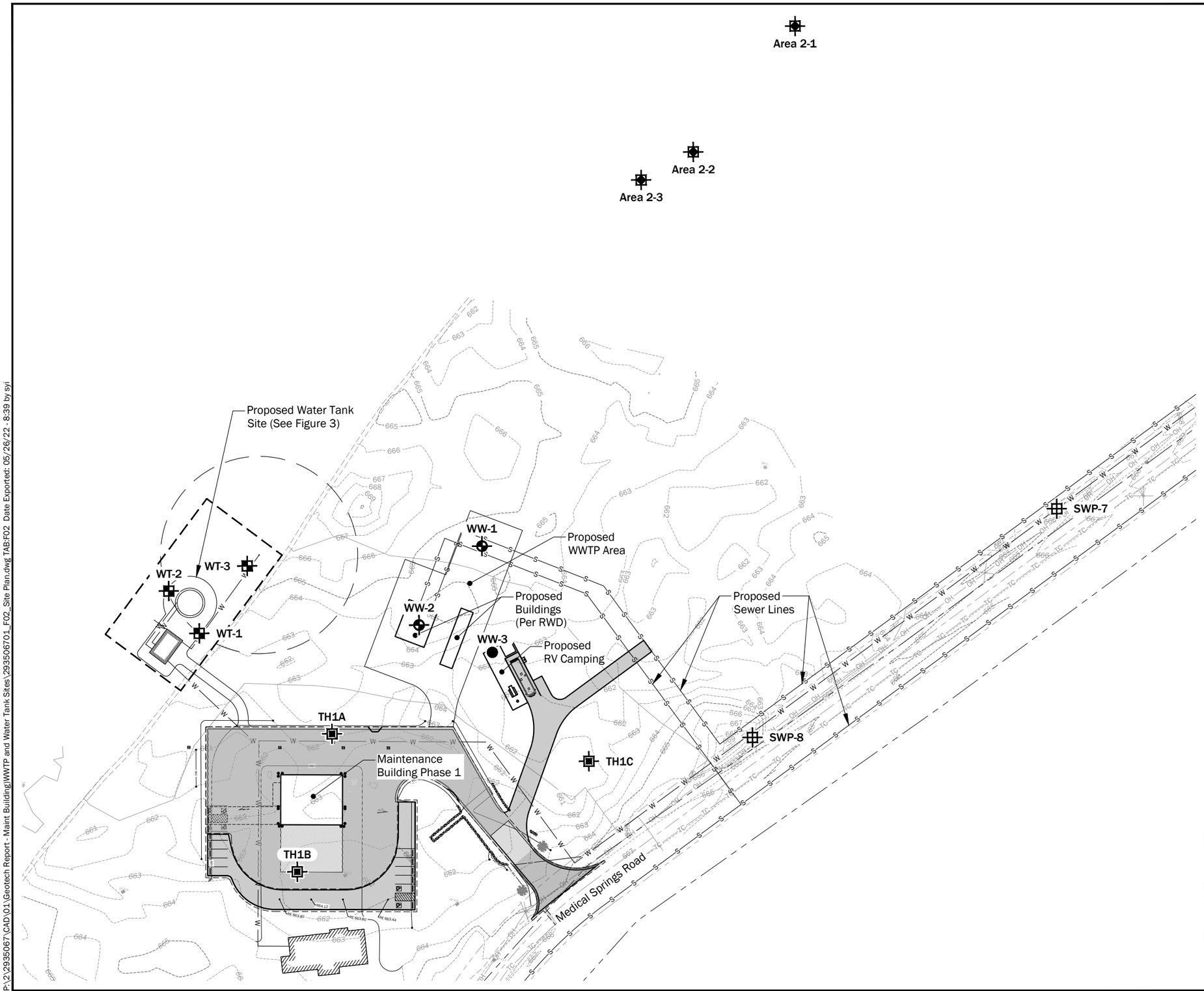


Legend

- **WT-1** — Test Pit by GeoEngineers, Inc., 2022
- **WW-1** — Boring by GeoEngineers, Inc., 2021
- **WW-3** — Monitoring Well by GeoEngineers, Inc., 2021
- **SWP-8** — Test Pit by GeoEngineers, Inc., 2021
- **Area 2-3** — Test Pit by GeoEngineers, Inc. for Proposed Drainage Basin 2, 2021
- **TH1A** — Test Pit by GeoEngineers, Inc. for Proposed Maintenance Building Area, 2020

N W E S

100 0 100
Feet

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from RWD Landscape Architects, dated 09/07/21.

Vertical Datum: NAVD 88.

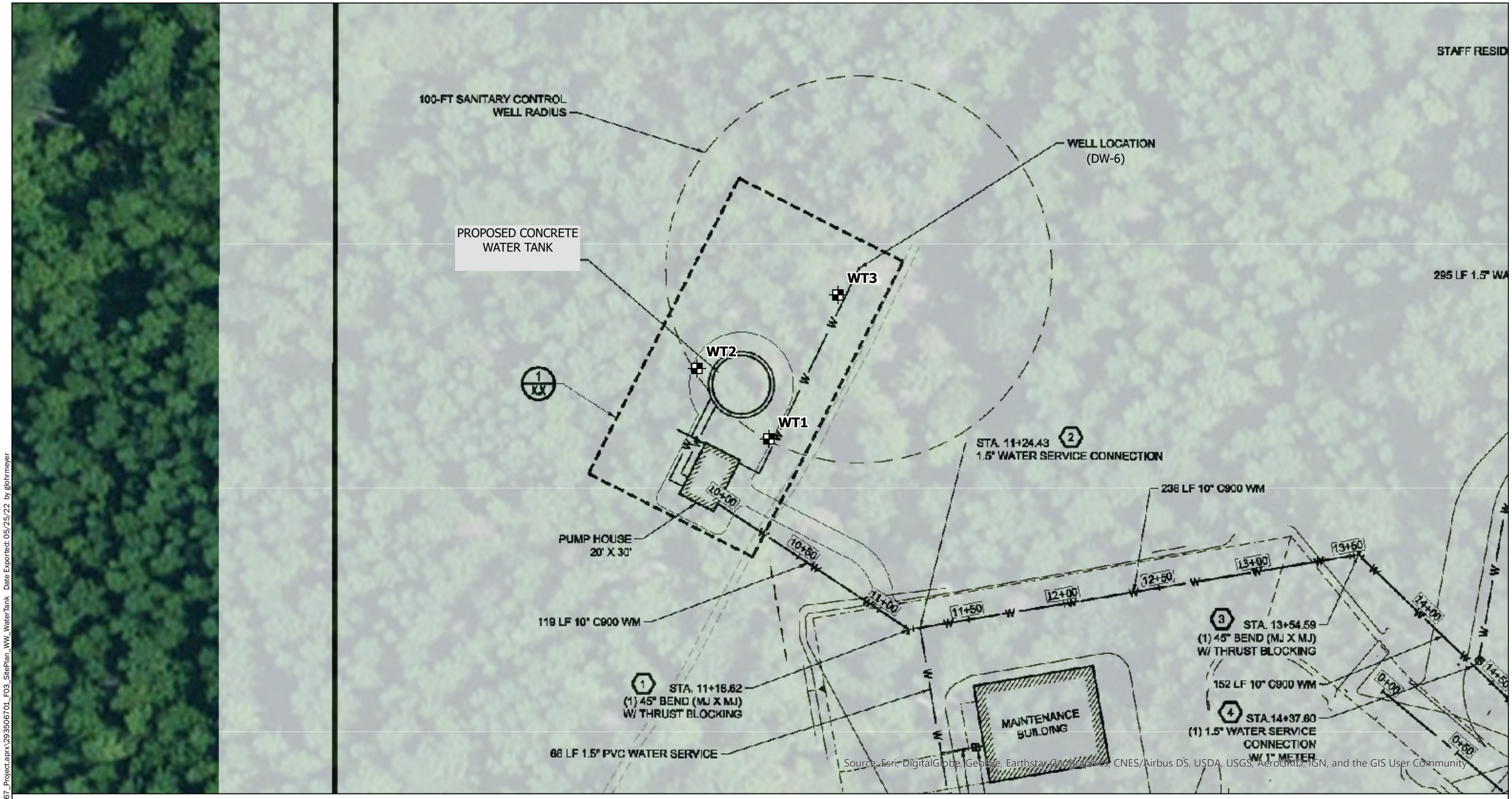
Projection: NAD83 Washington State Planes, South Zone, US Foot.

Site Plan

Nisqually State Park, Maintenance Building, WWTP and Water Tank Sites
Pierce County, Washington

GeoEngineers

Figure 2



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Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Basemap from WA State Parks and Recreation Commission, Aerial from ESRI.

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

WT-1 Test Pit by GeoEngineers, Inc., 2022

N W E S

50 0 50

Feet

Site Plan

Nisqually State Park Proposed Water Tank
Pierce County, Washington

GeoEngineers

Figure 3

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel / Dames & Moore (D&M)

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

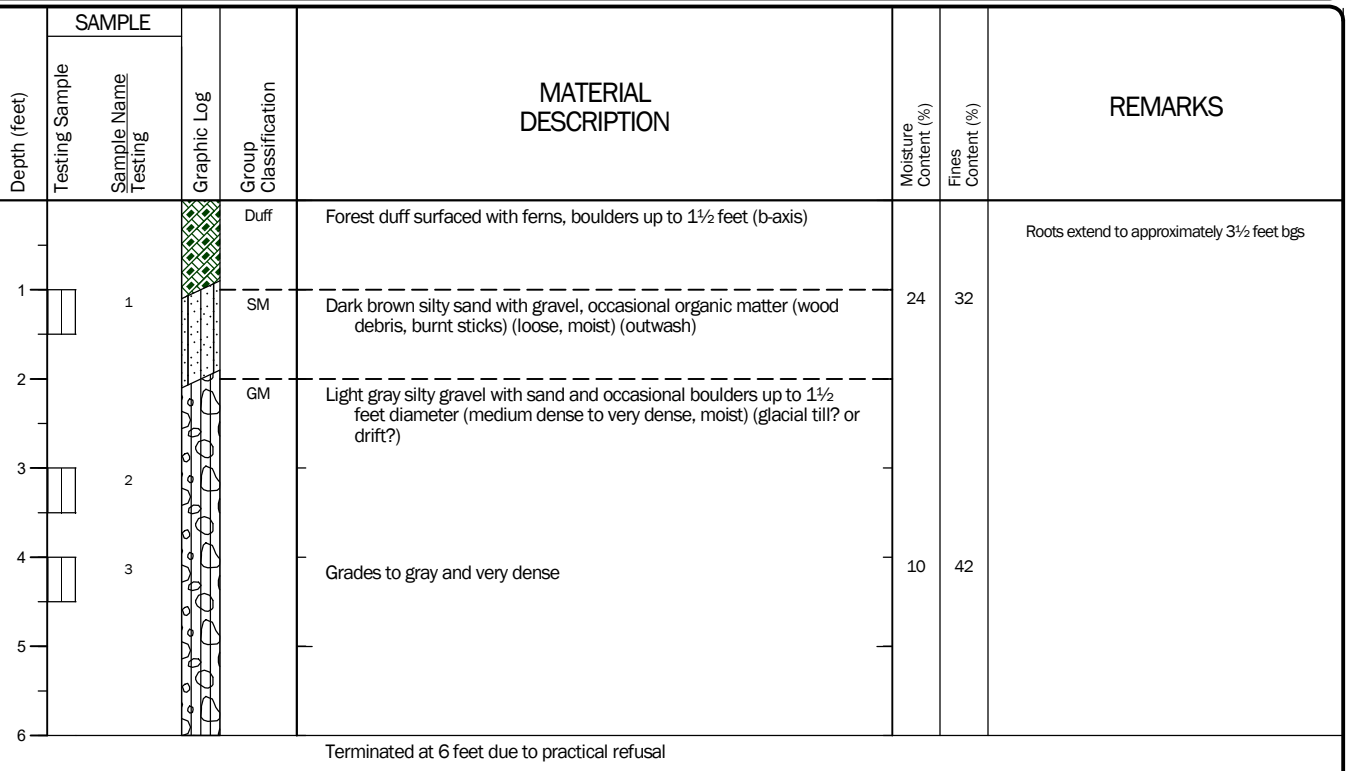
NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure 4

Date Excavated 3/24/2022	Total Depth (ft) 6	Logged By OA Checked By SWH	Excavator Equipment Volvo ECR 88D	Groundwater not observed Caving not observed
Surface Elevation (ft) Undetermined Vertical Datum NAVD88		Latitude Longitude	Coordinate System WA State Plane South Horizontal Datum NAD83 (feet)	



Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit WT-1

GeoEngineers

Project: Nisqually State Park, Proposed Water Tank
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure 5
Sheet 1 of 1

Date Excavated 3/24/2022	Total Depth (ft) 4.75	Logged By OA Checked By SWH	Excavator Equipment Volvo ECR 88D	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) Vertical Datum Undetermined NAVD88		Latitude Longitude	Coordinate System WA State Plane South Horizontal Datum NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					Duff	Forest duff surfaced with ferns, boulders up to 1 foot diameter			
	1		1		SM	Light brown silty fine to coarse sand with gravel (medium dense, moist) (outwash)			
	2				GM	Light brown silty gravel with sand (medium dense, moist) (weathered till?)			
	3		2		GM	Gray and orange with moderate to heavy oxidation staining silty gravel with sand (dense, moist) (till)			
	4		3			Grades to very dense, weathered bedrock?			Slow groundwater seepage observed at 4 feet
						Terminated at 4¾ feet due to practical refusal			

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit WT-2

GeoEngineers

Project: Nisqually State Park, Proposed Water Tank
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure 6
Sheet 1 of 1

Date Excavated	3/24/2022	Total Depth (ft)	4.25	Logged By OA Checked By SWH	Excavator Equipment Volvo ECR 88D	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	Undetermined NAVD88			Latitude Longitude	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					Duff	Approximately 6 inches of forest duff surfaced with ferns, boulders up to 1 foot diameter			
	1				SM	Dark brown silty fine to coarse sand with gravel (loose to medium dense, moist) (outwash)			
					GM	Light brown silty gravel with sand (medium dense, moist) (weathered till)			
	2		1				16	45	
	3				GM	Gray and orange with moderate to heavy oxidation staining silty gravel with sand (dense, moist) (till) Grades to without oxidation staining			
	4		2						
			3			Terminated at 4½ feet due to practical refusal			

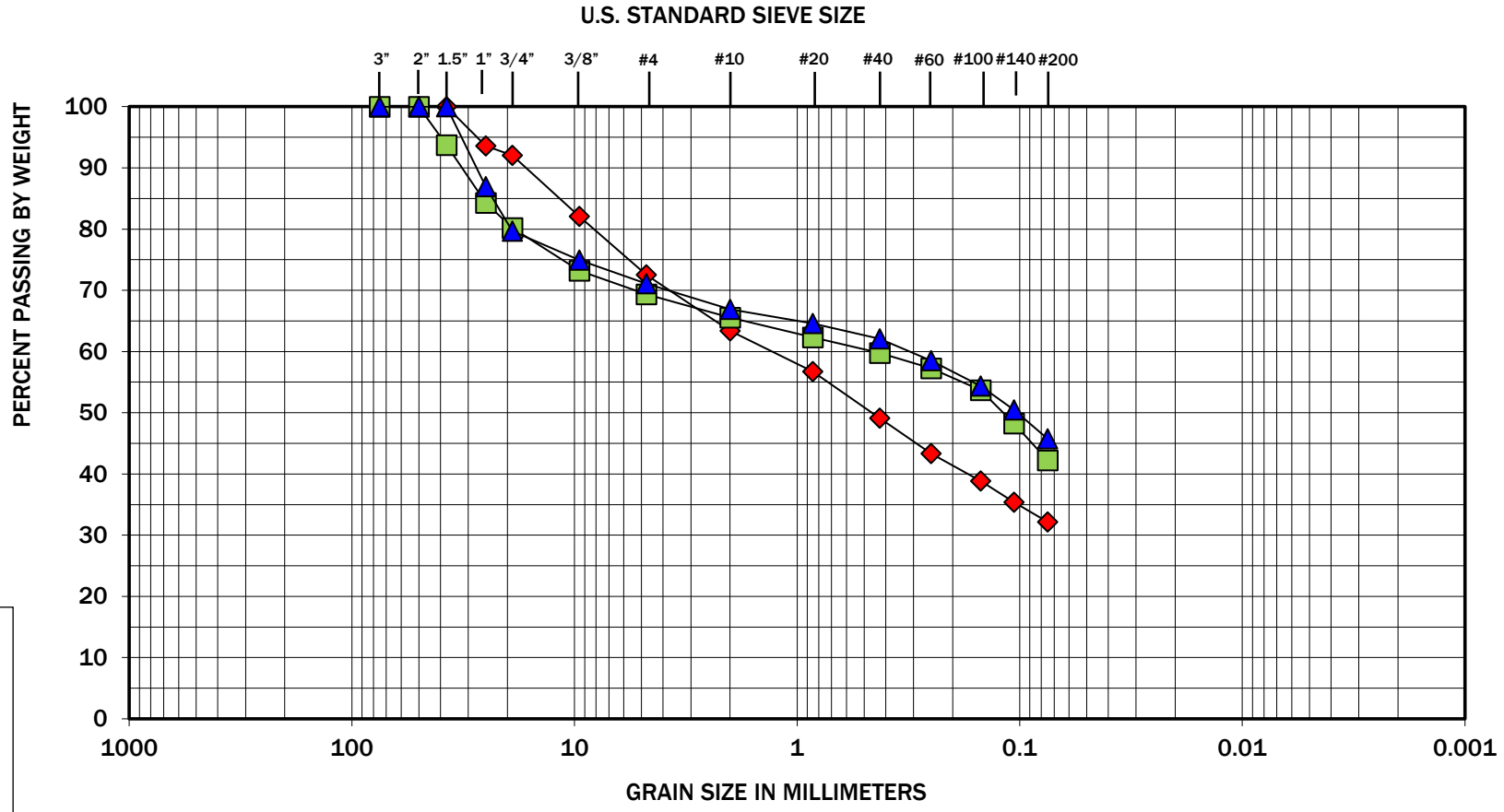
Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit WT-3

GeoEngineers

Project: Nisqually State Park, Proposed Water Tank
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure 7
Sheet 1 of 1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	WT-1	1	24	Silty sand with gravel (SM)
■	WT-1	4	10	Silty gravel with sand (GM)
▲	WT-3	1	16	Silty gravel with sand (GM)

Sieve Analysis Results

Proposed Water Tank, Nisqually State Park
Pierce County, Washington

GeoEngineers

Figure 8

AASHTO ACCREDITED

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

APPENDICES

GeoEngineers

APPENDIX A
Logs of Explorations

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure A-1

Date Excavated	1/20/2021	Total Depth (ft)	9.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavating Equipment Komatsu PC120	See "Remarks" section for groundwater observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	Undetermined NAVD88	Easting (X) Northing (Y)			Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	Approximately 6 inches of forest duff			
	1				SM	Brown-gray silty fine sand with occasional ¼- to ½-inch roots (loose, moist)			
	2				SP-SM	Brown-gray fine sand with silt (loose, moist)			
	3		1 SA		SM	Brown-gray silty fine sand with trace ½-inch roots (loose, moist)	29	40	Significant caving observed from 3 to 6 feet
	4				SP-SM	Brown-gray fine to coarse sand with silt and gravel (loose, moist)			
	5				SP	Gray fine to medium sand with gravel and trace silt (medium dense, moist)			
	6		2 SA				6	2	
	7								
	8								
	9		3		GP	Gray fine to coarse gravel with sand, cobbles and trace silt (dense, wet)			Rapid groundwater seepage observed at 9½ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TH-4A

GeoEngineers

Project: Proposed Maintenance Facility Nisqually State Park
Project Location: Pierce County, Washington
Project Number: 2935-067-00

Figure A-2
Sheet 1 of 1

Date Excavated	1/20/2021	Total Depth (ft)	8	Logged By CJL Checked By SWH	Excavator Kelly's Excavating Equipment Komatsu PC120	See "Remarks" section for groundwater observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	Undetermined NAVD88	Easting (X) Northing (Y)			Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					SOD	Approximately 4 inches of sod			
	1				GM	Dark brown silty fine to coarse gravel with sand, cobbles and boulders (dense, moist) (outwash)			Moderate caving observed from 1 to 3 feet
	2				GP-GM	Brown fine to coarse gravel with silt, sand, cobbles and boulders (dense, moist) (till?)			
	3	✓	1 SA			Grades to wet	9	8	Heavy perched groundwater seepage observed at 2¾ feet
	4				GP	Brown fine to coarse gravel with sand, cobbles, boulders and trace silt (dense, wet) (outwash?)			
	5								
	6				ML	Gray with iron oxide staining silt with fine sand and trace gravel (hard, moist) (glaciolacustrine)			
	7	✓	2						
	8								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TH-4B

GeoEngineers

Project: Proposed Maintenance Facility Nisqually State Park
Project Location: Pierce County, Washington
Project Number: 2935-067-00

Figure A-3
Sheet 1 of 1

Date Excavated 1/20/2021	Total Depth (ft) 14	Logged By CJL Checked By SWH	Excavator Kelly's Excavating Equipment Komatsu PC120	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Undetermined Vertical Datum NAVD88		Easting (X) Northing (Y)	Coordinate System WA State Plane South Horizontal Datum NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUF	Approximately 6 inches of forest duff			
	1				GP	Brown-gray fine to coarse gravel with sand, cobbles and trace silt (dense, moist) (fill)			
	2				SP	Brown-gray fine sand with trace silt and occasional gravel (loose, moist) (fill)			
	3		1						
	4					Grades to medium dense with occasional cobbles			
	5								
	6				GP-GM	Brown-gray fine to coarse gravel with sand, silt, cobbles, occasional boulders (dense, _____) (outwash/alluvium)			Increased gravel
	7		2						
	8								
	9								
	10								
	11				GP-GM	Brown-gray fine gravel with sand, silt, gravel and occasional cobbles (dense, moist) (outwash/alluvium)			
	12					Grades to with fine roots at 12 to 12½ feet			Miner caving observed from 12 to 13 feet
	13		3		GP	Brown-gray fine to coarse gravel with sand, cobbles and trace silt (very dense, moist) (outwash/alluvium)			
	14								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TB-4A

GeoEngineers

Project: Proposed Maintenance Facility Nisqually State Park
Project Location: Pierce County, Washington
Project Number: 2935-067-00

Figure A-4
Sheet 1 of 1

Date Excavated	1/20/2021	Total Depth (ft)	11.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavating Equipment Komatsu PC120	See "Remarks" section for groundwater observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	Undetermined NAVD88	Easting (X) Northing (Y)			Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	Approximately 8 inches of forest duff			Moderate caving observed from 0 to 5 feet
	1				SP	Brown-gray fine to medium sand with occasional ¼- to 1-inch roots and trace silt (loose, moist) (outwash)			
	2		1						
	3					Grades to medium dense with occasional gravel			Occasional approximate 3- to 6-inch lenses of fine sand
	4								
	5					Grades to gray with trace gravel			
	6		2 MC				5		
	7								Significant caving observed from 7 to 11½ feet
	8								
	9				GP	Brown-gray fine to coarse gravel with sand, cobbles, occasional boulders and trace silt (very dense, moist)			
	10		3			Grades to wet			
	11								Heavy groundwater seepage observed at 11 feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TB-4B

GeoEngineers

Project: Proposed Maintenance Facility Nisqually State Park
Project Location: Pierce County, Washington
Project Number: 2935-067-00

Figure A-5
Sheet 1 of 1

Date Excavated	1/20/2021	Total Depth (ft)	9.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavating Equipment Komatsu PC120	See "Remarks" section for groundwater observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	Undetermined NAVD88	Easting (X) Northing (Y)			Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					SOD	Approximately 3 inches of sod			
					SP-SM	Brown fine to medium sand with silt and deleterious debris (charcoal, glass and plastic) (loose, moist) (fill)			Old campfire
	1				GP	Brown-gray fine to coarse gravel with sand, cobbles, occasional boulders, trace silt and occasional ¼- to 1-inch roots (medim dense, moist) (alluvium)			
	2								
	3								Moderate caving observed from 3 to 6 feet
	4	1	SA				3	1	
	5								
	6								
	7								Significant caving observed from 7 to 9½ feet
	8								
	9	2	SA			Grades to wet	6	1	Heavy groundwater observed at 9¼ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TB-4C

GeoEngineers

Project: Proposed Maintenance Facility Nisqually State Park
Project Location: Pierce County, Washington
Project Number: 2935-067-00

Figure A-6
Sheet 1 of 1

WATER WELL REPORT

DEPARTMENT OF ECOLOGY
State of Washington

Type of Work:
☒ Construction
☐ Decommission ⟹ Original installation NOI No. _____

Proposed Use: ☒ Domestic ☐ Industrial ☐ Municipal ☐ Dewatering ☐ Irrigation ☐ Test Well ☐ Other _____

Construction Type: ☒ New well ☐ Alteration ☐ Deepening ☐ Other _____

Method: ☐ Driven ☐ Jetted ☐ Cable Tool ☐ Dug ☒ Air- ☐ Mud-Rotary

Dimensions: Diameter of boring 8 in., to 275 ft.
Depth of completed well 265 ft.

Construction Details:

Casing	Liner	Diameter	From	To	Wall Thickness	Steel	PVC	Welded	Thread
☒	☐	8 in.	0	255	.375 in.	☒	☐	☒	☐
☐	☒	7.5 in.	252	265	.375 in.	☒	☐	☒	☐
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐

Perforations: ☐ Yes ☒ No Type of perforator used _____
No. of perforations ____ Size of perforations ____ in. by ____ in.
Perforated from ____ ft. to ____ ft. below ground surface

Screens: ☒ Yes ☐ No ☒ K-Packer ⟹ Depth 252 ft.
Manufacturer's Name Rosco Moss
Type wire wrape Model No. _____
Diameter 7.5 in. Slot size 100 in. from 255 ft. to 265 ft.
Diameter ____ in. Slot size ____ in. from ____ ft. to ____ ft.

Sand/Filter pack: ☐ Yes ☒ No Size of pack material .375 in.
Materials placed from 275 ft. to 265 ft.

Surface Seal: ☒ Yes ☐ No To what depth? 30' ft.
Material used in seal Bentonite 3/8" chips Hole plug
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

Pump: Manufacturer's Name _____ Type: _____
H.P. ____ Pump intake depth: ____ ft. Designed flow rate: ____ gpm

Water Levels: Land-surface elevation above mean sea level ____ ft.
Stick-up of top of well casing 3 ft. above ground surface
Static water level 188.5 ft. below top of well casing Date _____
Artesian pressure ____ lbs. per square inch Date _____
Artesian water is controlled by _____ (cap, valve, etc.)

Well Tests:
Was a pumping test performed? ☐ No ☒ Yes ⟹ by whom? Holt Services Inc.
Yield ____ gpm with ____ ft. drawdown after ____ hrs.
Yield ____ gpm with ____ ft. drawdown after ____ hrs.
Yield 73 gpm with 56.65 ft. drawdown after 24 hrs.

Recovery data (time = zero when pump is turned off – water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
18	208				
66	197				
274	191				

Date of pumping test 8/17/21

Bailer test ____ gpm with ____ ft. drawdown after ____ hrs.
Air test ____ gpm with stem set at ____ ft. for ____ hrs. Date _____
Artesian flow ____ gpm
Temperature of water ____ ° F Was a chemical analysis made? ☐ Yes ☐ No

Notice of Intent No. WE44307
Unique Ecology Well ID Tag No. BJE 653
Site Well Name (if more than one well): Nisqually State Park
Water Right Permit/Certificate No. _____
Property Owner Name Washington State Parks Recreation
Well Street Address Marsel Prairie Rd
City Eatonville County Pierce - 27
Tax Parcel No. 0416194008
Was a variance approved for this well? ☐ Yes ☒ No
If yes, what was the variance for? _____

Location (see instructions on page 2): ☐ WWM or ☐ EWM
NE ¼-¼ of the SE ¼; Section 19 Township 16N Range 4E
Latitude (Example: 47.12345) 46.856151
Longitude (Example: -120.12345) -122.342469

Driller's Log/Construction or Decommission Procedure
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information. Use additional sheets if necessary.

Material	From	To
Sand	0'	7'
Till gray with black	7'	58'
Clay with gravel	58'	61'
Clay and sand	61'	75'
Green rock and sand	75'	80'
Gray and black sand with gravel	80'	102'
Silt stone	102'	115'
Gravel and sand	115'	126'
Green clay	126'	158'
Sandstone with fine clay lenses	158'	192'
Gravel and sand	192'	220'
Clay	220'	225'
Gravel	225'	275'

RECEIVED
By WELL CONSTRUCTION AND LICENSING OFFICE at 8:04 am, Oct 13, 2021

Start Date 07/06/2021 Completed Date 8/18/21

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Trainee ☐ PE – Print Name Christopher Perry
Signature _____
License No. 3252
IF TRAINEE: Sponsor's License No.
Sponsor's Signature

Drilling Company Holt Services Inc
Address 10621 Todd rd East
City, State, Zip Edgewood, WA, 98372
Contractor's Registration No. HOLTSSI898JG Date 8/24/21

ECY 050-1-20 (Rev 08/19) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure A-1

Drilled Start 9/23/2021 End 9/23/2021	Total Depth (ft) 31.5	Logged By OA Checked By	Driller Holocene Drilling, Inc.	Drilling Method Sonic	
Surface Elevation (ft) 665 Vertical Datum NAVD88	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment GeoProbe 8140LC			
Latitude 46.8558 Longitude -122.34188	System Datum WA State Plane South NAD83 (feet)	See "Remarks" section for groundwater observed			
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							DUF	Forest duff			
						1		SM	Tan fine silty sand with gravel (dense, moist) (outwash/ice contact)			
660	5		7	33		2 SA				4	15	
						3 SA		GM	Gray silty gravel with sand (very dense, moist) (outwash/ice contact)	6	21	(Density likely due to gravel)
655	10			80/6"		4						Broken SPT sampler, possibly due to boulder
								GM	Tan-brown fine to coarse silty sand with gravel (very dense, wet) (outwash/ice contact)			Groundwater observed at approximately 12 feet at time of drilling
650	15		5	50/6"		5 SA 6				8	15	
						7						
645	20		18	53		8 SA		GM	Dark gray silty gravel with sand (very dense, moist) (outwash/ice contact)	15	29	
								ML	Dark gray sandy silt (hard, moist) (Mashel Formation)			
						9 SA				31	56	
640	25		18	70/6"		10A 10B						
								SM	Dark gray silty sand (very dense, moist) (Mashel Formation)			
						11						
635	30		18	34		12 SA		ML	Dark gray silt with sand (Mashel Formation)	30	79	

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Boring WW-1

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-2
Sheet 1 of 1

Drilled Start 9/23/2021 End 9/23/2021	Total Depth (ft) 31.5	Logged By OA Checked By	Driller Holocene Drilling, Inc.	Drilling Method Sonic	
Surface Elevation (ft) 665 Vertical Datum NAVD88	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment GeoProbe 8140LC			
Latitude 46.85555 Longitude -122.34206	System Datum WA State Plane South NAD83 (feet)	See "Remarks" section for groundwater observed			
Notes:					

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							DUF	Forest duff			
						1		SM	Tan silty fine to medium sand with occasional gravel, cobbles and boulders (loose, moist) (outwash/ice contact)			
660	5	1		50/2"		2			Grades to very dense			Rock in shoe; very slow drilling from 5 to 10 feet below the ground surface
						3 SA		GM	Gray gravel with sand, cobbles and boulders (very dense, moist) (outwash/ice contact)	4	21	
655	10	2		50/2"		4						Boulders shifted drill alignment
						5 SA				11	19	Drilled through rock
						6						
650	15	5		50/1"		7						Groundwater observed at approximately 14 feet during drilling
						8 SA		SM	Brown silty fine sand with oxidation staining (very dense, moist to wet) (Mashel Formation)	9	22	
645	20	18		70/6"		9 & 10 SA		SM	Dark gray silty sand (very dense, moist) (Mashel Formation)	30	40	Very difficult drilling
						11						
640	25	18		55		12 SA				12	8	
						13		SP-SM	Gray sand with silt and occasional gravel (very dense, wet) (Mashel Formation)			
635	30											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Boring WW-2

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-3
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/23/2021	9/23/2021	31.5	OA		Holocene Drilling, Inc.	Sonic

Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	GeoProbe 8140LC
Surface Elevation (ft) Vertical Datum	664 NAVD88	Top of Casing Elevation (ft)	
Latitude Longitude	46.85552 -122.34175	Horizontal Datum	WA State Plane South NAD83 (feet)

DOE Well I.D.: BNG 443
A 2-in well was installed on 9/23/2021 to a depth of 31.5 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/7/2021	11.53	653

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0								DUF	Forest duff		
									GM	Tan silty gravel with sand and cobbles (dense, moist) (outwash/ice contact)		
660						1 SA					7	23
	5		17	70		2						
						3 SA					4	17
	10		4	50/5"		4				Grades to wet		
650						5 SA			GP-GM	Brown sandy medium gravel with silt (very dense, wet) (outwash/ice contact)	7	8
									ML	Gray sandy silt (hard, moist) (Mashel Formation)		
	15		18	70		6						
645						7 SA				Minor organic matter and green laminations	26	66
	20		18	36		8 SA					33	67
										Pieces of bark present		
640						9						
	25		18	49		10						
635			18			11 SA					35	78
	30		18	40		12						

WELL LOG

- Steel surface
- 3/8-inch bentonite seal
- 2-inch Schedule 40 PVC well casing
- 12/20 sand backfill
- 2-inch Schedule 40 PVC screen, 0.020-inch slot width
- 4
- 5
- 30
- 31.5

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Date:10/14/21 Path:\\GEOENGINEERS.COM\WAN\PROJECTS\2 2935067\GINT\293506701.GPJ DBLibrary\Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_WELL_%F

Log of Monitoring Well WW-3

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-4
Sheet 1 of 1

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for Robert W. Droll Landscape Architects and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with Robert W. Droll Landscape Architects dated July 6, 2021 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for Nisqually State Park site in Pierce County, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

1 Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- Encourages contractors to conduct additional study to obtain the specific types of information they need or prefer.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as

they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

GeoEngineers

Geotechnical Engineering Services

Proposed Wastewater Treatment Plant and
Sanitary Sewer Line
Nisqually State Park
Pierce County, Washington

for
Robert W. Droll, Landscape Architects

October 21, 2021

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

Proposed Wastewater Treatment Plant and
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Pierce County, Washington

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Robert W. Droll, Landscape Architects

October 21, 2021

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Geotechnical Engineering Services

Proposed Wastewater Treatment Plant and Sanitary Sewer Line Nisqually State Park Pierce County, Washington

File No. 2935-067-01

October 21, 2021

Prepared for:

Robert W. Droll, Landscape Architects
4405 7th Avenue SE
Lacey, Washington 98503

Attention: Bob Droll

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Stephen W. Helvey, LG, LEG, LHG
Senior Engineering Geologist

Debra C. Overbay, PE
Associate

SWH:DCO:leh

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APPENDICES

1.0 INTRODUCTION AND PROJECT UNDERSTANDING

This report presents the results of our geotechnical engineering study for a portion of the overall Nisqually State Park improvement project. The subject of this report is a proposed wastewater treatment plant (WWTP) and associated sanitary sewer line (SSL). Our understanding of this portion of the project is based on information provided by members of the design team.

The proposed WWTP is to be located generally north of the intersection of Mashel Prairie Road and an un-named road, which descends downward to the southwest toward the Nisqually River. The intersection is about 1 mile southwest of the intersection between State Route 7 (SR-7) and Mashel Prairie Road. Nearby planned features include the Park Maintenance facility. The proposed SSL is located along both sides of Mashel Prairie Road for a distance of about 4,200 feet northeast of the proposed WWTP.

The approximate area of the WWTP and SSL is shown in the Vicinity Map, Figure 1. The approximate WWTP site boundary is shown in Figure 2. The approximate locations of the proposed SSL is shown in Figure 3.

We understand the project is in the preliminary stages and as such a final site layout has not been developed for the WWTP. A proposed layout of the SSL with proposed manhole locations has also not been developed. Proposed features for this part of the overall project consist of the following:

WWTP At-Grade Structures

- Operations building, single-story, slab-on-grade structure
- Mechanical building, 1.5 stories, slab on grade structure
- Odor Control Unit
- Non-Potable Water Tank, about 6,000 gallon capacity

WWTP Below-Grade Structures

- Cast-in-place reinforced concrete process tank, 15 x 80 x 12-feet deep
- Equalization tank, likely polyvinyl chloride (PVC) or fiberglass reinforced plastic (FBR) founded 16 to 18 feet below grade
- Concrete influent pump station founded about 22 feet below grade

SSL

- Below-grade transmission pipes from the various improvement site areas to the WWTP. We understand these pipes will likely be about 8 to 12 inches in diameter and less than 6 feet below grade. The SSL will be located along Mashel Prairie Road. This feature will be about 4,200 feet long and may contain up to 14 manhole structures.

We understand that the above grade structures are generally lightly loaded with the exception of the water tank. The below grade structures are settlement sensitive.

Our work was generally performed in accordance with our revised proposal, dated February 11, 2021. We received written authorization on June 10, 2021.

2.0 SCOPE OF SERVICES

The scope of services completed for this portion of the project includes the following tasks.

1. Mobilized to the site to mark exploration locations. Clear publicly owned utilities at the exploration locations by contacting the One-Call utility located service.
2. Schedule and observe the completion of three borings, to depths of about 30 feet each, within the Wastewater Treatment Plant area. The explorations were completed using track-mounted sonic drilling equipment.
3. Construct a 2-inch diameter monitoring well in one of the borings. Develop the monitoring well using a small submersible pump. Measure groundwater levels in the monitoring well and install a pressure transducer in the well.
4. Complete eight test pit explorations on the west side of Mashel Prairie Road. The test pits were excavated to depths from 6 to 8 feet below existing grade.
5. Log soils encountered in the explorations in general accordance with ASTM International (ASTM) D 1586 procedures.
6. Collect samples from the explorations and submit selected samples for laboratory testing. Samples were collected on a near continuous basis in the borings. Samples in the test pit were collected from the trackhoe bucket.
7. Document observations of groundwater, if any, encountered in the explorations.
8. Evaluate pertinent physical and engineering characteristics of the soils based on the results of the field exploration, laboratory testing and our experience.
9. Perform evaluations and engineering analyses, and provide conclusions and recommendations for the proposed WWTP improvements. These included the following:
    - An evaluation of feasible shoring methods for the proposed below-grade structures. This included conventional shoring (slide rails, internally braced, trench boxes, etc.) and open cuts with partial shoring.
    - Lateral earth pressures on temporary excavation shoring for level ground conditions and sloping backfill, where appropriate.
    - Dewatering considerations.
    - Shallow foundation recommendations including allowable bearing pressures, lateral resistance and estimates of expected foundation settlement.
    - Slab-on-grade and mat foundation recommendations including subgrade preparation, modulus, and allowable bearing/areal loading and post-construction settlement.
    - Lateral soil pressures on permanent below-grade structures for level ground conditions.
    - Geotechnical parameters to evaluate buoyancy uplift resistance.
10. Perform engineering analyses and provide conclusions and recommendations for conventional trenching techniques to be used to install the proposed SSL. This includes the following:
    - Geotechnical parameters for trench shoring design.
    - Trench excavation considerations.

- Bedding and backfilling of pipelines and manholes.
- Dewatering requirements.

11. Provide recommendations for earthwork and site preparation including suitability of on-site soils for reuse in backfill, placement and compaction of backfill, and mitigation of unsuitable soil conditions. This includes an evaluation of the effects of weather and/or construction equipment on site soils.
12. Provide recommendations regarding erosion and sedimentation control, including sequencing of excavation activities to minimize disturbance of the area.
13. Discuss seismicity at the WWTP site and evaluate the earthquake engineering aspects of the project, including liquefaction potential.

3.0 SURFACE CONDITIONS

The proposed WWTP is located on a relatively flat upland area. Site grades are slightly undulatory, varying from about Elevation 662 to about Elevation 666 feet. The project area is currently covered in fir and alder trees with moderate to thick brush.

The proposed SSL follows Mashel Prairie Road from the WWTP area about 4,200 feet northeast of the WWTP site, as shown in Figures 1 and 2. The northern approximately 2,500 feet of the line is located in a relatively flat plain that ranges from about 716 to 707 feet in elevation. The SSL traverses a low slope between test pit SW-6 and a utility easement. The slope varies in elevation from about 705 feet to about 698 feet. The remainder of the SSL slopes slightly downward to the southwest from 698 feet elevation to about 665 feet elevation.

A proposed maintenance complex is to be located south of the WWTP, as shown in Figure 2. Various campgrounds and other proposed park features are to be located east and west of the proposed SSL as shown in Figure 3. Geotechnical recommendations for these and other park development features are provided in separate reports.

3.1. Geologic Conditions

Geologic conditions at the site and nearby area were evaluated by reviewing the Washington State Department of Natural Resources "Geologic Map of the Centralia Quadrangle, Washington, 1987." Materials mapped at and in the site area comprise Vashon Drift, Undifferentiated (map unit Qdv). This material is mapped over a broad area at and around the project site. These geologic materials are described as glacial outwash with silts, clays, lacustrine deposits and some ice contact deposits.

Mashel Formation sedimentary rocks (Tmh) are mapped beneath the Qdv material in the Ohop River valley wall, generally west of the site. Mashel Formation rocks are described as varying from claystone, sandstone to poorly cemented basaltic gravel.

4.0 FIELD EXPLORATION AND LABORATORY TESTING

4.1. Field Explorations

Soil and groundwater conditions within the WWTP area were explored by completing three borings on September 23, 2021. Eight test pits were completed within the SSL alignment on July 8, 2021. The approximate locations of the explorations completed for this project are presented on Figures 2 and 3. Details of the field exploration program and logs of the explorations are presented in Appendix A, Field Explorations and Laboratory Testing.

4.2. Laboratory Testing

Soil samples obtained during our site exploration were taken to GeoEngineers, Inc.'s (GeoEngineers) laboratory for further evaluation. Selected samples were tested for the determination of moisture content and grain-size distribution (sieve analysis), Descriptions of the laboratory testing, and the test results are presented in the exploration logs and in Appendix A.

4.3. Subsurface Conditions

4.3.1. WWTP

Variable soil conditions were encountered in the three borings. Approximately 6 to 8 inches of forest duff/vegetation was encountered at the ground surface in each exploration.

Beneath the duff material, we encountered what we interpret to be ice-contact/outwash deposits to depths ranging from about 13 to 21 feet in the three borings. The ice contact/outwash consists of dense silty sand with gravel, cobbles and boulders and dense to very dense silty gravel with sand. Soil densities, derived from driven soil samples, are likely over-stated in this unit due to the sampler size and presence of oversized particles (gravel, cobbles and boulders).

Interlayered hard silt with sand and very dense sand with silt material was encountered beneath the ice contact/outwash deposit in each boring. This material appears to be Mashel Formation bedrock. The bedrock material was encountered to the full depth explored in the borings.

The contact between the ice contact/outwash material and the bedrock appears to vary across the site. Within the Maintenance Building area, the contact was encountered at about 7 feet below ground surface in TH-1C (Appendix B). The contact was encountered at 13 feet in WW-3, 17 feet in WW-2 and 21.5 feet in WW-3.

Boulders and cobbles were encountered in all the borings and in the Maintenance Building test pits.

4.3.2. SSL

Four to six inches of forest duff material was encountered in all of the test pits (SWP-1 through SWP-8). Granular medium dense to dense outwash was then encountered to the full depth explored in all of the test pits. Most of this material was gravel with sand or gravel with sand and silt. A layer of medium dense sand was encountered in SWP-6.

4.3.3. Groundwater

Groundwater was observed in the borings at depths ranging from about 12 to 14 feet during drilling. Groundwater was measured at a depth of 11.53 feet below ground surface in WW-3 on October 7, 2021.

Groundwater in this well appears to be perched on the Mashel Formation bedrock material. Groundwater was not encountered in the test pit explorations completed for the SSL.

Groundwater levels will likely rise at the site during the normal wet late fall/winter months. We expect that future groundwater levels at the site will vary with precipitation and the depth to the Mashel Formation bedrock beneath the ice contact/outwash material.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary of Geotechnical Considerations

Based on our observations and the results of our subsurface exploration and testing program, it is our opinion that the site is suitable for the proposed WWTP and SSL projects. A summary of the primary geotechnical considerations is provided below. The summary is presented for introductory purposes only and should be used in conjunction with the detailed recommendations presented in this report.

- The near-surface soils within the WWTP area contain a moderate to high percentage of fines and are sensitive to small changes in moisture content. These soils are susceptible to disturbance from construction traffic when the moisture content is more than a few percent above the optimum moisture content for compaction. These soils will be difficult, if not impossible, to work or compact when wet or if earthwork is performed in wet weather. Portions of the gravel soils contain a low to moderate percentage of fines. These soils may be suited for earthwork under wet and dry conditions. Cobbles and boulders were encountered in our explorations and should be anticipated during grading activities and site excavations.
- Groundwater levels observed during drilling and measured in well WW-3 are above foundation grades for several of the proposed below-grade structures, requiring up to approximately 12 feet of drawdown based on groundwater measurements to date. Dewatering will be required to construct these features regardless of season. The volume of dewatering will likely be less during typical summer/early fall months. We recommend that earthwork and construction be scheduled to avoid the normal wet late fall and winter months, when groundwater levels will be highest. Dewatering considerations using individually pumped wells are discussed in a subsequent section.
- Temporary shoring recommendations for conventional methods (slide rails, internally braced, trench boxes, and partial shoring) are discussed in Section 5.4. We recommend temporary slopes be inclined at 1½H:1V (horizontal to vertical) or flatter. These slopes may need to be modified depending on the total excavation depth, seepage conditions, localized sloughing, and the dewatering methods utilized during construction.
- We recommend all new fill placed below new structures, parking and driveway areas be placed and compacted as structural fill. In areas where the structural fill is to be placed, the topsoil and root mass must be removed, and the existing subgrade soils should be evaluated prior to fill placement to identify soft or unsuitable soils. Subgrade evaluation should be accomplished by either probing or proof-rolling with heavy, rubber-tired construction equipment.
- The proposed at-grade structures may be satisfactorily supported on continuous and isolated shallow foundations supported on the recompacted native gravel soils or on a minimum 2-foot thickness of compacted structural fill. We recommend an allowable soil bearing pressure of 3,000 pounds per square foot (psf) for design of shallow footings supported as recommended in this report.

- We recommend slabs-on-grade be underlain by a minimum 18-inch thickness of on-site soils or structural fill compacted to a minimum of 95 percent of the maximum dry density (MDD) per ASTM D 1557. The upper 4 inches should consist of a capillary break layer. Capillary break material should consist of well-graded sand and gravel or crushed rock that is a coarse-grained aggregate with negligible sand and silt.
- Permanent structures that extend below the water table will be subjected to buoyancy and uplift. Groundwater may be encountered at about 10 feet below the ground surface (or higher depending on winter conditions). Based on the subsurface soil consistency and type encountered in the borings, we estimate minor ground settlement (less than 1 inch) may occur at the site as the result of lowering the water table.
- Weakly cemented Mashel Formation bedrock (silt with sand/sand with silt) was encountered at variable depths across the site. These materials will likely be encountered/exposed in excavations to construct below-grade structures and are in a hard/very dense condition. This unit and the above outwash layer will provide suitable bearing surfaces for the proposed below-grade structures. We recommend that foundation grades for the below-grade features be over-excavated a minimum of 12-inches to allow placement of a crushed rock base layer to provide protection and uniform support. An allowable bearing pressure of 5,000 psf can be used for design of the planned below-grade structures supported as recommended.

5.2. Site Preparation and Earthwork

5.2.1. General

Site development work will include removing existing trees and vegetation, stripping of forest duff/topsoil and root layer and completing relatively deep excavations to construct the various proposed project elements. The near-surface site soils encountered in our explorations are moisture sensitive due to moderate to high fines content. Deeper soils encountered in the SSL alignment do not appear to be moisture sensitive.

Grading and reuse of the moisture-sensitive soils is more practical during the dry season (typically July through September). Moisture conditioning necessary to obtain proper compaction of these soils will likely not be practical during the cooler and wetter winter months and may still present challenges during the normally dry summer months, particularly those soils in deep excavations. We recommend a contingency be included in the project budget and schedule for export of unsuitable wet on-site soil and import of select granular soil if earthwork will be performed during periods of wet weather.

The following sections provide our recommendations for earthwork, site development, and fill materials.

5.2.2. Stripping and Clearing

The existing trees, shrubs, topsoil, unsuitable soils and boulders should be stripped and removed from all proposed construction areas. Based on our explorations, the depth of stripping to remove unsuitable surface organic materials should generally vary between 6 and 12 inches. Greater stripping depths will be required to remove localized zones of loose or organic-rich soil and tree roots or if large boulders are encountered. The primary root systems for trees and shrubs should be completely removed. Required stripping depths should be evaluated based on observations during the stripping operation. Stripped organic material should be transported off site for disposal or processed and used as fill in landscaping areas. Excavations for boulder depressions should be backfilled with structural fill compacted to the densities indicated in Section 5.6 “Fill Placement and Compaction” of this report.

5.2.3. Excavations

Excavations ranging from about 13 feet to 22 feet below grade will be required for the below-grade WWTP structures (concrete process tank, equalization tank and concrete pump tank). Excavation depths for the SSL pipeline are 6 feet or less, based on preliminary information. Excavation depths for manholes is presently unknown.

Large excavators will likely be required to complete the WWTP excavations. The Mashel bedrock material will likely require large-toothed excavator buckets. We recommend that final preparation of footing and trench excavations be performed using a smooth-blade bucket to prevent excessive disturbance of the excavation base.

Boulders and large cobbles were encountered in the explorations and should be anticipated during grading and/or utility excavations. Accordingly, the contractor should be prepared to remove boulders, if encountered. Boulders may be removed from the site or buried in landscape areas. Voids caused by boulder removal must be backfilled with structural fill.

5.3. Temporary Cut Slopes

Temporary cut slopes and shoring will be required to construct the below-grade portions of the project. We recommend that temporary slopes in the ice contact/outwash soils be inclined at 1½H:1V (horizontal:vertical) or flatter. Flatter cut slopes may be necessary depending on control of groundwater seepage and dewatering methods. Where temporary open cut slopes are utilized, we recommend the following:

- No traffic, construction equipment or supplies should be allowed at the top of cut slopes for a distance of at least 10 feet from the top of the cut.
- Exposed soil along temporary cut slopes should be protected from surface erosion using waterproof tarps or Visqueen, when appropriate.
- Construction should be scheduled so that the length of time the temporary cut is left open is minimized.
- Erosion control measures should be constructed as appropriate to reduce runoff from the site.
- Surface water flow should be diverted away from all excavations.
- The general condition of the temporary cut slopes should be observed periodically by a geotechnical engineer to identify potential problems.

If temporary cut slopes experience excessive sloughing or raveling during construction, it may become necessary to modify the cut slopes to maintain safe working conditions and protect adjacent facilities or structures. Slopes experiencing excessive sloughing or raveling can be flattened, supported with shoring, or additional dewatering can be provided if the poor slope performance is related to groundwater seepage.

Temporary cut slopes and shoring must comply with the provisions of Title 296 Washington Administrative Code (WAC), Part N, “Excavation, Trenching and Shoring.” The contractor performing the work must have the primary responsibility for protection of workmen and adjacent improvements, determining whether shoring is required, and for establishing the safe inclination for open-cut slopes.

5.4. Temporary Shoring

5.4.1. General

Excavations deeper than 4 feet should be shored if temporary cut slopes are not employed. Because of the diversity of available shoring systems and construction techniques, the design of temporary shoring is most appropriately left up to the contractor proposing to complete the installation. We recommend that the shoring be designed by a PE licensed in the State of Washington, and that the PE-stamped shoring plans and calculations be submitted to Robert W. Droll, Landscape Architects (RWD), Washington State Parks and the Engineer for review prior to construction. The following paragraphs present general recommendations for the type of shoring system and design parameters that we conclude are likely to be considered by prospective bidders.

Multiple shoring alternatives can be considered for the proposed below-grade structures. Shoring systems should incorporate a dewatering plan. Our recommendations regarding conventional or internally braced shoring are presented in the following sections.

5.4.2. Lateral Pressures for Conventional or Internally Braced Shoring

The lateral soil pressures acting on temporary shoring will depend on the nature and density of the soil behind the wall, the inclination of the ground surface behind the wall, and the groundwater level. For walls that are free to yield at the top at least one thousandth of the height of the wall (i.e., wall height times 0.001), soil pressures will be less than if movement is restrained. The design of temporary shoring should allow for lateral pressures exerted by the adjacent soil, and for surcharge loads resulting from traffic, construction equipment, temporary stockpiles adjacent to the excavation, etc. Lateral load resistance can be mobilized through the use of braces, tiebacks, anchor blocks, and passive pressures on members that extend below the bottom of the excavation. Temporary shoring used to support trench excavations typically uses internal bracing such as hydraulic shoring or trench boxes.

We recommend that yielding walls retaining the medium dense to dense native soils be designed using an equivalent fluid density of 35 pounds per cubic foot (pcf), for horizontal ground surfaces and 55 pcf for a 2H:1V backslope if partial shoring is considered. For non-yielding (i.e., braced) systems, we recommend that the shoring be designed for a uniform lateral pressure of 22H in psf, where H is the depth of the planned excavation in feet below a level ground surface. These values assume that the soil behind the shoring has been dewatered such that the groundwater table is at least 2 feet below the base of the excavation. Temporary dewatering recommendations are discussed in a subsequent section of this report. If the dewatering system is not designed to lower the groundwater level behind the shoring walls, hydrostatic pressures must be included in the shoring design. For this condition, temporary shoring should be designed using a lateral pressure equal to an equivalent fluid density of 80 pcf, for horizontal ground conditions adjacent to the excavation.

The above lateral soil pressures do not include traffic, sloping ground, or construction surcharges that should be added separately, where present. The shoring design must incorporate all appropriate surcharges.

The soil pressure available to resist lateral loads against shoring is a function of the passive resistance that can develop on the face of below-grade elements of the shoring as those elements move horizontally into the soil. The allowable passive resistance on the face of embedded shoring elements may be computed using an equivalent fluid density of 170 pcf below the water table and 320 pcf above the water table. This passive equivalent fluid density value includes a factor of safety of about 1.5.

5.5. Temporary Dewatering

5.5.1. General

We anticipate that all of the proposed below-grade WWTP structures will likely encounter groundwater seepage, based on our observations during drilling. It is possible that the SSL excavations will not encounter groundwater, if those excavations are 6 feet or less and the excavations are completed during the dry summer months.

At the WWTP, we expect groundwater to flow from the ice contact/outwash material, above the Mashel Formation bedrock. Groundwater levels at the site are being measured in WW-3 using a pressure transducer. Groundwater level data collected during the winter of 2021-2022, spring and summer of 2022 will likely provide a more accurate indication of the optimum seasonal time period for construction.

5.5.2. Pumped Wells

Individually pumped high-capacity wells may be used to dewater the excavations. Pumped wells are generally the most effective dewatering method in areas where dewatering to deeper than about 15 feet below the ground surface (bgs) is necessary.

We recommend that all dewatering wells installed for this project be properly developed to remove fine sediment from the immediate vicinity of the well screens. Proper development is essential for producing efficient wells and helps to reduce the turbidity of the water discharged from each well. Filter packs consisting of graded sand, or sand and fine gravel should be installed around the well screens in areas where the aquifer contains a high percentage of fine sand and silt.

5.5.3. Open Excavation Pumping

If very highly permeable zones intersect the excavations, open pumping may be required to remove water that has seeped into the excavation. This is accomplished by pumping from sumps that have been excavated into the base of the trench. This form of passive dewatering should only be used when limited drawdown is required (e.g., less than about 3 feet), or to supplement pumped wells to remove excess water. Drainage ditches that are connected to the sump are typically excavated along the sidewalls at the base of the excavation or trench. The excavation for the sump and the drainage ditches should be backfilled with gravel or crushed rock to reduce the amount of erosion and associated sediment in the water pumped from the sump. In our experience, a slotted casing or perforated 55-gallon drum that is installed in the sump backfill provides a suitable housing for a submersible pump.

The amount of water removed from the excavation by open pumping should be minimized because of high turbidity levels. Temporary storage of dewatering effluent from the sumps in a settlement tank or basin may be required to meet discharge permit requirements and reduce sediment content prior to discharging the water to surface water courses. Open pumping will not adequately dewater the base of the excavations and might therefore lead to base instability unless a cutoff shoring system is utilized.

5.5.4. Other Considerations

We strongly advise against the use of small-diameter vacuum wellpoint systems for dewatering. These systems are limited in terms of pumping capacity and suction lift, both factors that will compromise the ability of these systems to fully dewater the excavations.

The disposal of water from dewatering operations should generally conform with requirements established in the Stormwater Pollution Prevention Plan (SWPPP), to be prepared for the project. We anticipate this would include options for the disposal of clean (non-turbid) water discharged from dewatering wells.

We recommend the contract specifications require that the contractor retain a specialty dewatering subcontractor to design and install an appropriate dewatering system that will operate in conjunction with the selected shoring method to adequately lower the groundwater level without adversely affecting adjacent facilities. The specifications should require the dewatering subcontractor be experienced in dewatering in the subsurface soil and groundwater conditions anticipated at the site.

Dewatering specifications should be written to address the conditions of the site, with a requirement that the contractor submit a detailed dewatering plan. To reduce the risk of low bids that misinterpret the shoring and dewatering requirements of the project, we recommend that the bid schedule require the contractor submit a one-page description of their shoring and dewatering concept for the project, and an acknowledgment that they have read this Geotechnical Engineering Report. The dewatering plan should include measures to be implemented if the dewatering system fails to achieve the required dewatering, or if groundwater levels rise in open excavations during construction.

The specifications should require that the contractor's shoring and dewatering plan be reviewed by GeoEngineers to assess whether the proposed method is feasible and that the design is consistent with our recommendations. A shoring and groundwater monitoring program may also be applicable depending on the construction sequencing at this site.

5.6. Subgrade Evaluation

After stripping and excavation to planned subgrade is complete, we recommend the exposed soils be proofrolled or probed and then compacted to a firm and unyielding condition. If dry weather conditions persist, the subgrades for at grade structures can be evaluated by proofrolling with a loaded dump truck or similar heavy rubber-tired construction equipment to identify soft, loose or unsuitable areas. Proofrolling must be conducted prior to placing fill. Below-grade subgrades can be evaluated using a small roller or by probing. If the subgrades are prepared during or exposed to wet weather, or groundwater, we recommend that they be evaluated by probing with a steel probe rod.

The proofrolling/probing should be observed by a qualified geotechnical engineer, who will evaluate the suitability of the subgrade and identify any areas of yielding. If soft or otherwise unsuitable areas revealed during proofrolling cannot be compacted to a stable and uniformly firm condition, we recommend that: (1) the subgrade soils be scarified (e.g., with a ripper or a farmer's disc), aerated and recompacted; or (2) the unsuitable soils be excavated to firm soil and replaced with structural fill, as recommended by the geotechnical engineer.

5.7. Weather Considerations

Soils encountered in our explorations contain a sufficient percentage of fines (silt) to be moisture sensitive. When the moisture content of these soils is appreciably above the optimum moisture content, these soils become muddy and unstable, operation of equipment on these soils will be difficult, and it will be difficult to meet the required compaction criteria. Additionally, disturbance of these near-surface soils should be expected if earthwork is completed during periods of wet weather.

The wet weather season generally begins in early November and continues through April in Western Washington; however, periods of wet weather may occur during any month of the year. The optimum earthwork period for these types of soils is typically June through October. If wet weather earthwork is unavoidable, we recommend that:

- Structural fill placed during the wet season or during periods of wet weather consist of gravel borrow (Section 9-03.14(1) of the 2020 Washington State Department of Transportation [WSDOT] Standard Specifications) with the added restriction that no more than 5 percent of the material passes the U.S. No. 200 sieve. The cleaner zones of outwash soils will likely be suitable based on this criteria.
- The ground surface in and around the work areas be sloped so that surface water is directed away from the work areas. The ground surface should be graded such that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.

5.8. Erosion and Sedimentation Control

The site will be susceptible to erosion during wet weather conditions, particularly if large segments of exposed subgrades are exposed to rainfall. Development, implementation and adherence to an Erosion and Sedimentation Control Plan should reduce the project impact on erosion-prone areas. The Plan should be designed in accordance with applicable city, county and/or state standards. The Plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure.
- Re-vegetating or mulching denuded areas.
- Directing runoff away from exposed soils.
- Reducing the length and steepness of slopes with exposed soils.
- Decreasing runoff velocities.
- Preparing drainage ways and outlets to handle concentrated or increased runoff.
- Confining sediment to the project site.
- Inspecting and maintaining control measures frequently.

Some sloughing erosion and raveling of exposed or disturbed soil on slopes should be expected, particularly if the work is completed during the wet season. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until the permanent erosion protection is established, and the site is stabilized, site monitoring may be required by qualified personnel who will evaluate the effectiveness of the erosion control measures and recommend repairs and/or modifications as appropriate. Provision for modifications to the erosion control system based on monitoring observations should be included in the Erosion and Sedimentation Control Plan.

5.9. Fill Materials

The workability of material used as structural fill depends on the gradation and moisture content of the soil. As the amount of fines (material passing the U.S. No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult, if not impossible to achieve. As discussed previously, we recommend that select granular fill or crushed rock be used as structural fill during the rainy season. The following paragraphs summarize the material requirements for fill and backfill.

5.9.1. On-site Soils

Soils encountered in our explorations may be considered for use as structural fill during periods of extended dry weather, provided they can be properly moisture conditioned and do not contain an unacceptable amount of organic materials. The clean gravel outwash soils encountered in the SSL test pits can likely be used as structural fill during wet and dry weather conditions. On-site materials used as structural fill must be free of roots, organic matter and other deleterious materials and particles larger than 3 inches in diameter.

5.9.2. Select Granular Fill

Select granular fill (pit run) used during the wet season should meet the criteria for gravel borrow as discussed in Section 5.3. Organic matter, debris, or other deleterious material must not be present. Granular fill used during periods of prolonged dry weather may have up to 12 percent passing a U.S. No. 200 sieve provided the material can be moisture conditioned and compacted to the minimum criteria.

5.9.3. Pipe Bedding

Trench backfill for the bedding and pipe zone must consist of well-graded granular material with a maximum particle size of ¾ inch and less than 5 percent passing the U.S. No. 200 sieve. The material must be free of roots, debris, organic matter, and other deleterious material.

5.9.4. Crushed Rock

Crushed rock fill must consist of clean, durable, crushed angular rock that has a maximum particle size of 4 inches, is well graded between coarse and fine sizes, and has less than 5 percent fines (material finer than a U.S. No. 200 sieve). A smaller maximum particle size will be required for some applications as discussed in other sections of this report. Gravel materials should be crushed to have at least two fractured faces. Organic matter, debris, or other deleterious material must not be present.

5.10. Fill Placement and Compaction

5.10.1. General

Fill soils should be compacted at a moisture content near optimum. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Fill and backfill material should be placed in uniform, horizontal lifts, and uniformly densified with vibratory compaction equipment. The maximum lift thickness will vary depending on the material and compaction equipment used but should generally not exceed 10 inches in loose thickness. We recommend that density testing of the placed structural fill be completed by a qualified geotechnical engineer to check that the structural fill compaction requirements presented in this report are achieved.

5.10.2. Area Fills and Bases

Fill placed to raise site grades and aggregate base materials under foundations and slabs should be placed on a prepared subgrade that consists of firm, inorganic native soils or compacted fill. Fill must be compacted to at least 95 percent of the MDD determined by ASTM Test Method D 1557 (modified Proctor). In pavement and crushed rock surfacing areas, the compaction criteria can be reduced to 92 percent below a depth of 2 feet from finished grade.

During wet weather or in areas that are particularly sensitive to subgrade disturbance, we recommend placing a woven geotextile between the subgrade and the first lift of fill. For this application, the first lift must comprise select granular fill. We recommend a 10-inch lift thickness and densification by static rolling for the initial lift.

5.10.3. Trench Backfill

Backfill in the bedding and pipe zone should be compacted to 90 percent of the MDD as determined by ASTM Test Method D 1557, or as recommended by the pipe manufacturer.

In nonstructural areas, trench backfill above the pipe zone should be compacted to at least 85 percent of the MDD as determined by ASTM Test Method D 1557. Suitable native soils or select granular soils should be acceptable in non-structural areas.

Within structural areas, trench backfill placed above the pipe zone must be compacted to at least 92 percent of the MDD as determined by ASTM Test Method D 1557 at depths greater than 2 feet below the finished subgrade, and to 95 percent within 2 feet of finished subgrade. Trench backfill in structural areas should consist of select granular fill or crushed rock as described in the previous sections.

5.11. Permanent Slopes

We recommend that permanent cut and fill slopes be inclined no steeper than 2H:1V. Flatter cut slopes may be necessary in areas where persistent groundwater seepage or zones of soft or loose soils are encountered.

To reduce the potential for erosion, newly constructed slopes should be planted or hydroseeded shortly after completion of grading. Some sloughing and raveling of the slopes should be expected until the vegetation is established. This may require localized repairs and reseeding. Temporary covering, such as heavy plastic sheeting, jute fabric, loose straw, or excelsior matting should be used to protect unvegetated slopes during periods of rainfall.

5.12. Foundation Support – At-Grade Structures

5.12.1. Shallow Foundations

Shallow foundations can be supported on undisturbed dense native ice contact/outwash soils following recompaction, or on a minimum 2-foot thickness of structural fill. Where dense native soils are encountered at footing subgrade, we recommend that the exposed surface be recompacted to a dense condition following excavation disturbance. If weather or subgrade conditions prevent adequate compaction, the subgrade should be overexcavated and replaced with a 2-foot thickness of structural fill. The structural fill pad should extend a minimum of 2 feet beyond the edges of the footing. Isolated column and continuous wall footings should have minimum widths of 24 and 18 inches, respectively.

The exterior footings should be embedded at least 18 inches below the lowest adjacent grade for frost protection. Interior footings can be founded a minimum of 12 inches below the top of the floor slab.

5.12.2. Bearing Capacity

We recommend that footings for the above-grade structures, founded as recommended be proportioned using an allowable bearing pressure of 3,000 psf. The recommended bearing pressures applies to the total of dead and long-term live loads and may be increased by one-third when considering earthquake or wind loads. This is a net bearing pressure. The weight of the footing and overlying backfill can be ignored in calculating footing sizes.

5.12.3. Footing Subgrade Preparation

Footing excavations should be performed using a smooth-edged bucket to limit bearing surface disturbance. Loose or disturbed materials present at the base of footing excavations should be removed or compacted. Foundation bearing surfaces should not be exposed to standing water. If water infiltrates and pools in the excavation, it must be removed, and the bearing surface reevaluated before placing structural fill or reinforcing steel.

We recommend that an experienced geotechnical engineer observe all foundation excavations before placing reinforcing steel in order to confirm that adequate bearing surfaces have been achieved and that the soil conditions are as anticipated. Unsuitable foundation subgrade soils must be removed and replaced with structural fill as recommended by the geotechnical engineer. It may be prudent to place a thin mud mat of lean concrete to protect the bearing surface if footing excavations are to remain open in wet weather.

5.12.4. Foundation Settlement

We estimate that settlements of footings designed and constructed as recommended will be less than ¾ inch, for the anticipated light loading conditions. Differential settlements between comparably loaded isolated column footings or along 50 feet of continuous footing should be less than ½ inch. Settlement is expected to occur rapidly as loads are applied.

5.13. Slabs-On-Grade

We recommend floor slabs and on-grade supported facilities such as equipment slabs be supported on a minimum 18-inch thickness of structural fill. The upper 4 inches should consist of capillary break material, a well-graded sand and gravel or crushed rock that is a coarse-grained aggregate with negligible sand and silt (similar to American Association of State Highway and Transportation Officials [AASHTO] Grading No. 57). If adequate compaction of the native soils is not possible or if soft soils are encountered, the unsuitable subgrade soils should be over-excavated and replaced with compacted structural fill to a depth of 18 inches below the bottom of the slab. Structural fill placed below the slab, if necessary, should extend a minimum of 2 feet beyond the edge of the slab on all sides. Provided the slab foundations are constructed on the recommended subbase layer, the foundation performance can be evaluated using a subgrade modulus of 80 pounds per cubic inch (pci).

We recommend that a representative from our firm observe the excavation for crushed rock subbase, monitor the proofrolling or perform the hand probing to evaluate the condition of the exposed subgrade, monitor the compaction of structural fill and crushed rock, and recommend modifications if required.

We estimate that the post-construction settlement of on-grade slabs under static loading conditions may range from about ¾ to 1 inch provided that the slab subgrade is prepared as recommended. We expect that settlements for these conditions will tend to occur rapidly after the loads are applied.

5.14. Lateral Resistance

The ability of the soil to resist lateral loads is a function of frictional resistance, which can develop on the base of footings and slabs and the passive resistance, which can develop on the face of below-grade elements of the structure as these elements tend to move into the soil. For footings and floor slabs founded in accordance with the recommendations presented above, the allowable frictional resistance may be computed using a coefficient of friction of 0.35 applied to vertical dead-load forces. The allowable passive resistance on the face of footings, grade beams or other embedded foundation elements founded above the water table may be computed using an equivalent fluid density of 300 pounds per cubic foot (pcf) for undisturbed on-site soils or structural fill extending out from the face of the foundation element a distance at least equal to two and one-half times the depth of the element.

The passive earth pressure and friction components may be combined provided that the passive component does not exceed two-thirds of the total. The passive earth pressure value is based on the assumptions that the adjacent grade is level, and that groundwater remains below the base of the footing throughout the year. The top foot of soil should be neglected when calculating passive lateral earth pressures unless the foundation area is covered with pavement or is inside a building.

The lateral resistance values include a safety factor of approximately 1.5.

5.15. Below-Grade Structures

5.15.1. Lateral Earth Pressures

We recommend permanent below-grade walls be designed using a uniform lateral pressure of 35*H in psf above the water table, where H is the depth of the structure below a level ground surface to the groundwater elevation. For preliminary design, we recommend the long-term groundwater elevation be assumed to be as high as 5 feet below the existing ground surface. Below this depth, a uniform lateral pressure of 18*H psf can be utilized (assuming buoyant unit weight), and the design should account for hydrostatic head. The hydrostatic pressure should be added to the 18*H psf lateral pressure. In addition, we recommend a seismic loading be approximated using a uniform lateral pressure equal to 10*H psf, where H is the depth in feet below grade of the structure. This seismic lateral pressure is in addition to and should be superimposed upon the static soil and hydrostatic pressures.

These lateral soil pressures do not include traffic or other surcharges that should be added separately, if appropriate. For traffic loading, we recommend that below grade walls be designed for a uniform surcharge pressure determined by increasing the apparent height of the backfill around the wall by 2 feet (250 psf). Other surcharge loads should be included as appropriate.

The soil pressure available to resist lateral loads is a function of the passive resistance that can develop on the face of below-grade elements as those elements move horizontally into the soil. The allowable passive resistance on the face of embedded foundation elements may be computed using an equivalent fluid density of 170 pcf below the water table and 320 pcf above the water table. This passive equivalent fluid density value includes a factor of safety of about 1.5.

5.15.2. Buoyancy and Uplift

Below-grade structures will extend below the groundwater level and should be evaluated for buoyancy and uplift resistance. Resistance to uplift can be developed by the dead weight of the structure, friction along the sides of the structure, and the weight of zones of soil which are located above the base of the structure which protrude beyond the permanent walls. For design purposes, we recommend that hydrostatic uplift pressures be considered beginning at a depth of 5 feet below existing site grade. Frictional resistance can be computed using a coefficient of friction of 0.35 applied to the lateral soil pressures. This coefficient of friction value includes a factor of safety of about 1.5. We recommend that lateral soil pressures for uplift resistance be computed using an equivalent fluid density of 20 pcf considering groundwater is present. Backfill above the base of the structure may be assumed to have a submerged unit weight of 60 pcf.

5.15.3. Foundation Support

Subsurface soil conditions encountered near the base of the below-grade structures consists of dense outwash or very dense weathered Mashel Formation that will provide adequate support for the base slabs/footings.

The silty soils will become easily disturbed during excavation and when wet. To provide a level foundation pad and prevent disturbance, we recommend placing a minimum 12-inch-thick layer of crushed rock beneath the base of the structures. All loose soil should be removed from the subgrade prior to placing the crushed rock. We recommend that subgrade areas be evaluated by a geotechnical engineer immediately prior to placing the crushed rock to confirm that subsurface conditions are as expected and that the bearing surface has been prepared adequately. An allowable bearing pressure of 5,000 psf can be used in design of the proposed below-grade facilities founded below a depth of 10 feet.

5.16. Seismic Design Parameters

We recommend the use of the following 2018 International Building Code (IBC) parameters for seismic design:

TABLE 1. SEISMIC DESIGN PARAMETERS

2018 IBC (ASCE 7-16) Seismic Design Parameters	
Spectral Response Acceleration at Short Periods (S_S)	1.188g
Spectral Response Acceleration at 1-Second Periods (S_1)	0.424g
Site Class	D
Design Peak Ground Acceleration (PGA_M)	0.55g
Design Spectral Response Acceleration at Short Periods (S_{DS})	0.811g
Design Spectral Response Acceleration at 1-Second Periods (S_{D1})	null[1]

[1] A ground motion hazard analysis may be required in accordance with Section 11.4.8 of ASCE 7-16 unless Exception 2 is utilized in design.

5.17. Liquefaction Potential

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in development of excess pore pressures in loose, saturated soils and subsequent loss of strength in the deposit of soil so affected. In general, soils that are susceptible to liquefaction include loose to medium dense “clean” to silty sands that are below the water table. Based on the conditions in our

explorations, there is the potential for some of the sand ice contact/outwash soils to experience liquefaction. However, based on the consistency of the outwash and depth to groundwater, it is our opinion the risk of liquefaction is low at the site.

6.0 LIMITATIONS

We have prepared this report for use by Robert W. Droll, Landscape Architects. This report may be made available to regulatory agencies. Our analysis, interpretations and conclusions should not be construed as a warranty of subsurface conditions beneath the site. We have relied on information prepared and supplied by others in developing our recommendations. GeoEngineers makes no representations as to the accuracy or reliability of these data.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix C titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

FIGURES

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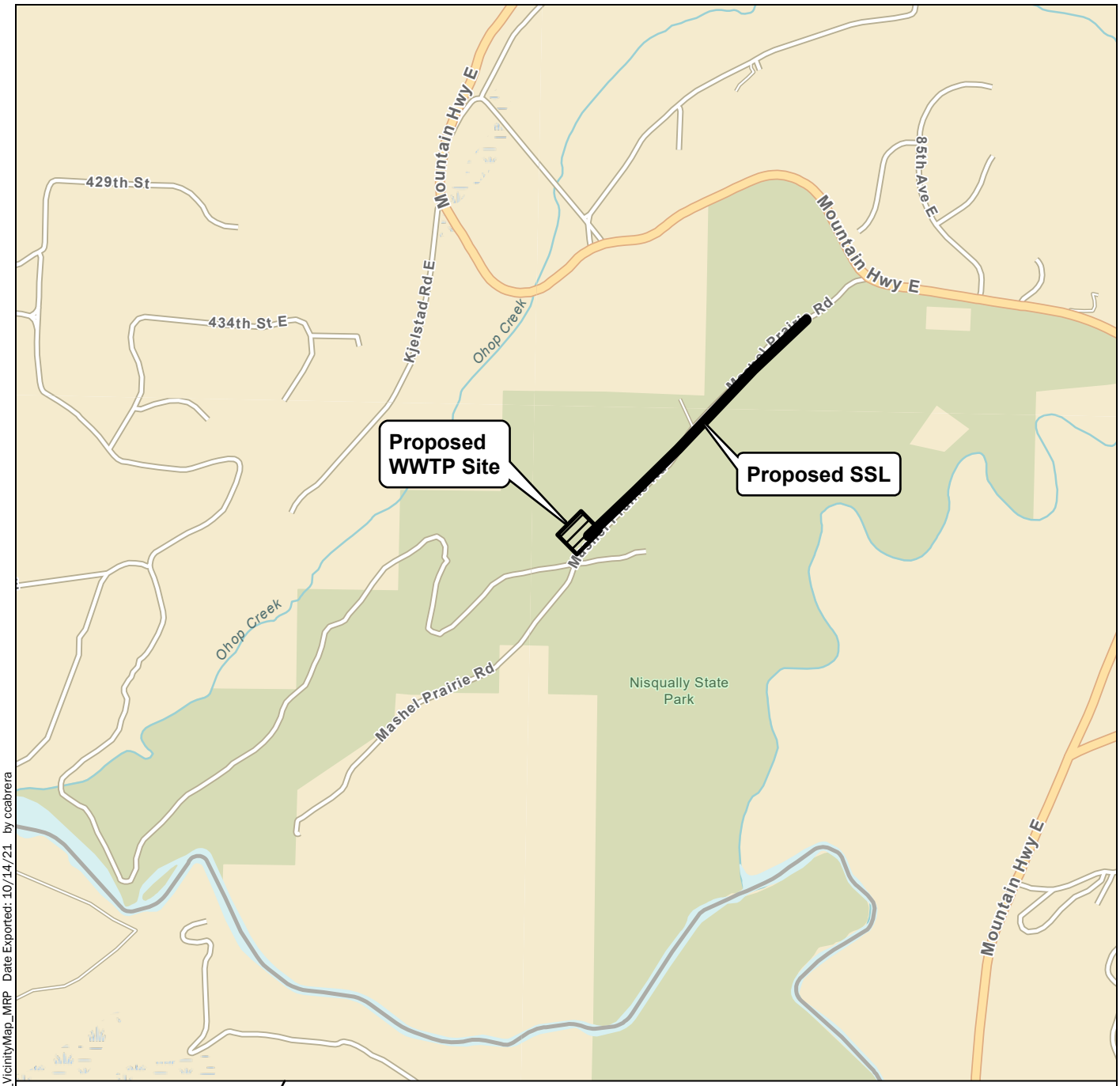

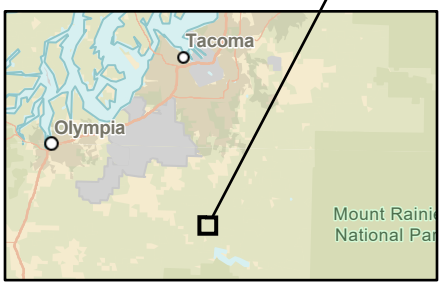

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Feet

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

Vicinity Map

Nisqually State Park Proposed WWTP and SSL
Pierce County, Washington

GeoEngineers

Figure 1

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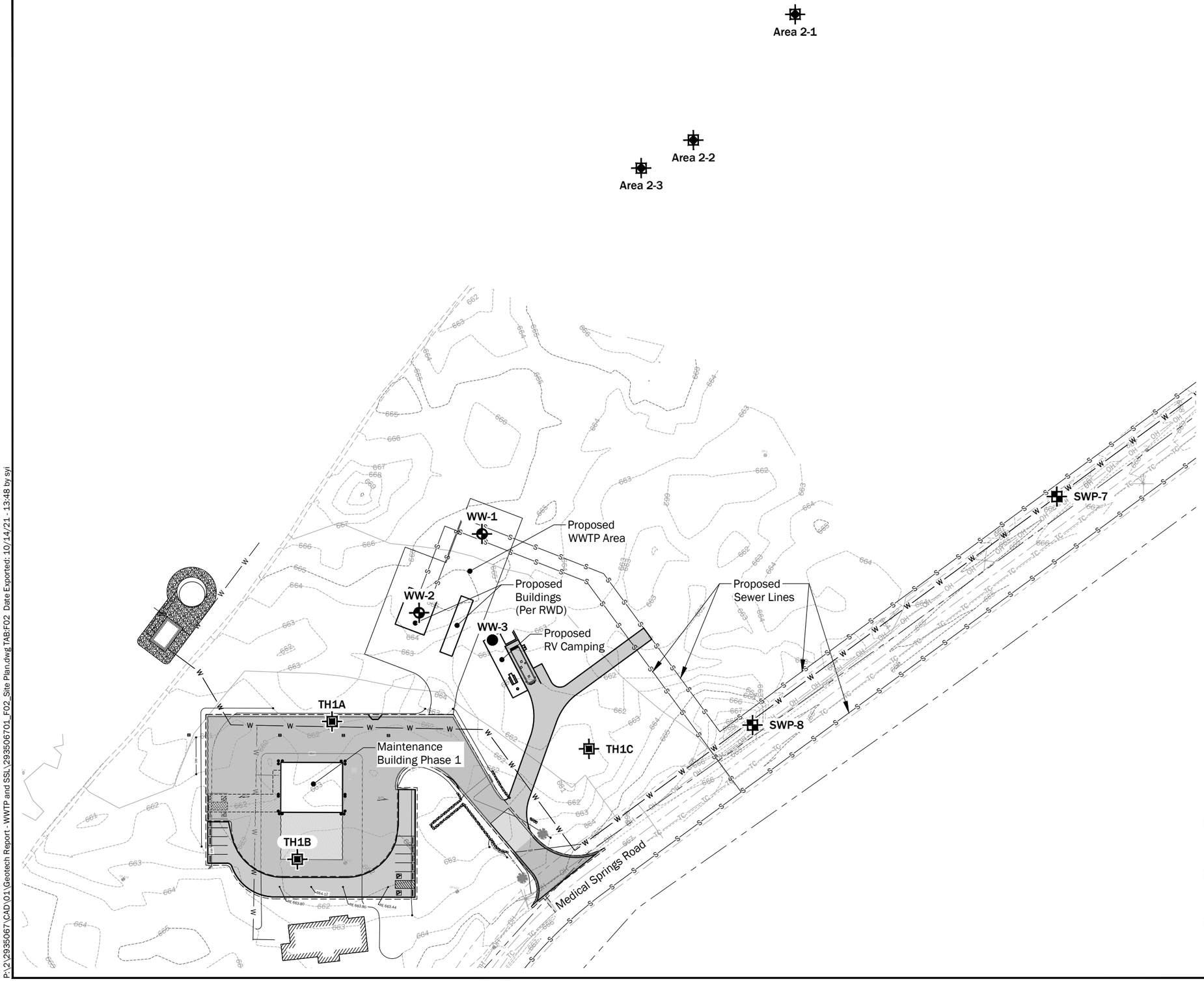

Legend

- **WW-1** — Boring by GeoEngineers, Inc., 2021
- **WW-3** — Monitoring Well by GeoEngineers, Inc., 2021
- **SWP-8** — Test Pit by GeoEngineers, Inc., 2021
- **Area 2-3** — Test Pit by GeoEngineers, Inc. for Proposed Drainage Basin 2, 2021
- **TH1A** — Test Pit by GeoEngineers, Inc. for Proposed Maintenance Building Area, 2020

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Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from RWD Landscape Architects, dated 09/07/21.

Vertical Datum: NAVD 88.

Projection: NAD83 Washington State Planes, South Zone, US Foot.

Site Plan

Nisqually State Park, Proposed WWTP and SSL
Pierce County, Washington

GeoEngineers

Figure 2

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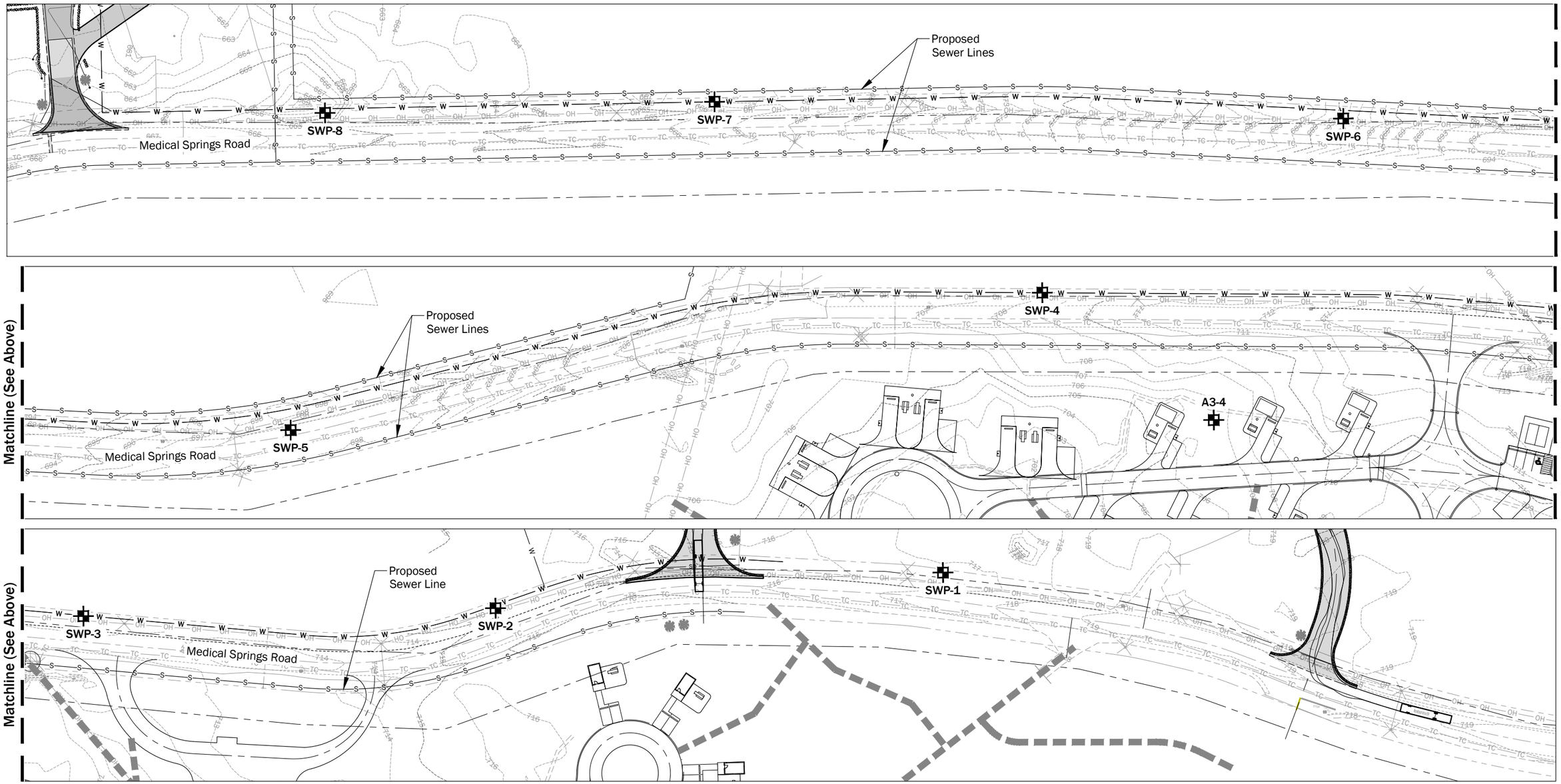

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from RWD Landscape Architects, dated 09/07/21.

Vertical Datum: NAVD 88.

Projection: NAD83 Washington State Planes, South Zone, US Foot.

Legend

SWP-8 Test Pit by GeoEngineers, Inc., 2021

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Site Plan

Nisqually State Park, Proposed WWTP and SSL
Pierce County, Washington

GeoEngineers

Figure 3

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APPENDICES

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APPENDIX A
Field Explorations and Laboratory Testing

APPENDIX A
FIELD EXPLORATIONS AND LABORATORY TESTING

Field Explorations

Soil and groundwater conditions were explored at the site by observing and collecting soil samples in three borings completed by Holocene Drilling, Inc. on September 23, 2021 and in eight test pits completed on July 9, 2021 by Kelly's Excavating, Inc. Explorations were completed to depths ranging from about 8 to about 31½ feet. Exploration locations should be considered approximate and are shown on Figures 2 and 3.

A monitoring well was constructed in boring WW-3 in general accordance with Washington State Department of Ecology (Ecology) regulations and covered with steel well monuments and caps. The well was developed by surging and pumping using a plastic submersible pump. This continued until relatively clear water was pumped from each well.

Our field representative obtained samples, classified the soils, maintained a detailed log of each exploration and observed groundwater conditions where applicable. Samples were collected on a continual basis from the sonic core barrel. Samples were also taken with a standard split spoon sampler at 5-foot intervals in general accordance with ASTM International (ASTM) D 1586. Samples from test pits were collected from the trackhoe bucket.

The samples were retained in sealed plastic bags. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. Summary logs of the explorations are included as Figures A-2 through A-12.

Laboratory Testing

Soil samples obtained from the explorations were brought to our laboratory to confirm field classifications. Selected samples were tested to determine their moisture content and grain-size distribution in general accordance with applicable ASTM standards.

The moisture content of selected samples was determined in general accordance with ASTM Test Method D 2216. The test results are presented in the respective exploration logs in Appendix A. Grain-size distribution (sieve analyses) testing was conducted in general accordance with ASTM Test Method D 422. The results of the grain-size and hydrometer analyses are presented in Figures A-13 and A-17.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

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Figure A-1

Drilled Start 9/23/2021 End 9/23/2021	Total Depth (ft) 31.5	Logged By OA Checked By	Driller Holocene Drilling, Inc.	Drilling Method Sonic	
Surface Elevation (ft) 665 Vertical Datum NAVD88	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment GeoProbe 8140LC			
Latitude 46.8558 Longitude -122.34188	System Datum WA State Plane South NAD83 (feet)	See "Remarks" section for groundwater observed			
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							DUF	Forest duff			
						1		SM	Tan fine silty sand with gravel (dense, moist) (outwash/ice contact)			
660	5		7	33		2 SA				4	15	
						3 SA		GM	Gray silty gravel with sand (very dense, moist) (outwash/ice contact)	6	21	(Density likely due to gravel)
655	10			80/6"		4						Broken SPT sampler, possibly due to boulder
								GM	Tan-brown fine to coarse silty sand with gravel (very dense, wet) (outwash/ice contact)			Groundwater observed at approximately 12 feet at time of drilling
650	15		5	50/6"		5 SA 6				8	15	
						7						
645	20		18	53		8 SA		GM	Dark gray silty gravel with sand (very dense, moist) (outwash/ice contact)	15	29	
								ML	Dark gray sandy silt (hard, moist) (Mashel Formation)			
						9 SA				31	56	
640	25		18	70/6"		10A 10B						
								SM	Dark gray silty sand (very dense, moist) (Mashel Formation)			
						11						
635	30		18	34		12 SA		ML	Dark gray silt with sand (Mashel Formation)	30	79	

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Boring WW-1

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-2
Sheet 1 of 1

Drilled Start 9/23/2021 End 9/23/2021	Total Depth (ft) 31.5	Logged By OA Checked By	Driller Holocene Drilling, Inc.	Drilling Method Sonic	
Surface Elevation (ft) 665 Vertical Datum NAVD88	Hammer Data 140 (lbs) / 30 (in) Drop	Drilling Equipment GeoProbe 8140LC			
Latitude 46.85555 Longitude -122.34206	System Datum WA State Plane South NAD83 (feet)	See "Remarks" section for groundwater observed			
Notes:					

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0							DUF	Forest duff			
						1		SM	Tan silty fine to medium sand with occasional gravel, cobbles and boulders (loose, moist) (outwash/ice contact)			
660	5	1		50/2"		2			Grades to very dense			Rock in shoe; very slow drilling from 5 to 10 feet below the ground surface
						3 SA		GM	Gray gravel with sand, cobbles and boulders (very dense, moist) (outwash/ice contact)	4	21	
655	10	2		50/2"		4						Boulders shifted drill alignment
						5 SA				11	19	Drilled through rock
						6						
650	15	5		50/1"		7						Groundwater observed at approximately 14 feet during drilling
						8 SA		SM	Brown silty fine sand with oxidation staining (very dense, moist to wet) (Mashel Formation)	9	22	
645	20	18		70/6"		9 & 10 SA		SM	Dark gray silty sand (very dense, moist) (Mashel Formation)	30	40	Very difficult drilling
						11						
640	25	18		55		12 SA				12	8	
						13		SP-SM	Gray sand with silt and occasional gravel (very dense, wet) (Mashel Formation)			
635	30											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Boring WW-2

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-3
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/23/2021	9/23/2021	31.5	OA		Holocene Drilling, Inc.	Sonic

Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	GeoProbe 8140LC
Surface Elevation (ft) Vertical Datum	664 NAVD88	Top of Casing Elevation (ft)	
Latitude Longitude	46.85552 -122.34175	Horizontal Datum	WA State Plane South NAD83 (feet)

DOE Well I.D.: BNG 443
A 2-in well was installed on 9/23/2021 to a depth of 31.5 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
10/7/2021	11.53	653

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0								DUF	Forest duff		
									GM	Tan silty gravel with sand and cobbles (dense, moist) (outwash/ice contact)		
660						1 SA					7	23
	5		17	70		2						
						3 SA					4	17
	10		4	50/5"		4				Grades to wet		
650						5 SA			GP-GM	Brown sandy medium gravel with silt (very dense, wet) (outwash/ice contact)	7	8
									ML	Gray sandy silt (hard, moist) (Mashel Formation)		
	15		18	70		6						
645						7 SA				Minor organic matter and green laminations	26	66
	20		18	36		8 SA					33	67
										Pieces of bark present		
640						9						
	25		18	49		10						
635			18			11 SA					35	78
	30		18	40		12						

WELL LOG

- Steel surface
- 3/8-inch bentonite seal
- 2-inch Schedule 40 PVC well casing
- 12/20 sand backfill
- 2-inch Schedule 40 PVC screen, 0.020-inch slot width
- 4
- 5
- 30
- 31.5

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Date:10/14/21 Path:\\GEOENGINEERS.COM\WAN\PROJECTS\2 2935067\GINT\293506701.GPJ DBLibrary\Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_WELL_%F

Log of Monitoring Well WW-3

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-4
Sheet 1 of 1

Date Excavated	7/8/2021	Total Depth (ft)	8	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	717 NAVD88	Latitude Longitude	46.86294 -122.331	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	4 inches of forest duff			
716	1				GP-GM	Brown fine to coarse gravel with silt, sand and cobbles (medium dense, moist) (outwash)			
715	2		1 SA				5	9	Severe caving from 2 to 8 feet
714	3				GP	Brown-gray fine to coarse gravel with sand and cobbles (loose, moist) (outwash)			
713	4								
712	5		2			Grades to gray with occasional boulders			
711	6								
710	7								
709	8								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit SWP-1

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-5
Sheet 1 of 1

Date Excavated	7/8/2021	Total Depth (ft)	8	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	715 NAVD88	Latitude Longitude	46.86199 -122.33212	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
714	0				DUFF	6 inches of forest duff			
	1				GP-GM	Brown fine to coarse gravel with silt, sand and cobbles (medium dense, moist) (outwash)			
713	2		1						
712	3								
711	4				GP	Gray fine to coarse gravel with sand, cobbles and occasional boulders (medium dense, moist) (outwash)			Moderate caving from 4 to 8 feet
710	5		2 SA				3	2	
709	6								
708	7								
707	8								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

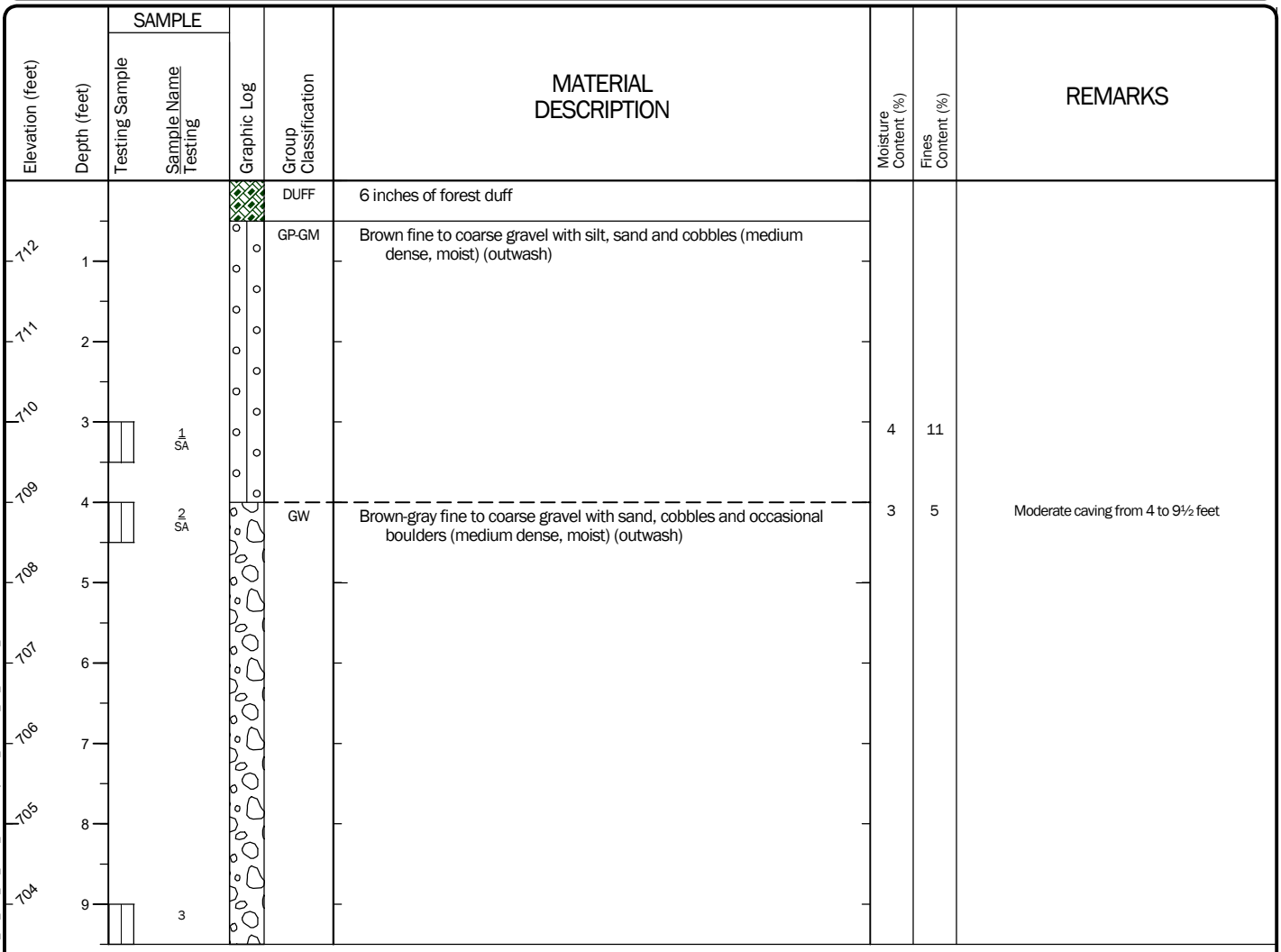
Log of Test Pit SWP-2

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-6
Sheet 1 of 1

Date Excavated	7/8/2021	Total Depth (ft)	9.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	713 NAVD88	Latitude Longitude	46.86117 -122.33322	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)	



Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit SWP-3

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-7
Sheet 1 of 1

Date Excavated 7/8/2021	Total Depth (ft) 9	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) 708 Vertical Datum NAVD88		Latitude 46.86008 Longitude -122.33485	Coordinate System WA State Plane South Horizontal Datum NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
707	0				DUFF	6 inches of forest duff			
	1				SP-SM	Brown-gray fine to medium sand with silt, gravel and cobbles (loose to medium dense, moist) (outwash)			Moderate caving from 1 to 6 feet
706	2								
705	3	✓	1 SA				4	6	
704	4				GP	Gray fine to coarse gravel with sand and cobbles (medium dense, moist) (outwash)			
703	5								
702	6	✓	2						
701	7								
700	8								
699	9								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit SWP-4

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-8
Sheet 1 of 1

Date Excavated	7/8/2021	Total Depth (ft)	8	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	698 NAVD88	Latitude Longitude	46.85834 -122.3365	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
697	0				DUFF	6 inches of forest duff			
	1				GP	Brown fine to coarse gravel with sand and cobbles (medium dense, moist) (outwash)			Moderate caving from 1 to 8 feet
696	2								
695	3					Grades to gray			
694	4		1						
693	5								
692	6								
691	7								
690	8								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit SWP-5

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-9
Sheet 1 of 1

Date Excavated	7/8/2021	Total Depth (ft)	8.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum	686 NAVD88	Latitude Longitude	46.85742 -122.33786	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	6 inches of forest duff			
685	1				GP-GM	Red-brown fine to coarse gravel with silt, sand, cobbles and occasional boulders (loose to medium dense, moist)			Moderate caving from 1 to 8½ feet
684	2								
683	3	■	1 SA				4	7	
682	4				GP	Gray fine to coarse gravel with sand, cobbles and occasional boulders (medium dense, moist)			
681	5				SP	Gray fine to coarse sand with gravel and occasional cobbles (medium dense, moist)			
680	6	■	2 SA				5	1	
679	7				GP	Gray fine to coarse gravel with sand, cobbles and occasional boulders (dense, moist)			
678	8	■	3						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit SWP-6

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-10
Sheet 1 of 1

Date Excavated	7/8/2021	Total Depth (ft)	9	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	666 NAVD88	Latitude Longitude	46.85621 -122.33962	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	6 inches of forest duff			
665	1				GP-GM	Brown gravel with silt and sand and cobbles (medium dense, moist)			
664	2		1 SA				5	10	
663	3								
662	4				GP-GM	Gray gravel with sand, silt and occasional cobbles (medium dense, moist)			
661	5		2						
660	6								
659	7					Grades to with iron-oxide staining and occasional gravel			
658	8								
657	9		3 SA			Grades to with gravel, cobbles and occasional boulders	11	12	

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit SWP-7

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-11
Sheet 1 of 1

Date Excavated 7/8/2021	Total Depth (ft) 6	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) 667 Vertical Datum NAVD88		Latitude 46.85543 Longitude -122.34065	Coordinate System WA State Plane South Horizontal Datum NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
666	0				DUFF	4 inches of forest duff			Moderate caving from 0 to 6 feet
	1				GP-GM	Brown fine to coarse gravel with silt, sand, cobbles and boulders (medium dense, moist)			
665	2		1 SA				6	11	
664	3								
663	4				GP	Gray fine to coarse gravel with sand, cobbles and boulders (medium dense, moist)			
662	5					Grades to dense			
661	6		2						

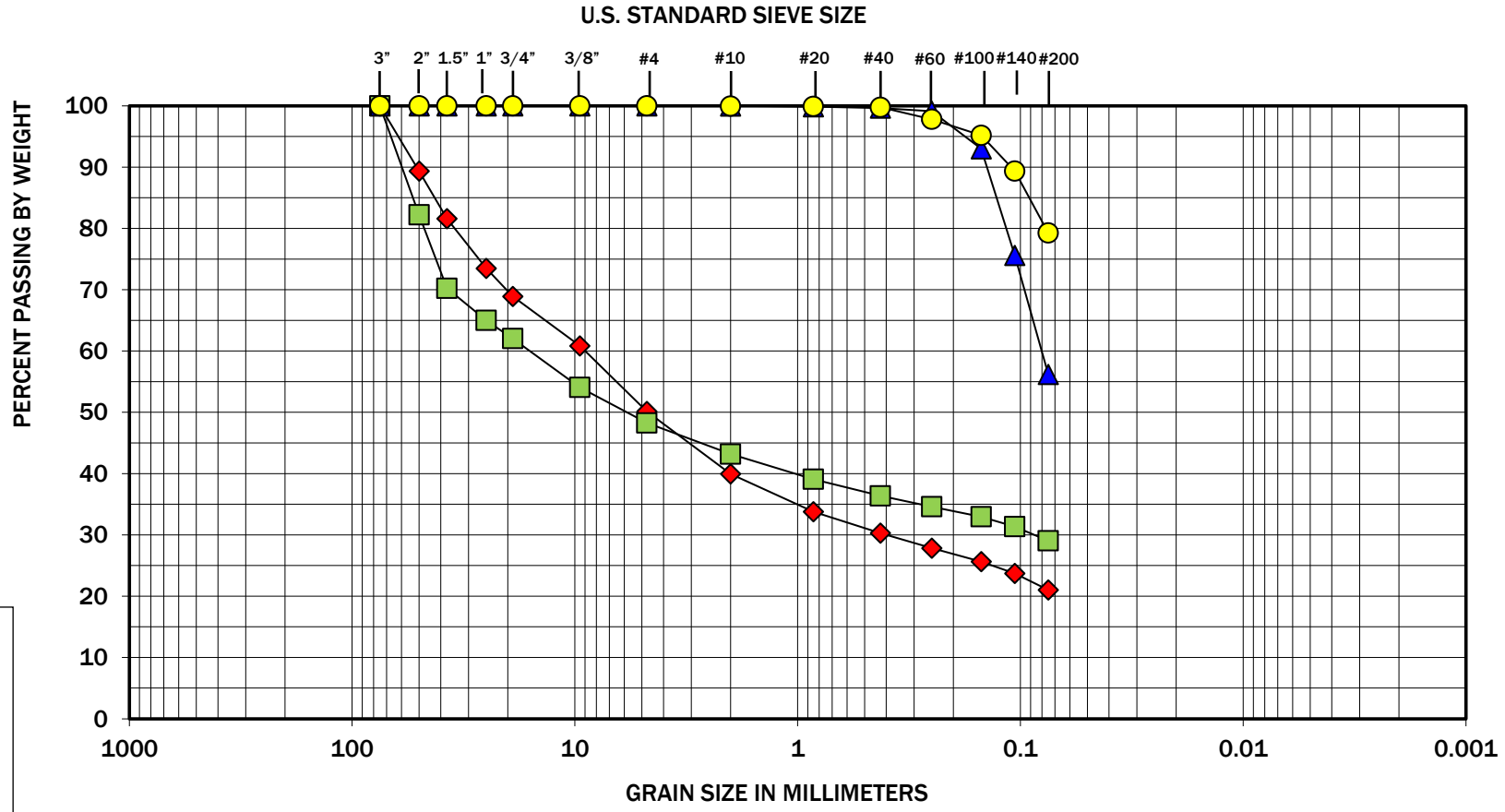
Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Test Pit SWP-8

GeoEngineers

Project: Nisqually State Park, Proposed WWTP and SSL
Project Location: Pierce County, Washington
Project Number: 2935-067-01

Figure A-12
Sheet 1 of 1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	WW-1	7	6	Silty gravel with sand (GM)
■	WW-1	20	15	Silty gravel with sand (GM)
▲	WW-1	23	31	Sandy silt (ML)
●	WW-1	30	30	Silt with sand (ML)

Sieve Analysis Results

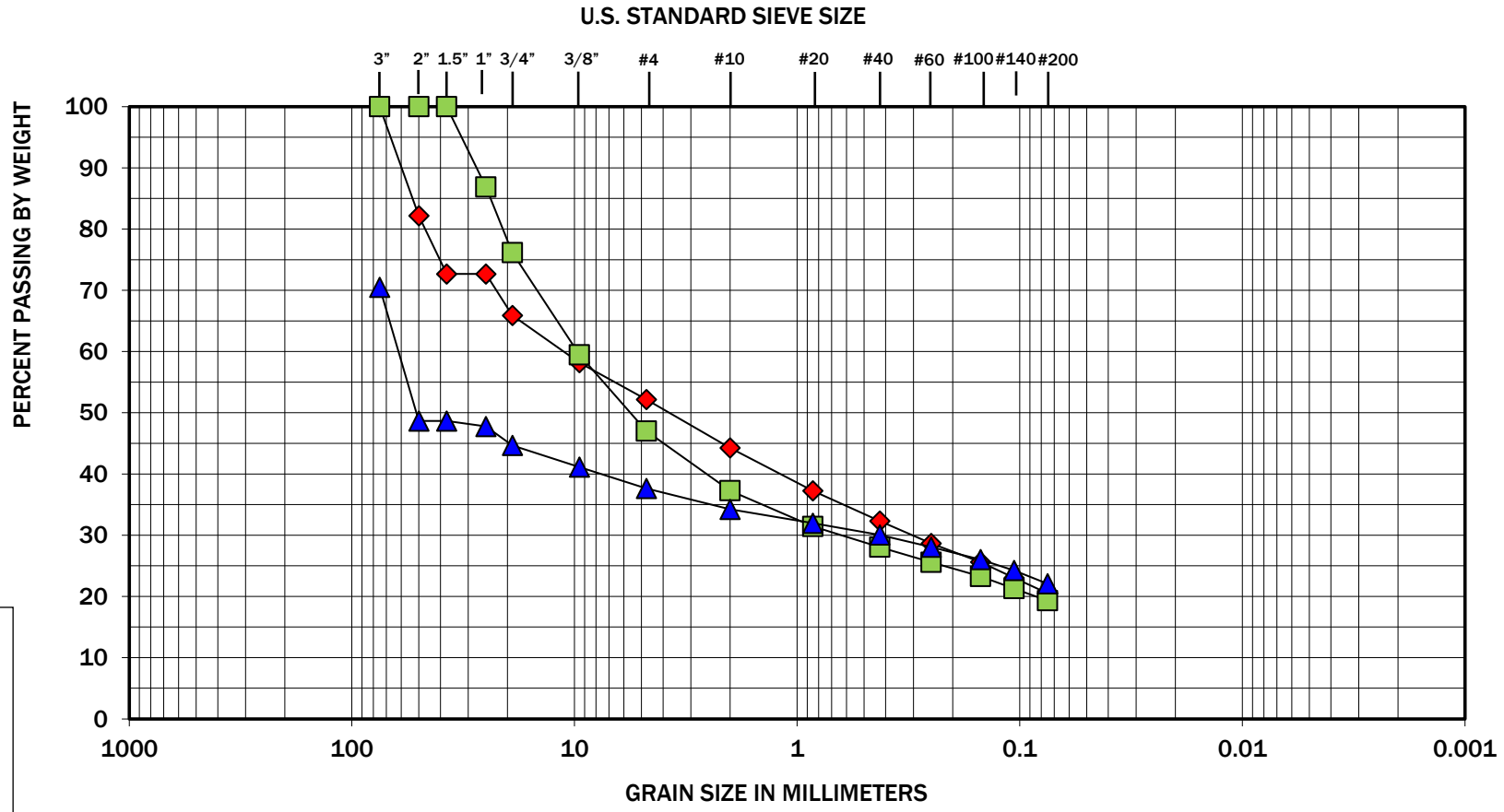
Nisqually State Park, MRP Plant and Sewer Line
Pierce County, Washington

GeoEngineers

Figure A-13

AASHTO ACCREDITED

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	WW-2	8	4	Silty gravel with sand (GM)
■	WW-2	13	11	Silty gravel with sand (GM)
▲	WW-2	18	9	Silty gravel with sand (GM)

Sieve Analysis Results

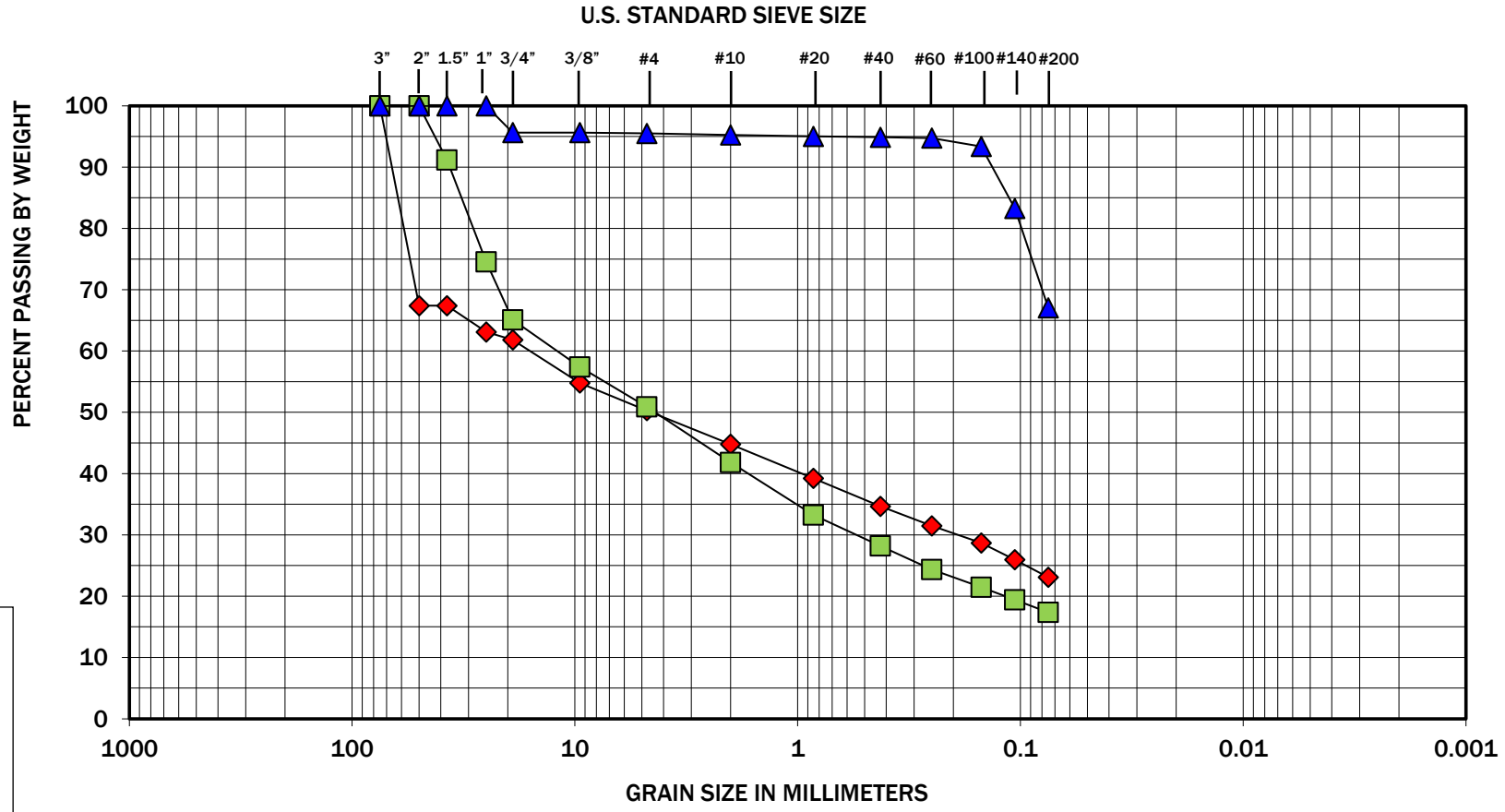
Nisqually State Park, MRP Plant and Sewer Line
Pierce County, Washington

GeoEngineers

Figure A-14

AASHTO ACCREDITED

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	WW-3	3	7	Silty gravel with sand (GM)
■	WW-3	8	4	Silty gravel with sand (GM)
▲	WW-3	20	33	Sandy silt (ML)

Sieve Analysis Results

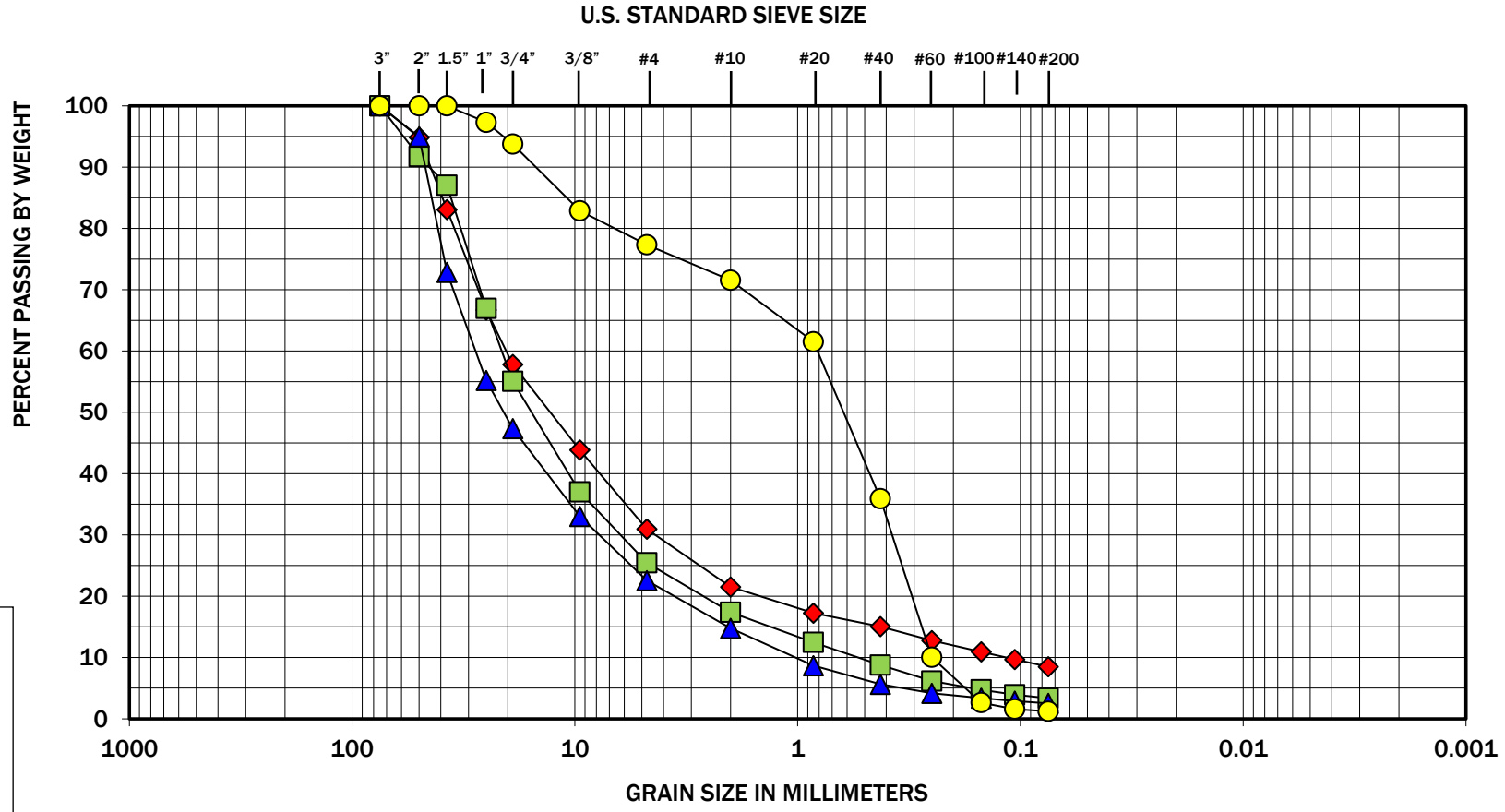
Nisqually State Park, MRP Plant and Sewer Line
Pierce County, Washington

GeoEngineers

Figure A-15

AASHTO ACCREDITED

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	SWP-1	2	5	Poorly graded gravel with silt and sand (GP-GM)
■	SWP-2	5.5	3	Poorly graded gravel with sand (GP)
▲	SWP-3	4	3	Well-graded gravel with sand (GW)
●	SWP-6	5.5	5	Poorly graded sand with gravel (SP)

Sieve Analysis Results

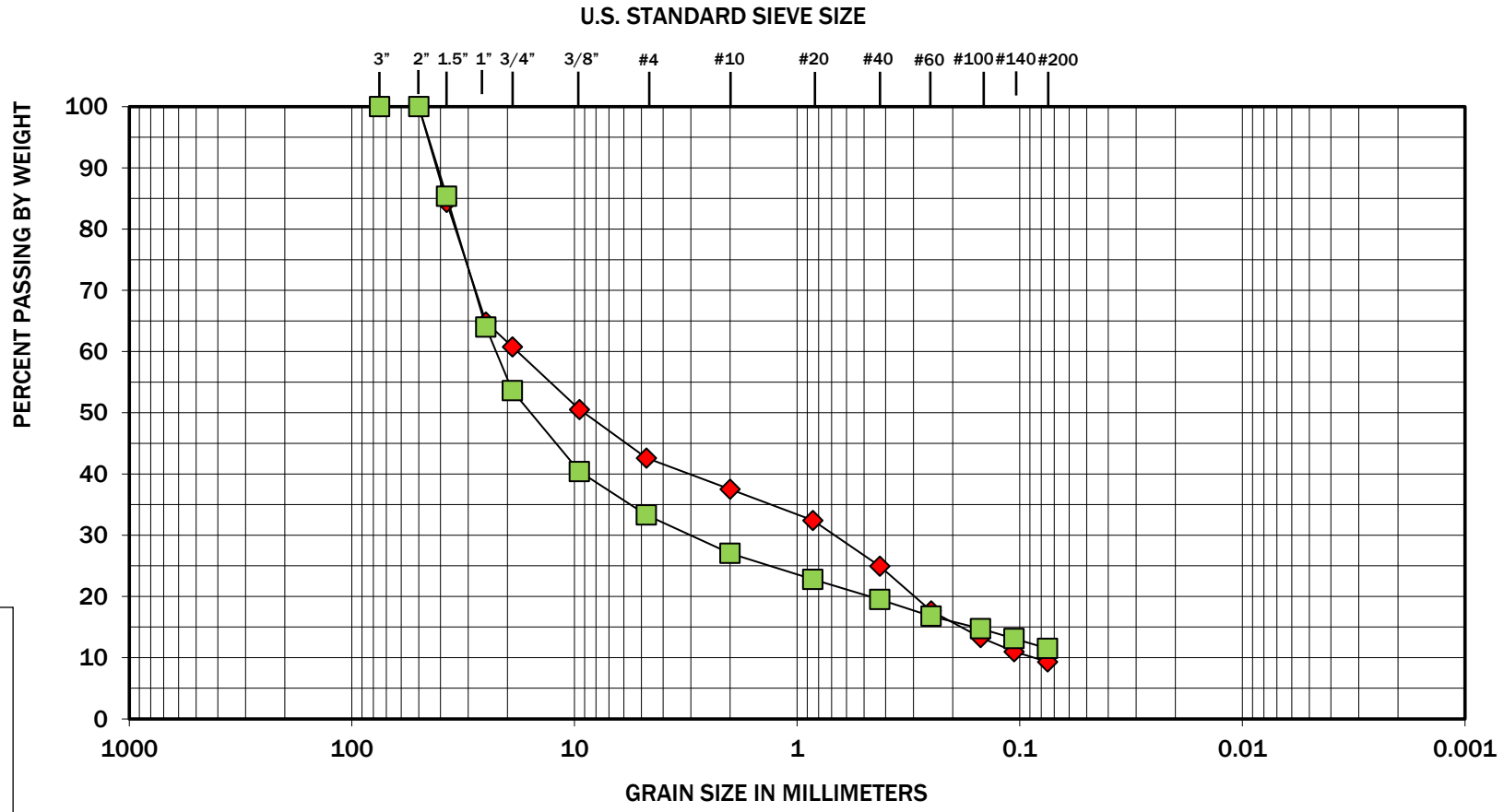
Nisqually State Park, MRP Plant and Sewer Line
Pierce County, Washington

GeoEngineers

Figure A-16

AASHTO ACCREDITED

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	SWP-7	2	5	Poorly graded gravel with silt and sand (GP-GM)
■	SWP-8	1.5	6	Poorly graded gravel with silt and sand (GP-GM)

GeoEngineers

Figure A-17

Nisqually State Park, MRP Plant and Sewer Line
Pierce County, Washington

Sieve Analysis Results

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The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

APPENDIX B
Proposed Maintenance Building and Drainage Basin 2 Test Pit Logs

Date Excavated	12/1/2020	Total Depth (ft)	10	Logged By SLG Checked By SWH	Excavator Kelly's Excavating Equipment Takeuchi TB138	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) Vertical Datum	662	Easting (X) Northing (Y)	1179575.94 560428.88	Coordinate System Horizontal Datum		

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
661	1				TS	Vegetation/topsoil (loose, dry to moist)			
					GP	Brown gravel with sand, cobbles and occasional boulders (medium dense, moist)			Numerous cobbles and occasional boulders encountered from 1 to 9 feet bgs
660	2		1 SA				5	5	
659	3								
658	4				GM	Gray silty gravel with sand (medium dense, moist to wet) (outwash)			
657	5		2						
656	6								
655	7								
654	8								
653	9		3 SA				18	17	Minor to moderate groundwater seepage observed at 9 feet bgs
652	10								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

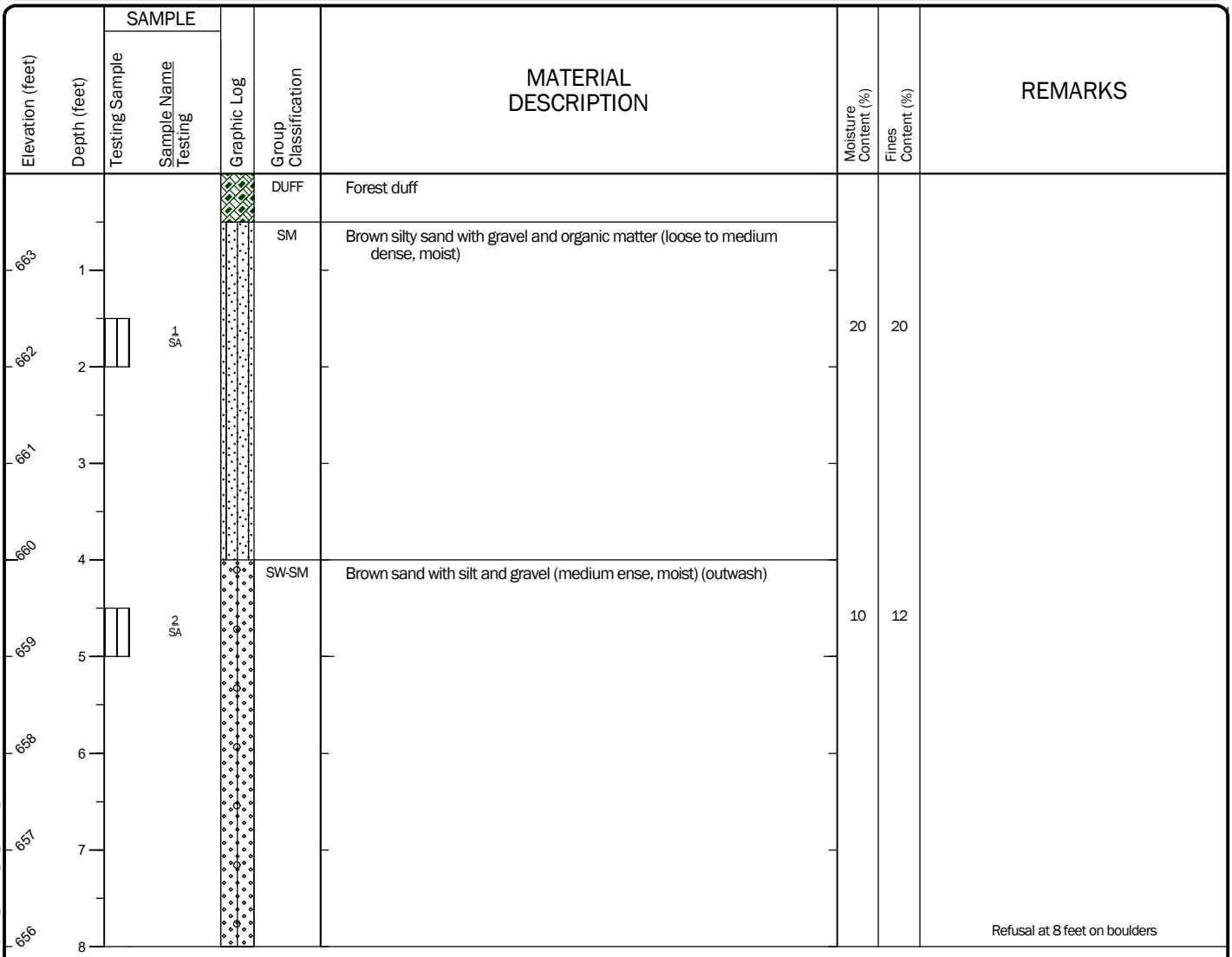
Log of Test Pit TH-1A

GeoEngineers

Project: Proposed Maintenance Facility Nisqually State Park
Project Location: Pierce County, Washington
Project Number: 2935-067-00

Figure A-2
Sheet 1 of 1

Date Excavated 12/1/2020	Total Depth (ft) 8	Logged By SLG Checked By SWH	Excavator Kelly's Excavating Equipment Takeuchi TB138	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum 664		Easting (X) 1179565.89 Northing (Y) 560254.63		Coordinate System Horizontal Datum



Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

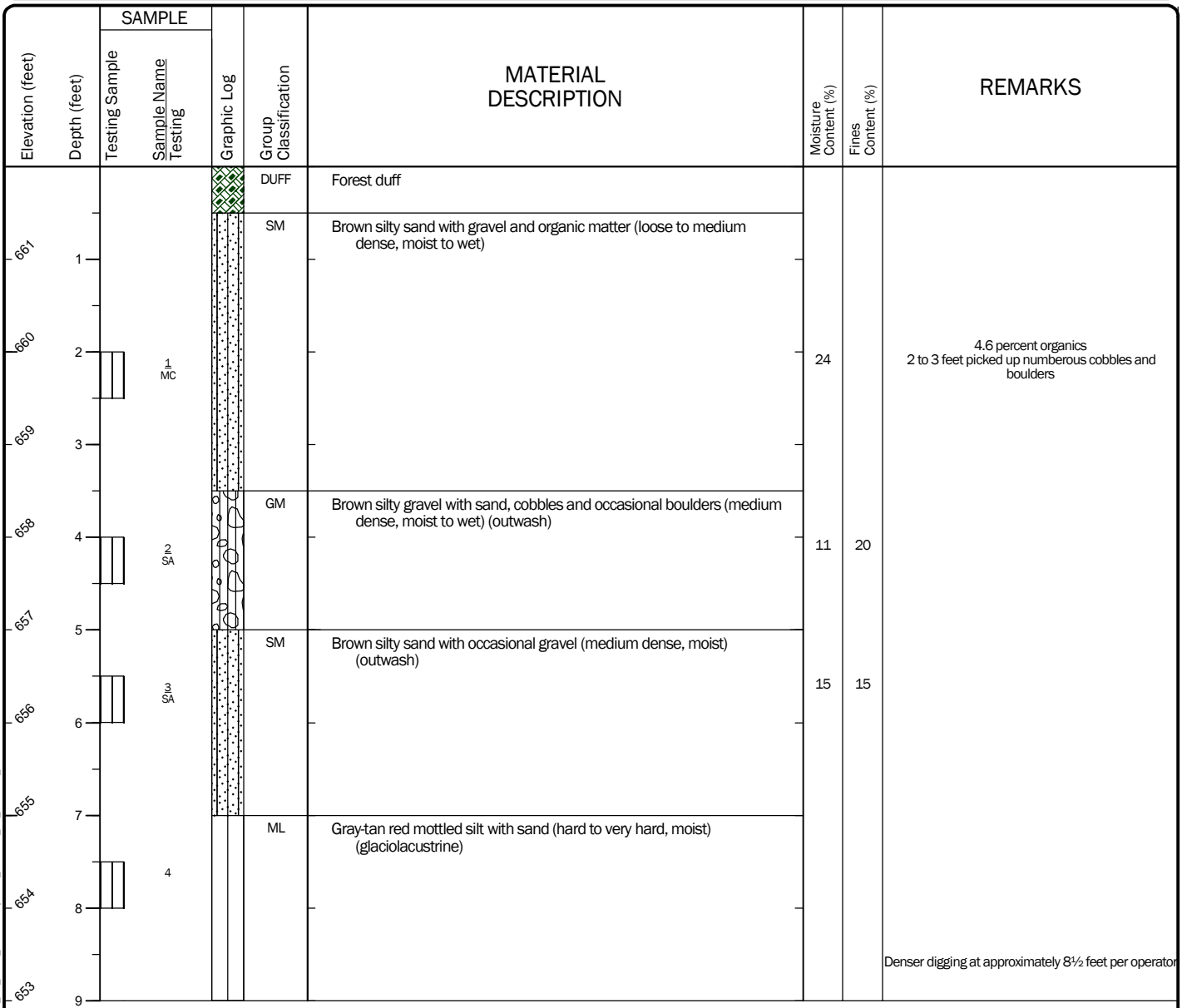
Log of Test Pit TH-1B

GeoEngineers

Project: Proposed Maintenance Facility Nisqually State Park
Project Location: Pierce County, Washington
Project Number: 2935-067-00

Figure A-3
Sheet 1 of 1

Date Excavated	12/1/2020	Total Depth (ft)	9	Logged By SLG Checked By SWH	Excavator Kelly's Excavating Equipment Takeuchi TB138	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	662	Easting (X) Northing (Y)	1179837.3 560445.85	Coordinate System Horizontal Datum		



Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TH-1C

GeoEngineers

Project: Proposed Maintenance Facility Nisqually State Park
Project Location: Pierce County, Washington
Project Number: 2935-067-00

Figure A-4
Sheet 1 of 1

Date Excavated 7/6/2021	Total Depth (ft) 10.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Komatsu PC 120	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum Undetermined		Latitude 46.85941745 Longitude -122.33712285	Coordinate System Horizontal Datum	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	6 inches of forest duff			
	1				GP-GM	Brown fine to coarse gravel with silt and sand and occasional cobbles (medium dense, moist) (outwash)			
	2								
	3		1			Grades to dense			
	4		2 SA				4	8	
	5				SP	Gray fine to medium sand with gravel and trace silt (loose, moist) (outwash)			
	6		3 SA				16	4	Severe caving from 6 to 10½ feet
	7								
	8								
	9				GP	Gray fine to coarse gravel with sand, cobbles and occasional boulders (loose, moist) (outwash)			
	10		4						

Notes: See Figure 3 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit Area 1-1 (PIT-1)

GeoEngineers

Project: Nisqually State Park Wastewater Treatment Plant
Project Location: Eatonville, Washington
Project Number: 2935-067-01

Figure 4
Sheet 1 of 1

Date Excavated 7/6/2021	Total Depth (ft) 9.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Komatsu PC 120	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum Undetermined		Latitude 46.85960561 Longitude -122.33680785		Coordinate System Horizontal Datum

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	12 inches of forest duff			
	1				GP-GM	Brown fine to coarse gravel with silt, sand and cobbles (loose, moist) (outwash)			
	2		1						Severe caving from 2 to 9½ feet
	3								
	4				GW	Brown-gray fine to coarse gravel with sand and trace silt (loose, moist) (outwash)			
	5		2 SA				2	4	
	6								
	7					Grades to with occasional boulders			
	8								
	9		3						

Notes: See Figure 3 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

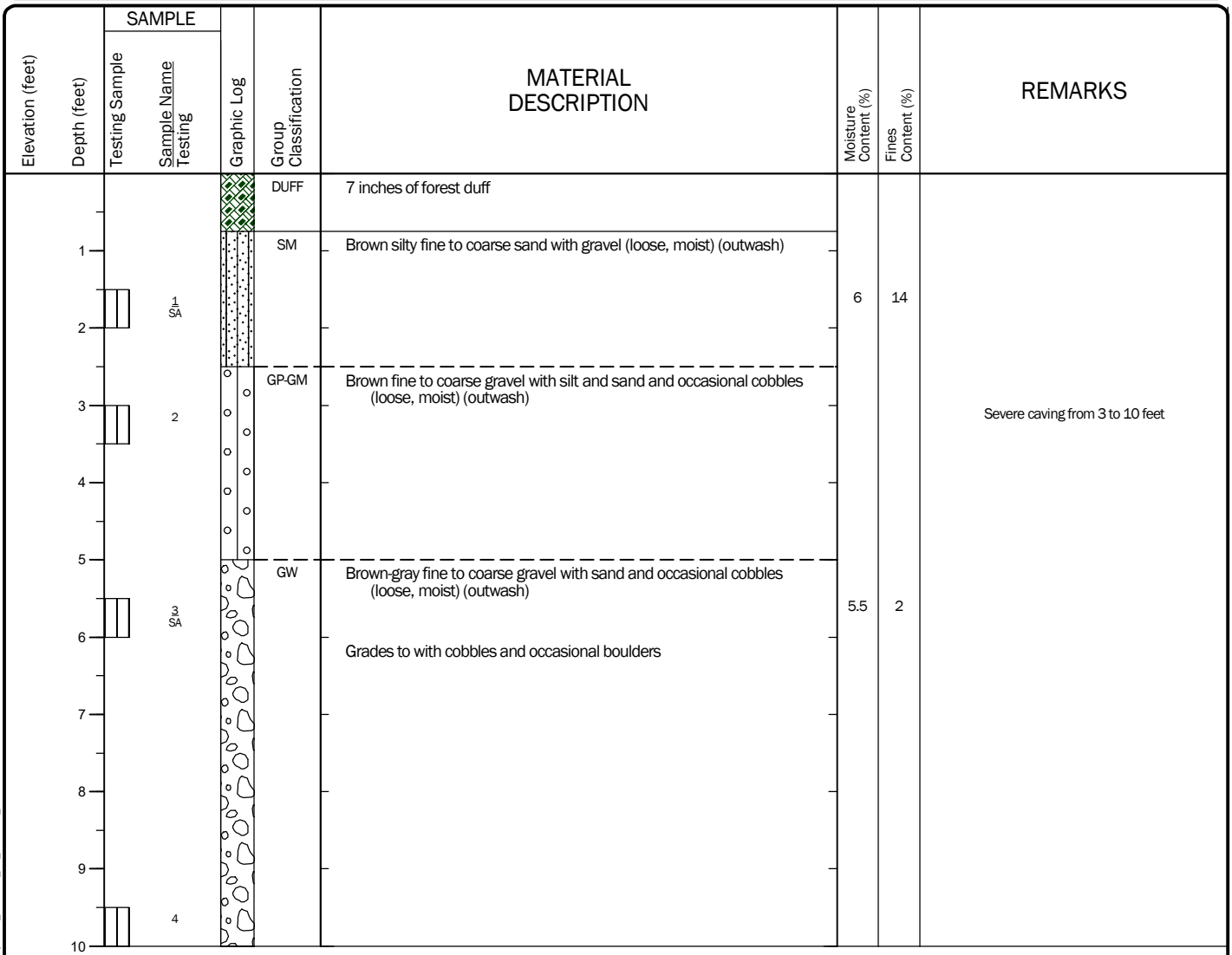
Log of Test Pit Area 1-2

GeoEngineers

Project: Nisqually State Park Wastewater Treatment Plant
Project Location: Eatonville, Washington
Project Number: 2935-067-01

Figure 5
Sheet 1 of 1

Date Excavated 7/7/2021	Total Depth (ft) 10	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Komatsu PC 120	Groundwater not observed See "Remarks" section for caving observed
Surface Elevation (ft) Vertical Datum Undetermined		Latitude 46.85968707 Longitude -122.33655649	Coordinate System Horizontal Datum	



Notes: See Figure 3 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit Area 1-3 (PIT-2)

GeoEngineers

Project: Nisqually State Park Wastewater Treatment Plant
Project Location: Eatonville, Washington
Project Number: 2935-067-01

Figure 6
Sheet 1 of 1

Date Excavated	7/8/2021	Total Depth (ft)	5.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Komatsu PC 120	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum	Undetermined			Latitude 46.85738345 Longitude -122.34102403	Coordinate System Horizontal Datum	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	6 inches of forest duff			
					SM	Light gray silty fine to medium sand with gravel and cobbles (dense to very dense, moist) (glacial till)			
	1								
	2		1						
	3					Grades to gray with occasional iron-oxide staining			
	4		2						
	5		3			Grades to no iron-oxide staining, with occasional boulders			

Notes: See Figure 3 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit Area 2-1

GeoEngineers

Project: Nisqually State Park Wastewater Treatment Plant
Project Location: Eatonville, Washington
Project Number: 2935-067-01

Figure 7
Sheet 1 of 1

Date Excavated 7/8/2021	Total Depth (ft) 5.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum Undetermined		Latitude 46.85698547 Longitude -122.341330049		Coordinate System Horizontal Datum

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	6 inches of forest duff			
	1				SM	Light brown-gray silty fine to medium sand with gravel and cobbles (dense, moist) (weathered till)			
	2								
	3		1 SA				11	47	
	4				SM	Gray with occasional iron-oxide staining silty fine to medium sand with gravel and cobbles (very dense, moist) (glacial till?)			
	5		2			Grades to no iron-oxide staining			

Notes: See Figure 3 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit Area 2-2

GeoEngineers

Project: Nisqually State Park Wastewater Treatment Plant
Project Location: Eatonville, Washington
Project Number: 2935-067-01

Figure 8
Sheet 1 of 1

Date Excavated 7/8/2021	Total Depth (ft) 5.5	Logged By CJL Checked By SWH	Excavator Kelly's Excavting, Inc. Equipment Takeuchi TB 138 Mini Excavator	Groundwater not observed Caving not observed
Surface Elevation (ft) Vertical Datum Undetermined		Latitude 46.85688087 Longitude -122.34151531	Coordinate System Horizontal Datum	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					DUFF	6 inches of forest duff			
	1				SM	Light brown-gray silty fine to medium sand with gravel and cobbles (dense, moist) (weathered till)			
	2		1 SA				9	42	
	3					Grades to with occasional boulders			
					SM	Gray with occasional iron-oxide staining silty fine to medium sand with gravel, cobbles and occasional boulders (very dense, moist) (glacial till)			
	4					Grades to no iron-oxide staining			
	5		2						

Notes: See Figure 3 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit Area 2-3

GeoEngineers

Project: Nisqually State Park Wastewater Treatment Plant
Project Location: Eatonville, Washington
Project Number: 2935-067-01

Figure 9
Sheet 1 of 1

APPENDIX C
Report Limitations and Guidelines for Use

APPENDIX C
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services Are Performed For Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of Robert W. Droll, Landscape Architects and their authorized agents. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or Geologic Report is Based on a Unique Set of Project-Specific Factors

This report has been prepared for the planned Wastewater Treatment Plant and Sewer Line improvements at Nisqually State Park in Pierce County, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

---

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

Most Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design

drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical, Geologic and Environmental Reports Should Not be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention, or assessment of the presence of Biological Pollutants in or around any structure. Accordingly, this report includes no interpretations, recommendations, findings, or conclusions for the purpose of detecting, preventing, assessing, or abating Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts. If Client desires these specialized services, they should be obtained from a consultant who offers services in this specialized field.

GeoEngineers

EARTHWORK SERVICES, INC.
PO Box 640
1116 1st St.
Cosmopolis, WA 98537
Phone: (360) 533-2007 Fax: (360) 533-1618
Email: earthwork@earthworkservices.com
Web: www.earthworkservices.com

February 6, 2025 Earthwork Services Job# 47722

Jonah Hayes
RWD Landscape Architects
4405 7th Ave. SE, Ste. 203
Lacey, WA 98503

RE: Nisqually State Park PH3A

Dear Jonah,

Enclosed please find grid elevation, cut/fill graphics, and volumes for this project, which was calculated using the average end area method and the following assumptions:

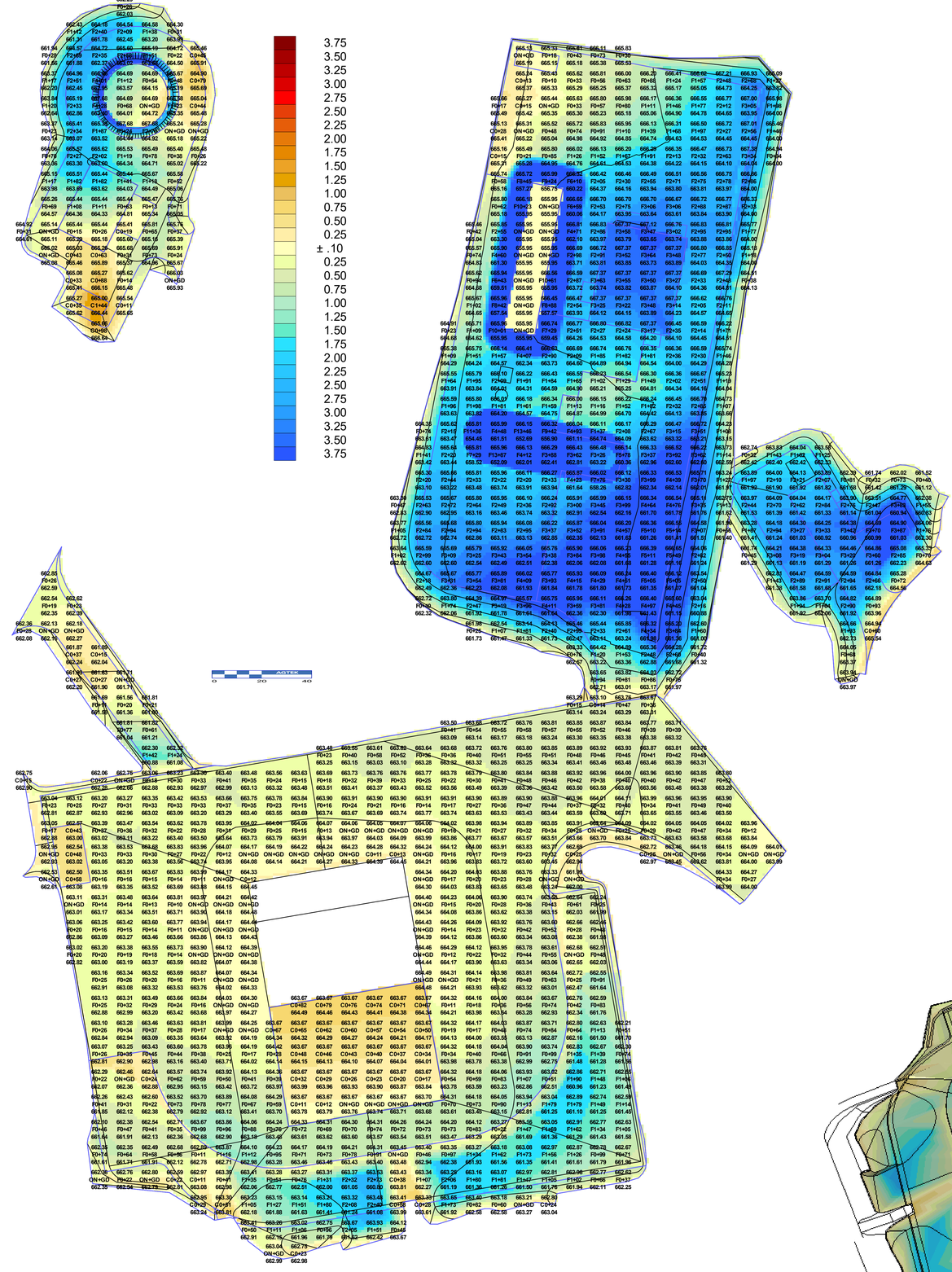
1. **No stripping was applied to the existing PH2A.**
2. A **stripping** depth of **6"** was applied to the **rest of site.**
3. A depth of **10"** from design elevations to subgrade in the **WWTF concrete B** and **trail.**
4. A depth of **8"** from design elevations to subgrade in the **Host, Maintenance, & Pump concrete A.**
5. A depth of **9"** from design elevations to subgrade in the **HMA B.**
6. A depth of **6"** from design elevations to subgrade in the **HMA A.**
7. A depth of **0"** from design elevations to subgrade in the **Maintenance paving overlay** and **Pump crushed base.**
8. A depth of **4"** from design elevations to subgrade in the **Host, Maintenance, & Pump crushed rock** and **WWTF gravel.**
9. A depth of **3"** from design elevations to subgrade in the **landscaping.**
10. A depth of **21"** from design elevations to subgrade in the **Pump reservoir.**
11. A depth of **27"** from design elevations to subgrade in the **WWTF MBR tank.**
12. A depth of **10"** from finish floor elevations to subgrade in the **Maintenance, Pump, & WWTF buildings.**
13. **Of your total fill of 4,276cy listed below, 358cy fall within your equalization tank backfill.**
14. **Of your total fill of 4,276cy listed below, 432cy fall within your MBR tank backfill.**

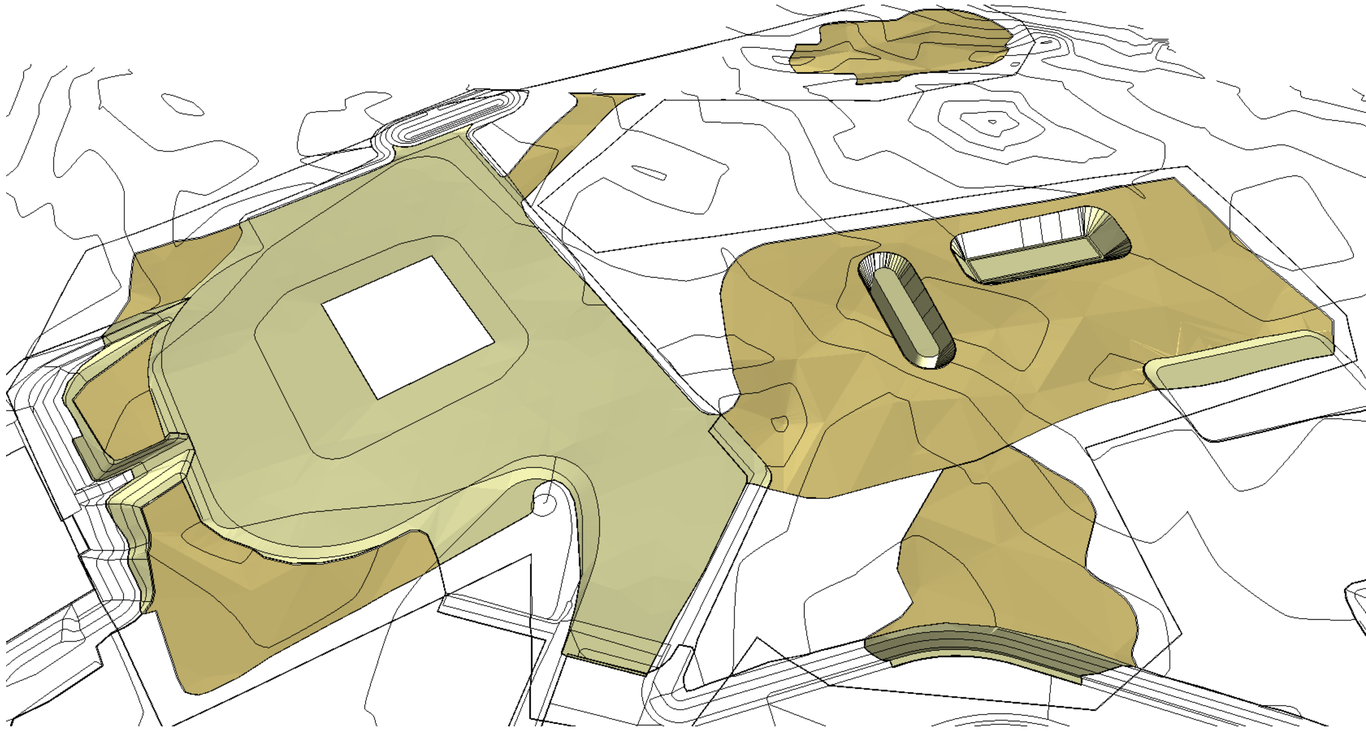
TOTAL RAW VOLUMES IN PLACE
(Volumes are in Cubic Yards)

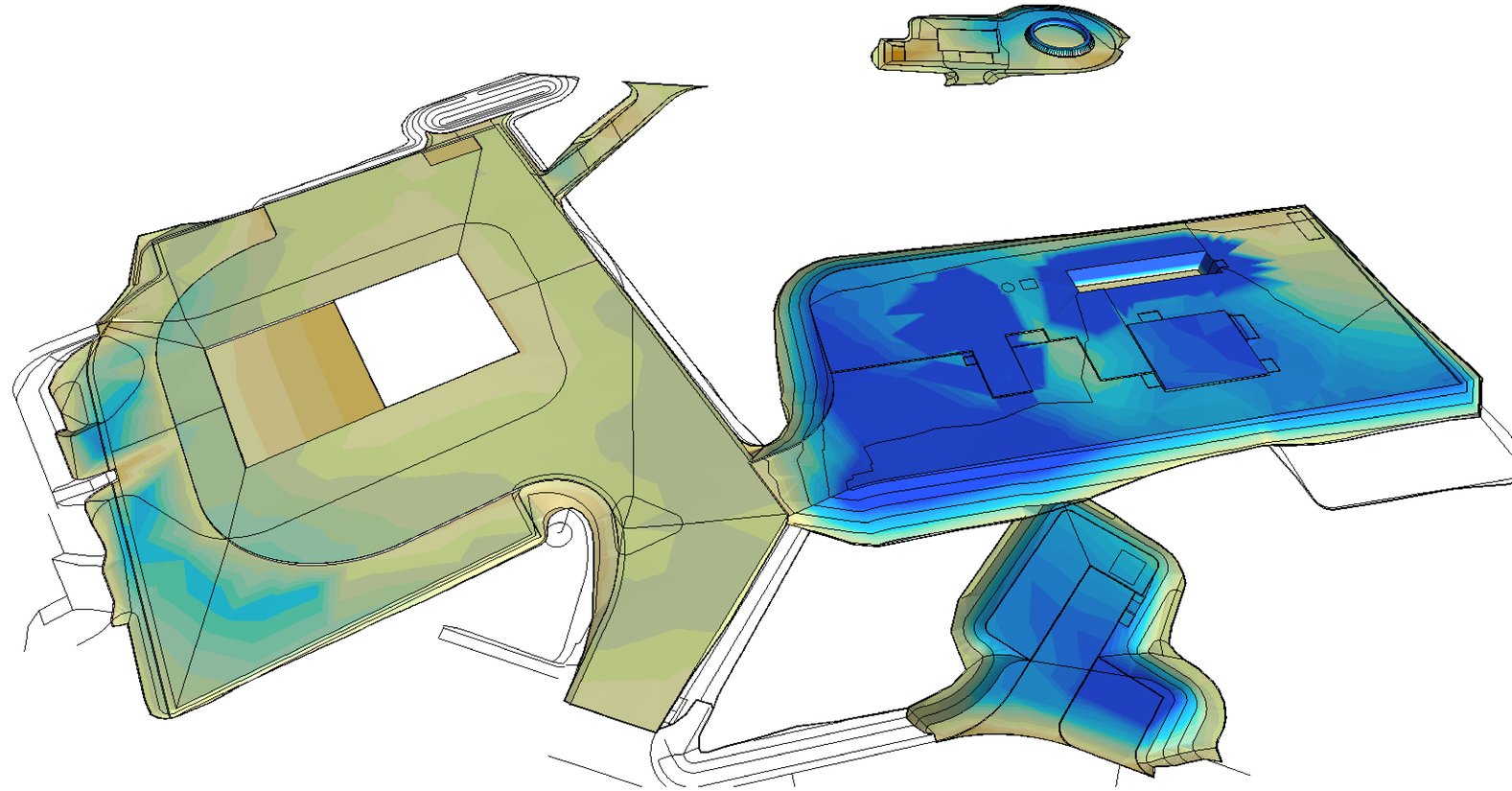
Activity	Area (ft^2)	Cut Volume	Fill Volume	Strip Volume
Schedule A	56,168	102	1.313	360
Schedule B	37,433	1,059	2,963	664
TOTAL SITE		**1,161**	**4,276**	**1,024**

Please call after you have reviewed this information if you have any questions.

* Raw volumes are calculated after existing terrain has been stripped, thus creating less cut and more fill of suitable material. Raw volumes have not been adjusted to reflect shrink or swell for compaction and expansion and are volumetric areas only.







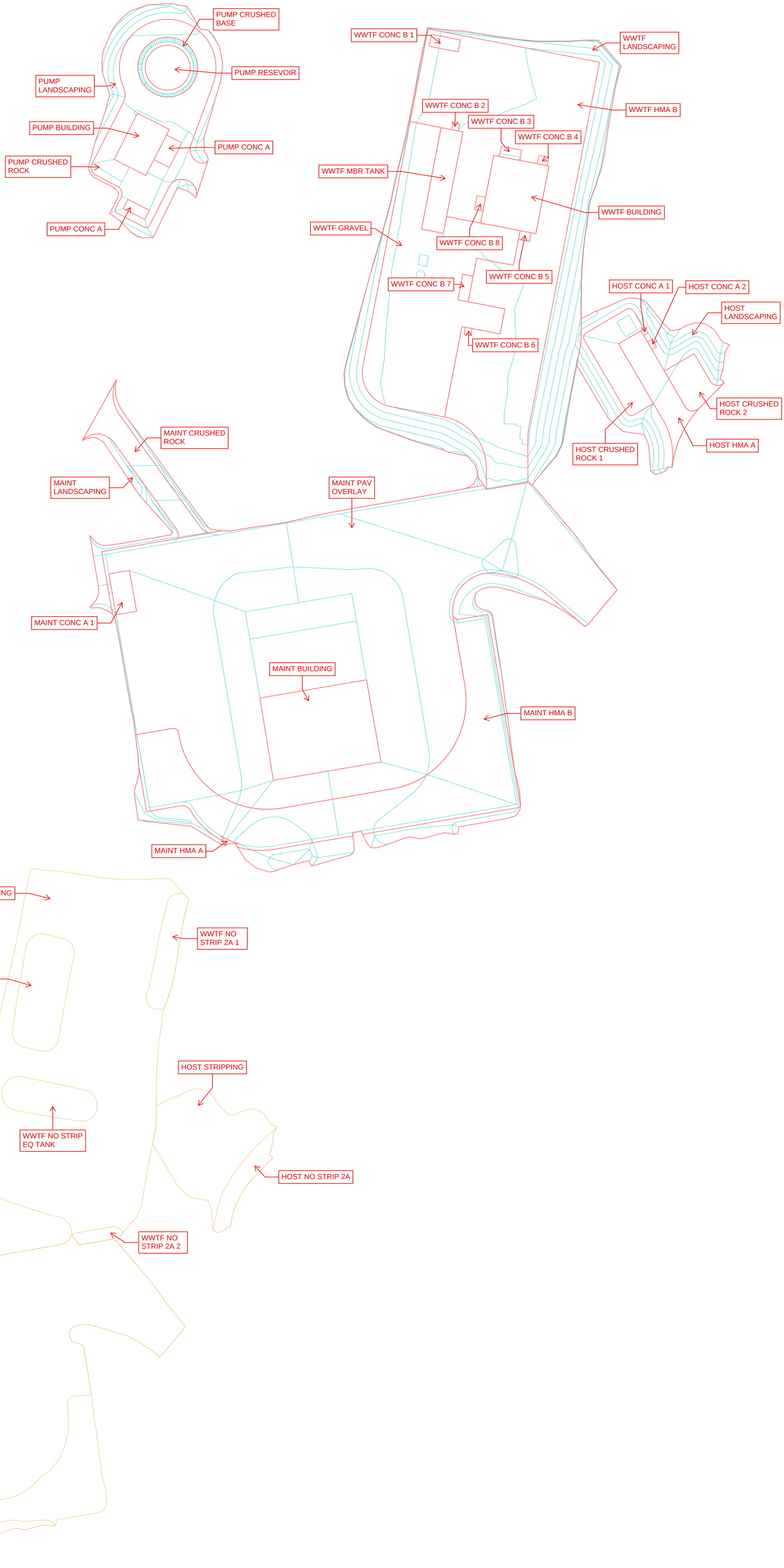
EARTHWORK SERVICES, INC.

Earthwork Take-Off Specialists

PO Box 640
1116 1st St.
Cosmopolis, WA 98537

360-533-2007
360-533-1618 Fax

earthwork@earthworkservices.com
www.earthworkservices.com


PUMP CRUSHED BASE
PUMP RESEVOIR
PUMP LANDSCAPING
PUMP BUILDING
PUMP CONC A
PUMP CRUSHED ROCK
PUMP CONC A
WWTF CONC B 1
WWTF LANDSCAPING
WWTF CONC B 2
WWTF HMA B
WWTF CONC B 3
WWTF CONC B 4
WWTF MBR TANK
WWTF BUILDING
WWTF GRAVEL
WWTF CONC B 8
WWTF CONC B 5
WWTF CONC B 7
HOST CONC A 1
HOST CONC A 2
HOST LANDSCAPING
WWTF CONC B 6
HOST CRUSHED ROCK 2
HOST CRUSHED ROCK 1
HOST HMA A
MAINT CRUSHED ROCK
MAINT LANDSCAPING
MAINT PAV OVERLAY
MAINT CONC A 1
MAINT BUILDING
MAINT HMA B
MAINT HMA A
PUMP STRIPPING
WWTF STRIPPING
WWTF NO STRIP 2A 1
WWTF NO STRIP MBR
HOST STRIPPING
WWTF NO STRIP EQ TANK
HOST NO STRIP 2A
MAINT STRIPPING 1
WWTF NO STRIP 2A 2
MAINT NO STRIP 2A
MAINT STRIPPING 2

Volume Report
Subgrade vs. Stripped

Name	Total	Area Cut	Area Fill	OnGrade	Volume Cut	Volume Fill	Comp/Ratio Cut	Comp/Ratio Fill	Compact Cut	Compact Fill	Export -Import	Change Per 0.1 ft
HOST CONC A 1	9	0	9	0	0	1	1.00	1.00	0	1	-1	**0**
HOST CONC A 2	15	0	15	0	0	1	1.00	1.00	0	1	-1	**0**
HOST CRUSHED ROCK 1	1,129	0	1,129	0	0	109	1.00	1.00	0	109	-109	**4**
HOST CRUSHED ROCK 2	558	53	499	6	1	53	1.00	1.00	1	53	-52	**2**
HOST HMA A	979	83	883	13	2	89	1.00	1.00	2	89	-87	**4**
HOST LANDSCAPING	2,529	66	2,420	43	0	136	1.00	1.00	0	136	-136	**9**
HOST Sub:	**5,219**	**202**	**4,955**	**62**	**3**	**389**			**3**	**389**	**-386**	**19**
MAINT BUILDING	3,045	2,653	0	392	47	0	1.00	1.00	47	0	47	**11**
MAINT CONC A 1	288	288	0	0	5	0	1.00	1.00	5	0	5	**1**
MAINT CRUSHED ROCK	1,215	306	656	253	3	13	1.00	1.00	3	13	-10	**5**
MAINT HMA A	16	16	0	0	0	0	1.00	1.00	0	0	0	**0**
MAINT HMA B	8,069	634	6,923	512	8	267	1.00	1.00	8	267	-259	**30**
MAINT LANDSCAPING	3,592	844	1,902	846	8	50	1.00	1.00	8	50	-42	**13**
MAINT PAV OVERLAY	27,485	199	23,363	3,923	3	348	1.00	1.00	3	348	-345	**102**
MAINT Sub:	**43,710**	**4,940**	**32,844**	**5,926**	**74**	**678**			**74**	**678**	**-604**	**162**
PUMP BUILDING	620	39	528	53	0	20	1.00	1.00	0	20	-20	**2**
PUMP CONC A	160	22	77	61	0	1	1.00	1.00	0	1	-1	**1**
PUMP CONC A	84	84	0	0	4	0	1.00	1.00	4	0	4	**0**
PUMP CRUSHED BASE	410	0	407	3	0	44	1.00	1.00	0	44	-44	**2**
PUMP CRUSHED ROCK	3,557	880	2,391	286	17	112	1.00	1.00	17	112	-95	**13**
PUMP LANDSCAPING	1,878	193	1,540	145	3	57	1.00	1.00	3	57	-54	**7**
PUMP RESEVOIR	530	84	407	39	1	12	1.00	1.00	1	12	-11	**2**
PUMP Sub:	**7,239**	**1,302**	**5,350**	**587**	**25**	**246**			**25**	**246**	**-221**	**27**
WWTF BUILDING	1,301	0	1,301	0	0	164	1.00	1.00	0	164	-164	**5**
WWTF CONC B 1	120	15	31	74	0	0	1.00	1.00	0	0	0	**0**
WWTF CONC B 2	16	0	16	0	0	6	1.00	1.00	0	6	-6	**0**
WWTF CONC B 3	72	0	72	0	0	9	1.00	1.00	0	9	-9	**0**
WWTF CONC B 4	29	0	29	0	0	3	1.00	1.00	0	3	-3	**0**
WWTF CONC B 5	33	0	33	0	0	2	1.00	1.00	0	2	-2	**0**
WWTF CONC B 6	16	0	16	0	0	3	1.00	1.00	0	3	-3	**0**
WWTF CONC B 7	92	0	92	0	0	8	1.00	1.00	0	8	-8	**0**
WWTF CONC B 8	40	0	40	0	0	4	1.00	1.00	0	4	-4	**0**
WWTF GRAVEL	7,367	0	7,367	0	0	988	1.00	1.00	0	988	-988	**27**
WWTF HMA B	13,124	357	12,350	417	4	1,273	1.00	1.00	4	1,273	-1,269	**49**
WWTF LANDSCAPING	6,449	28	6,384	37	0	467	1.00	1.00	0	467	-467	**24**
WWTF MBR TANK	771	0	6	765	0	0	1.00	1.00	0	0	0	**3**
WWTF Sub:	**29,430**	**400**	**27,737**	**1,293**	**4**	**2,927**			**4**	**2,927**	**-2,923**	**108**
Regions Total	**85,598**	**6,844**	**70,886**	**7,868**	**106**	**4,240**			**106**	**4,240**	**-4,134**	**316**

Stripping Qtys	Plane Area	Slope Area	Depth	Volume
HOST NO STRIP 2A	917	967	0.000	0
HOST STRIPPING	4,302	4,312	0.500	80
HOST Sub:	**5,219**	**5,279**		**80**
MAINT NO STRIP 2A	35,827	35,956	0.000	0
MAINT STRIPPING 1	6,710	6,715	0.500	124
MAINT STRIPPING 2	1,173	1,174	0.500	22
MAINT Sub:	**43,710**	**43,845**		**146**
PUMP STRIPPING	7,239	7,262	0.500	134
WWTF NO STRIP 2A 1	1,220	1,237	0.000	0
WWTF NO STRIP 2A 2	288	288	0.000	0
WWTF NO STRIP EQ TANK	1,500	1,503	0.000	0
WWTF NO STRIP MBR	2,679	3,373	0.000	0
WWTF Sub:	**5,687**	**6,401**	**0.000**	**0**

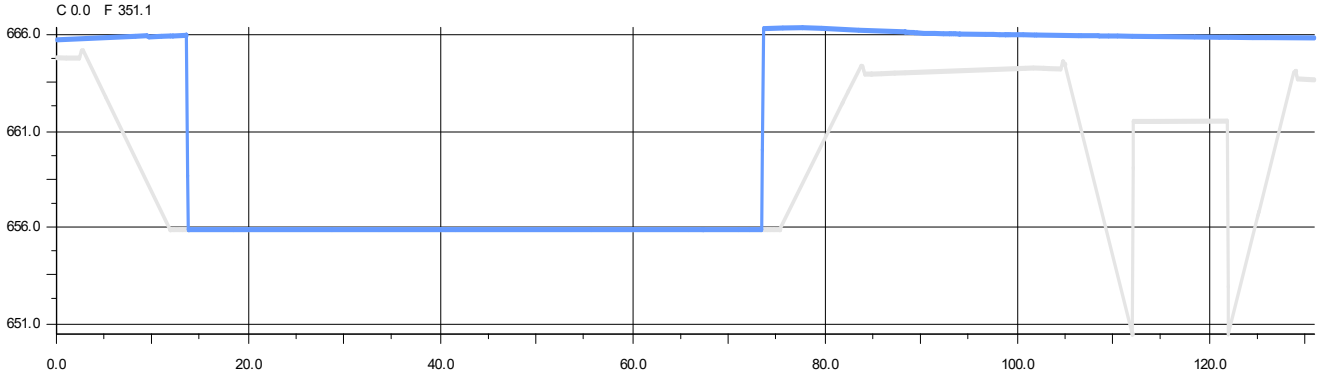
Stripping Qtys	Plane Area	Slope Area	Depth	Volume
WWTF STRIPPING	23,743	23,775	0.500	440
Total WWTF Sub:	**29,430**	**30,176**		**440**
Stripping Total	**85,598**	**86,562**		**800**

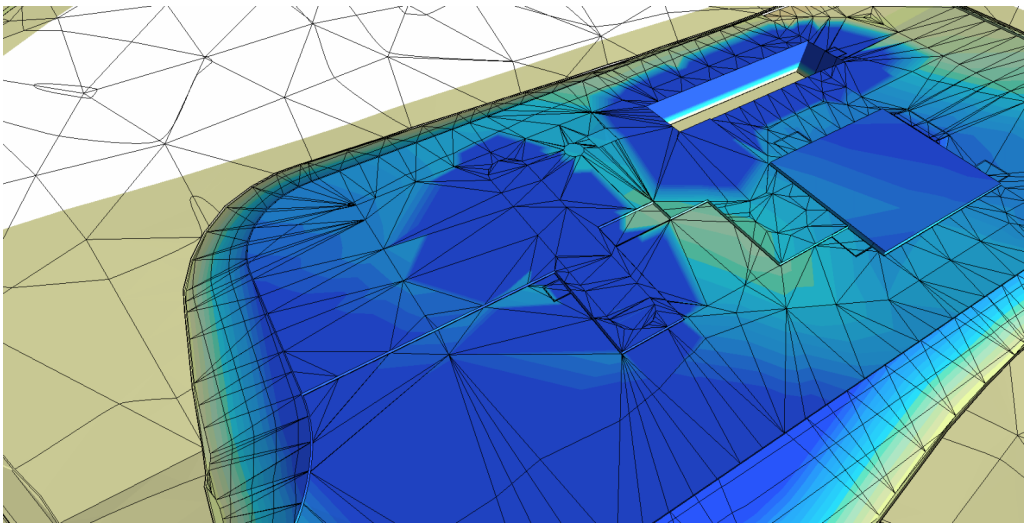
Sectional Qtys	Plane Area	Slope Area	Depth	Volume
HOST CONC A 1	9	9	0.670	0
HOST CONC A 2	15	15	0.670	0
HOST CRUSHED ROCK 1	1,129	1,129	0.330	14
HOST CRUSHED ROCK 2	558	558	0.330	7
HOST HMA A	979	979	0.500	18
HOST LANDSCAPING	2,529	2,600	0.250	24
HOST Sub:	**5,219**	**5,290**		**63**
MAINT BUILDING	3,045	3,048	0.830	94
MAINT CONC A 1	288	288	0.670	7
MAINT CRUSHED ROCK	1,215	1,216	0.330	15
MAINT HMA A	16	16	0.500	0
MAINT HMA B	8,069	8,093	0.750	225
MAINT LANDSCAPING	3,592	3,646	0.250	34
MAINT PAV OVERLAY	27,485	27,507	0.000	0
MAINT Sub:	**43,710**	**43,814**		**375**
PUMP BUILDING	620	620	0.830	19
PUMP CONC A	160	160	0.670	4
PUMP CONC A	84	84	0.670	2
PUMP CRUSHED BASE	410	507	0.000	0
PUMP CRUSHED ROCK	3,557	3,559	0.330	43
PUMP LANDSCAPING	1,878	1,923	0.250	18
PUMP RESEVOIR	530	530	1.750	34
PUMP Sub:	**7,239**	**7,383**		**120**
WWTF BUILDING	1,301	1,301	0.830	40
WWTF CONC B 1	120	120	0.830	4
WWTF CONC B 2	16	16	0.830	0
WWTF CONC B 3	72	72	0.830	2
WWTF CONC B 4	29	29	0.830	1
WWTF CONC B 5	33	33	0.830	1
WWTF CONC B 6	16	16	0.830	0
WWTF CONC B 7	92	92	0.830	3
WWTF CONC B 8	40	40	0.830	1
WWTF GRAVEL	7,367	7,368	0.330	90
WWTF HMA B	13,124	13,134	0.750	365
WWTF LANDSCAPING	6,449	6,693	0.250	62
WWTF MBR TANK	771	771	2.250	64
WWTF Sub:	**29,430**	**29,685**		**633**
Sectional Total	**85,598**	**86,172**		**1,191**

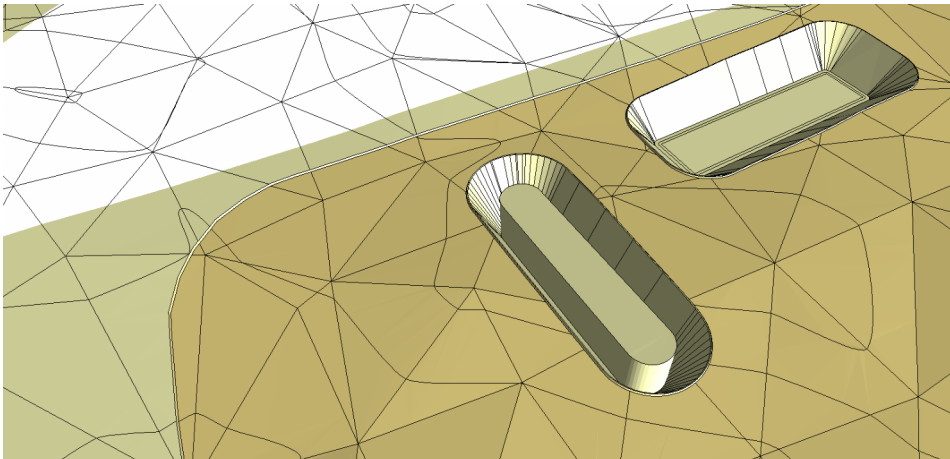
Job: NISQUALLY STATE PARK PH3A
Units: Ft-CY
Thu Feb 6, 2025 10:52:09 Page 1

Haul Report
Subgrade vs. Stripped

	Area				Volume		Fill	Haul	Average	Export
	Total	Cut	Fill	OnGrade	Cut	Fill	Factor	Distance	Slope	-Import
EQUALIZATION TANK BACKFILL	1,476	0	1,476	0	0	358	1.00	0	0.0%	-358
MBR TANK BACKFILL	2,647	2	1,878	767	0	432	1.00	0	0.0%	-432
Regions Total	**4,123**	**2**	**3,354**	**767**	**0**	**790**		**0**	**0.0%**	**-790**



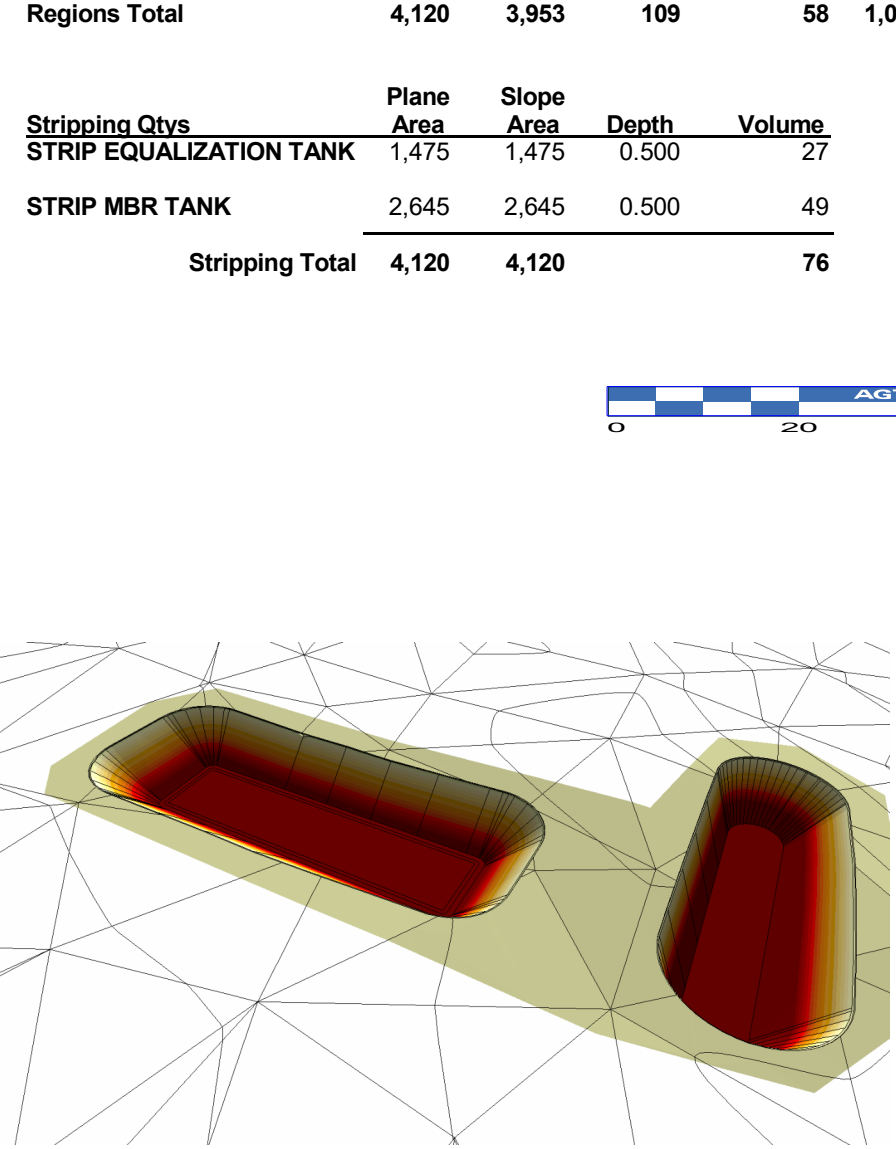


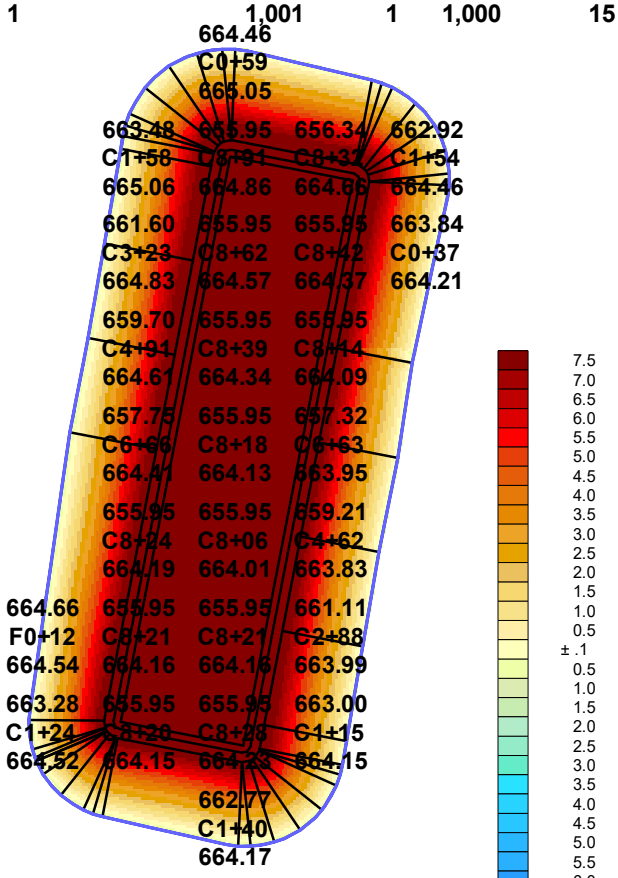


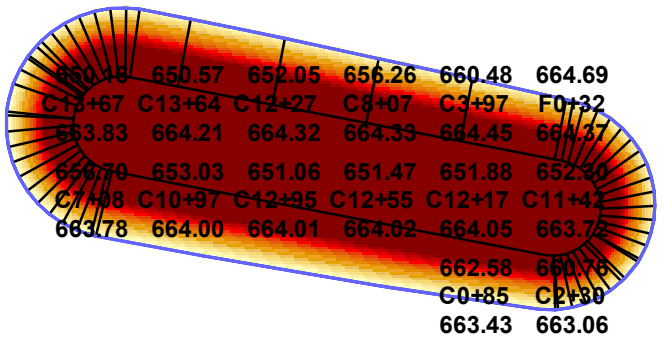
Volume Report
Design vs. Stripped

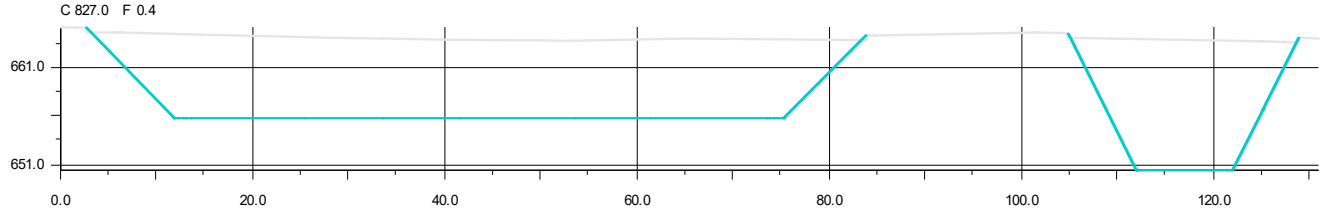
Name	Total	Cut	Area Fill	OnGrade	Volume Cut	Volume Fill	Comp/Ratio Cut	Comp/Ratio Fill	Compact Cut	Compact Fill	Export -Import	Change Per 0.1 ft
EQUALIZATION TANK	1,475	1,429	29	17	457	0	1.00	1.00	457	0	457	5
MBR TANK	2,645	2,524	80	41	544	1	1.00	1.00	544	1	543	10
Regions Total	**4,120**	**3,953**	**109**	**58**	**1,001**	**1**			**1,001**	**1**	**1,000**	**15**

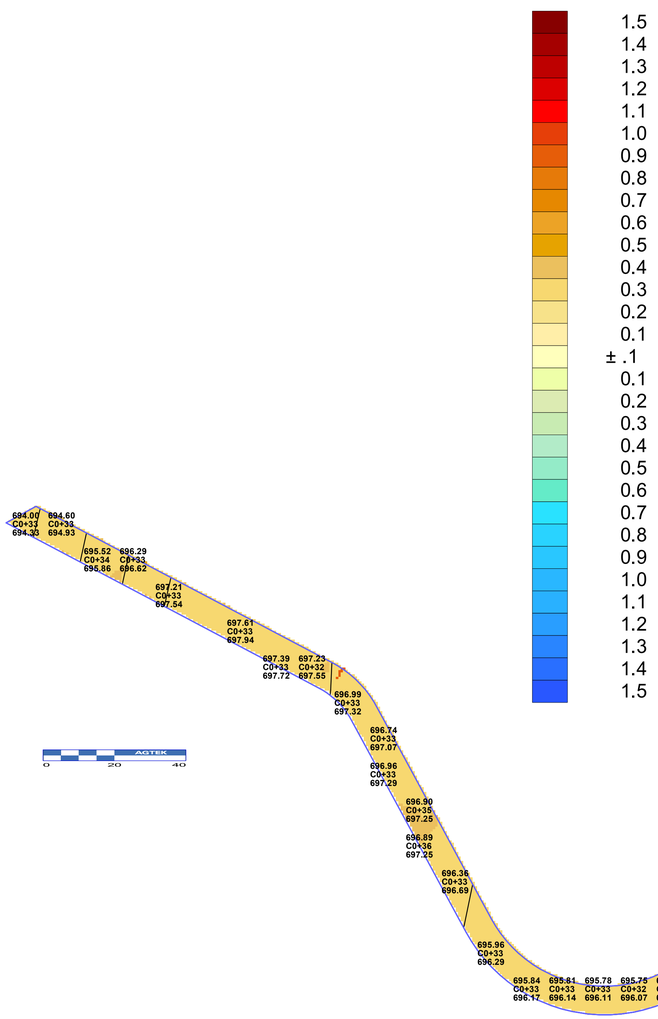
Stripping Qtys	Plane Area	Slope Area	Depth	Volume
STRIP EQUALIZATION TANK	1,475	1,475	0.500	27
STRIP MBR TANK	2,645	2,645	0.500	49
Stripping Total	**4,120**	**4,120**		**76**

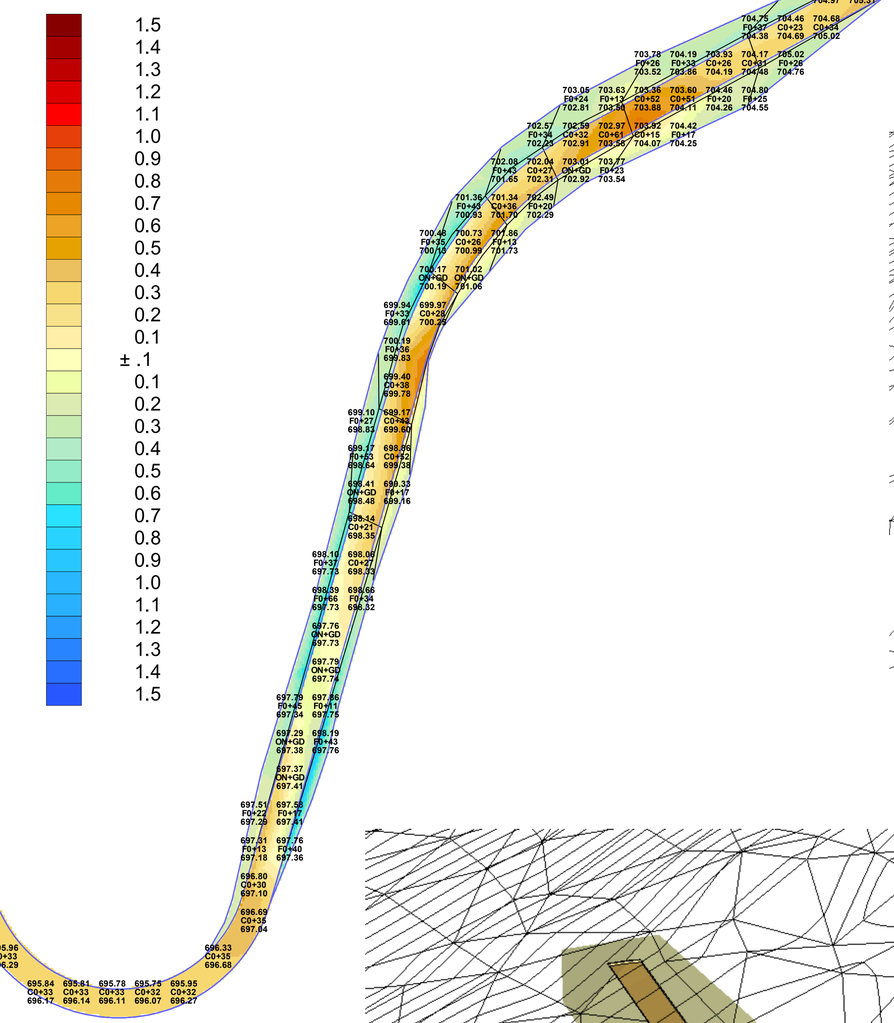


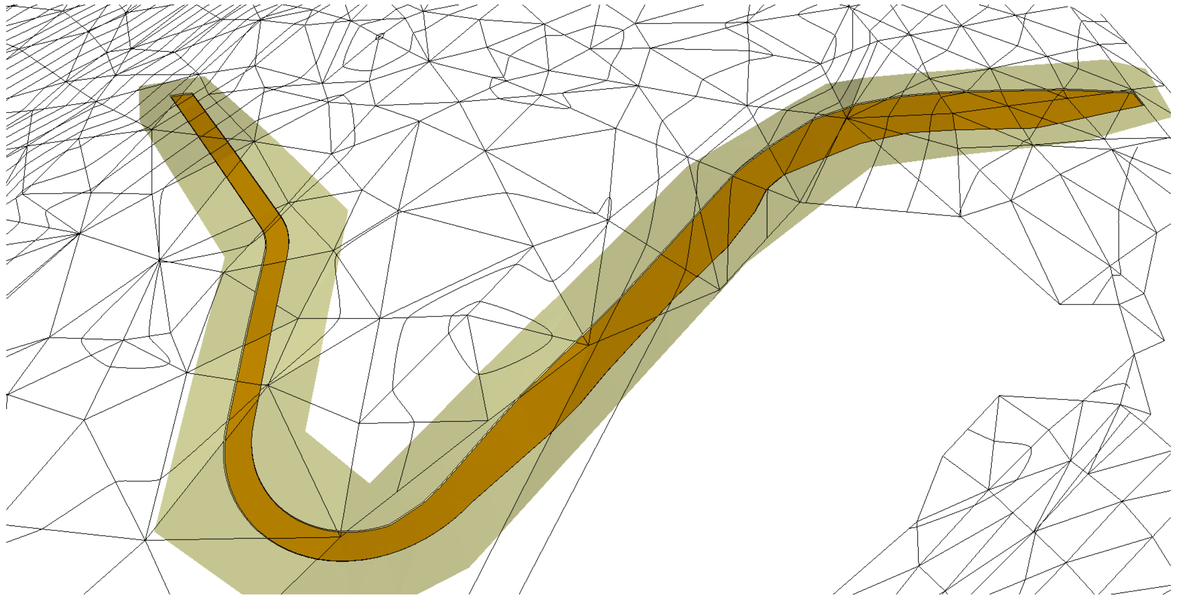


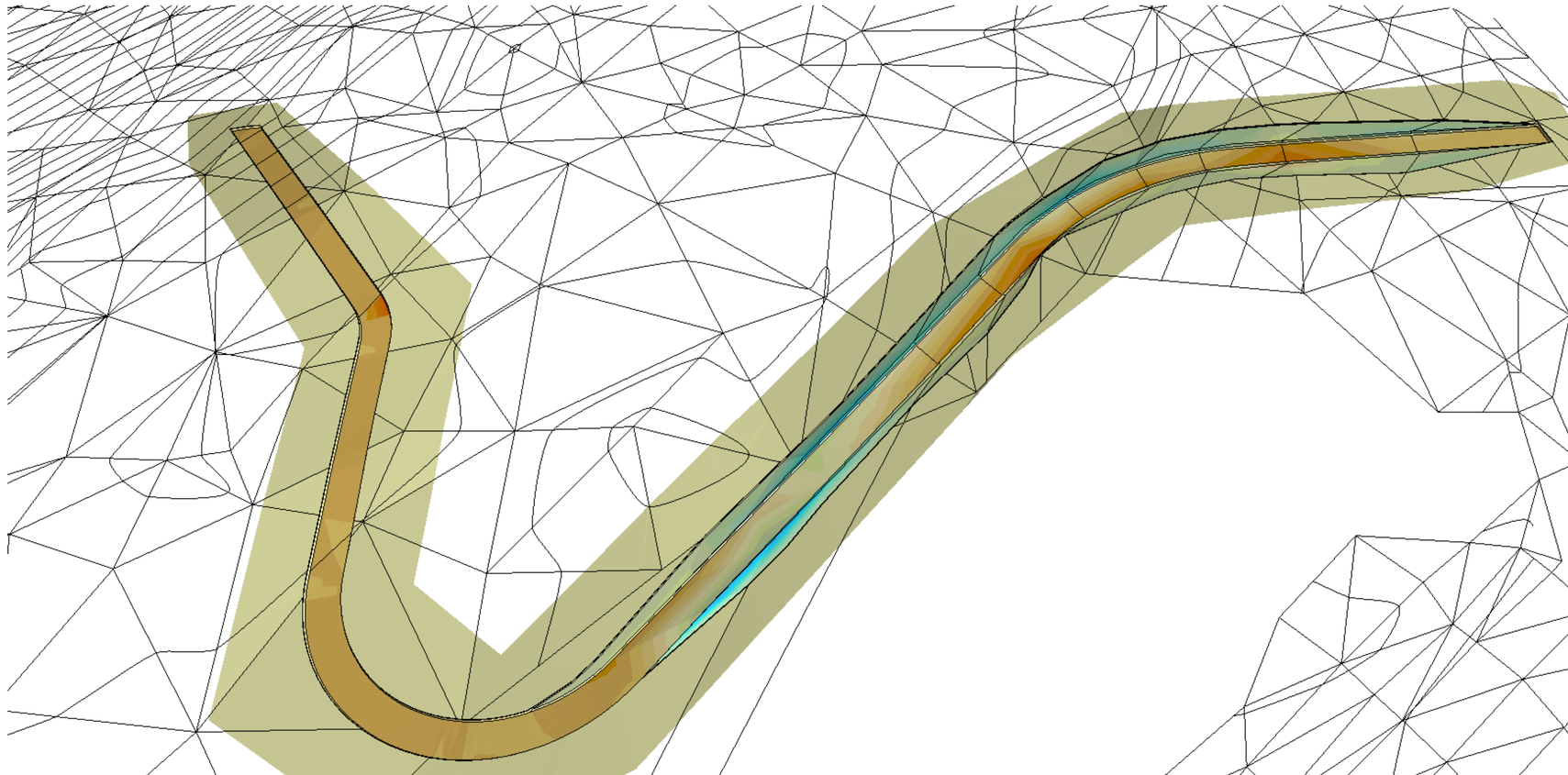












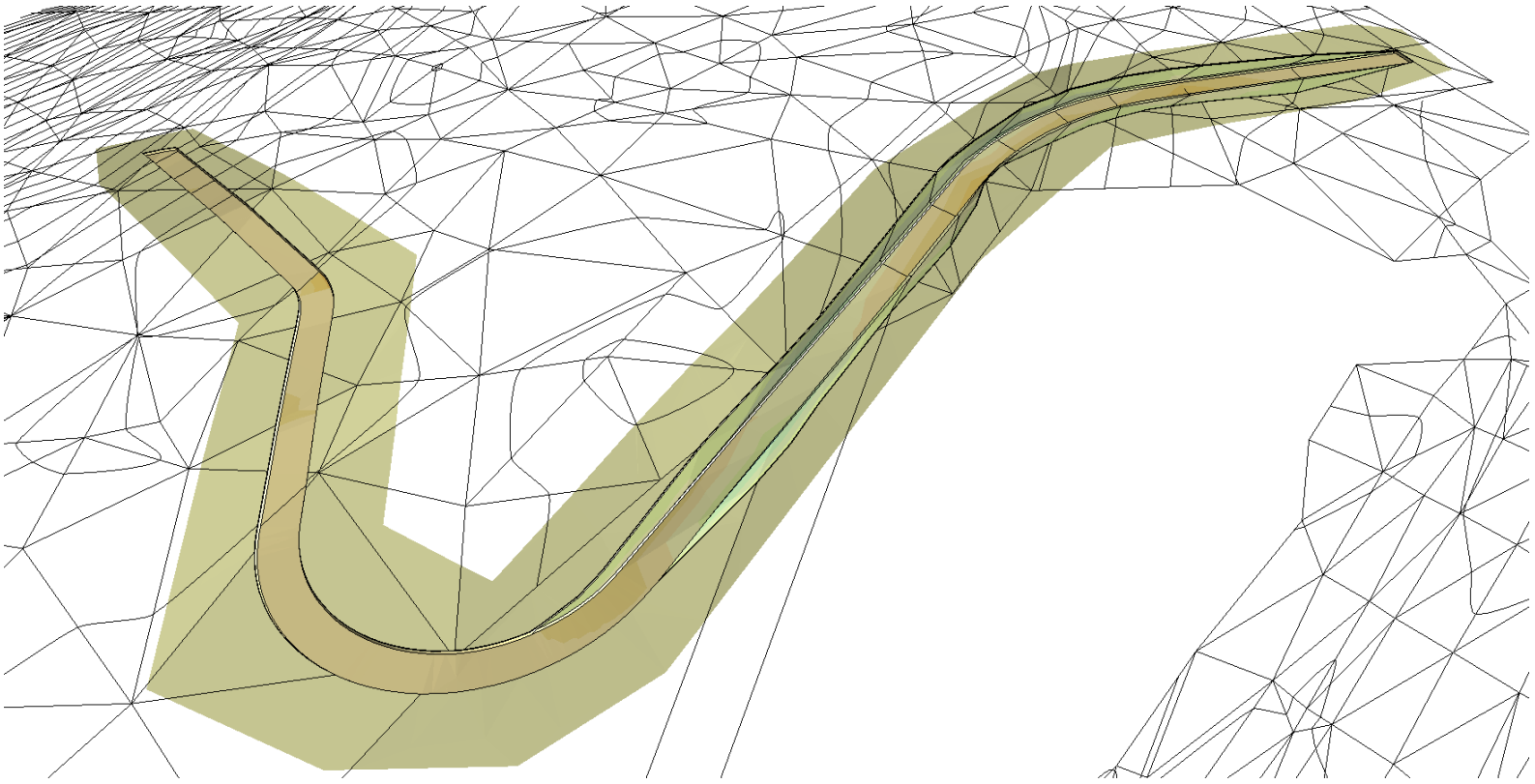
EARTHWORK SERVICES, INC.
Earthwork Take-Off Specialists
PO Box 640
1116 1st St.
Cosmopolis, WA 98537
360-533-2007
360-533-1618 Fax
earthwork@earthworkservices.com
www.earthworkservices.com

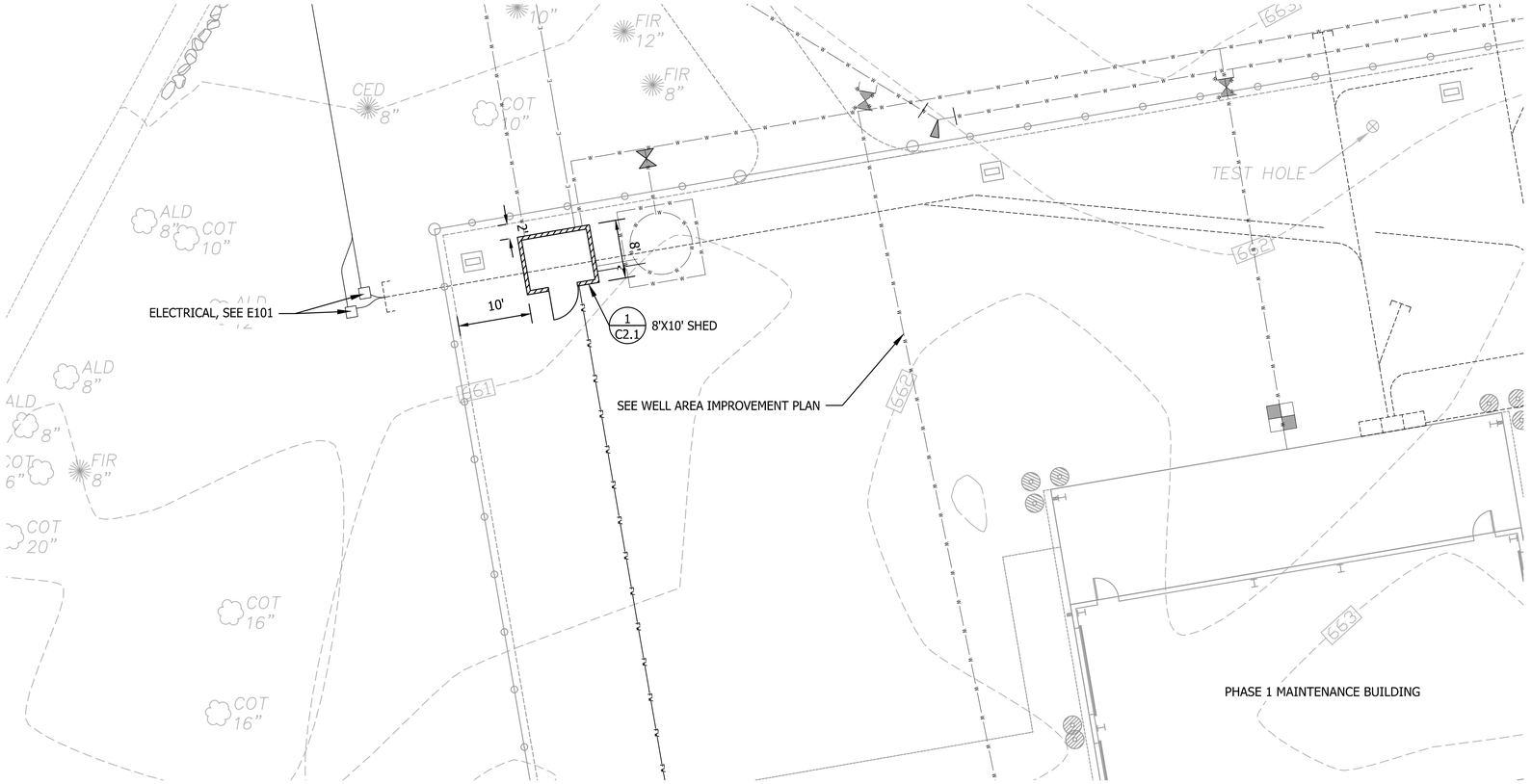
Volume Report
Subgrade vs. Stripped

Name	Total	Area Cut	Area Fill	OnGrade	Volume Cut	Volume Fill	Comp/Ratio Cut	Comp/Ratio Fill	Compact Cut	Compact Fill	Export -Import	Change Per 0.1 ft
LANDSCAPING	3,167	66	2,727	374	1	34	1.00	1.00	1	34	-33	**12**
TRAIL	4,836	4,143	134	559	53	1	1.00	1.00	53	1	52	**18**
Regions Total	**8,003**	**4,209**	**2,861**	**933**	**54**	**35**			**54**	**35**	**19**	**30**

Stripping Qtys	Plane Area	Slope Area	Depth	Volume
STRIPPING	8,003	8,016	0.500	148

Sectional Qtys	Plane Area	Slope Area	Depth	Volume
LANDSCAPING	3,167	3,184	0.250	29
TRAIL	4,836	4,845	0.830	149
Sectional Total	**8,003**	**8,029**		**178**

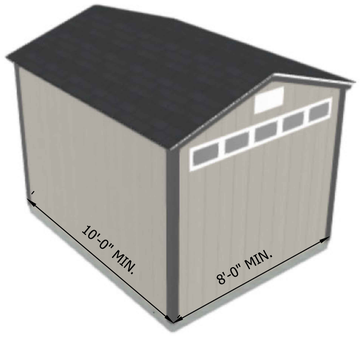




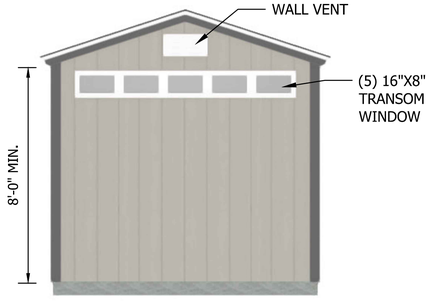
NORTHWEST CORNER OF MAINTENANCE BUILDING

SCALE: 1"=20'

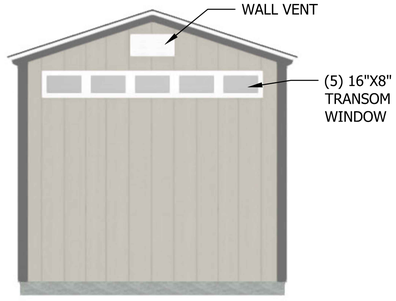
FRONT ISOMETRIC



BACK ISOMETRIC



RIGHT ELEVATION



LEFT ELEVATION

NOTE: INSTALLATION PER MANUFACTURER CUTSHEETS AND SPECIFICATIONS

1 C2.1 8'X10' SHED

SCALE: NOT TO SCALE

811 Call 811 two business days before you dig

SHEET__OF__

ALREADY CONSTRUCTED - FOR CONTRACTOR INFORMATION ONLY

CAD NO.

NO.	REVISIONS	INT.	APP.	DATE

ACTION	BY	DATE
DESIGNED	BD	3/31/2023
DRAWN	AD,JH	3/31/2023
CHECKED (FIELD)	BD	3/31/2023
CHECKED (HDQTS.)		

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

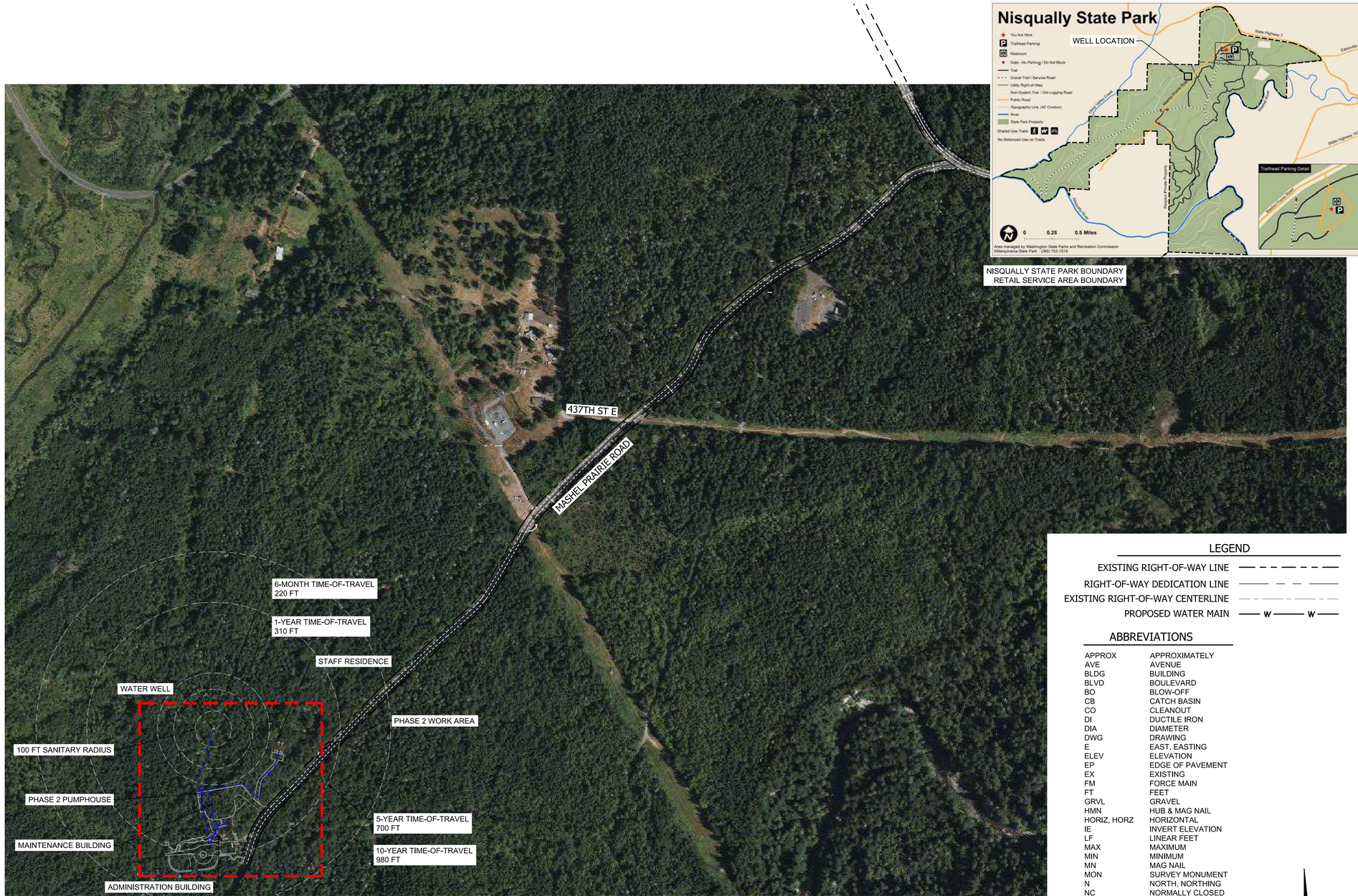
NISQUALLY STATE PARK

NEW FULL SERVICE PARK - PHASE 2

SITE PLAN
PUMP HOUSE SHED
A-C2.1

SCALE 10' 0 20'

PARKS FILE#



NISQUALLY STATE PARK BOUNDARY
RETAIL SERVICE AREA BOUNDARY

LEGEND

EXISTING RIGHT-OF-WAY LINE	
RIGHT-OF-WAY DEDICATION LINE	
EXISTING RIGHT-OF-WAY CENTERLINE	
PROPOSED WATER MAIN	W W

ABBREVIATIONS

APPROX	APPROXIMATELY
AVE	AVENUE
BLDG	BUILDING
BLVD	BOULEVARD
BO	BLOW-OFF
CB	CATCH BASIN
CO	CLEANOUT
DI	DUCTILE IRON
DIA	DIAMETER
DWG	DRAWING
E	EAST, EASTING
ELEV	ELEVATION
EP	EDGE OF PAVEMENT
EX	EXISTING
FM	FORCE MAIN
FT	FEET
GRVL	GRAVEL
HMN	HUB & MAG NAIL
HORIZ, HORZ	HORIZONTAL
IE	INVERT ELEVATION
LF	LINEAR FEET
MAX	MAXIMUM
MIN	MINIMUM
MN	MAG NAIL
MON	SURVEY MONUMENT
N	NORTH, NORTHING
NC	NORMALLY CLOSED
NE	NORTHEAST
NO	NORMALLY OPEN
NTS	NOT TO SCALE
S	SOUTH, SLOPE
SCH	SCHEDULE
SE	SOUTHEAST
SEC	SECTION
SD	STORM DRAIN
SS	SANITARY SEWER
SSMH	SEWER MANHOLE
ST	STREET
STA	STATION
STD	STANDARD
SW	SOUTHWEST
T	TOWNSHIP
TYP	TYPICAL
W	WEST
W/	WITH
WM	WATER MAIN

ALREADY CONSTRUCTED - FOR CONTRACTOR INFORMATION ONLY

CAD NO. PARKCODE-PROJECTCODE-YEAR-FILENAME

NO.	REVISIONS	INT.	APP.	DATE

ACTION	BY	DATE
DESIGNED	KWM	01/06/23
DRAWN	NA	01/06/23
CHECKED (FIELD)	BEE	01/06/23
CHECKED (HDQTS.)	XXX	XX/XX/XX

BENJAMIN E. A. ENDRIZ
STATE OF WASHINGTON
49448
REGISTERED PROFESSIONAL ENGINEER
1-31-2023

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

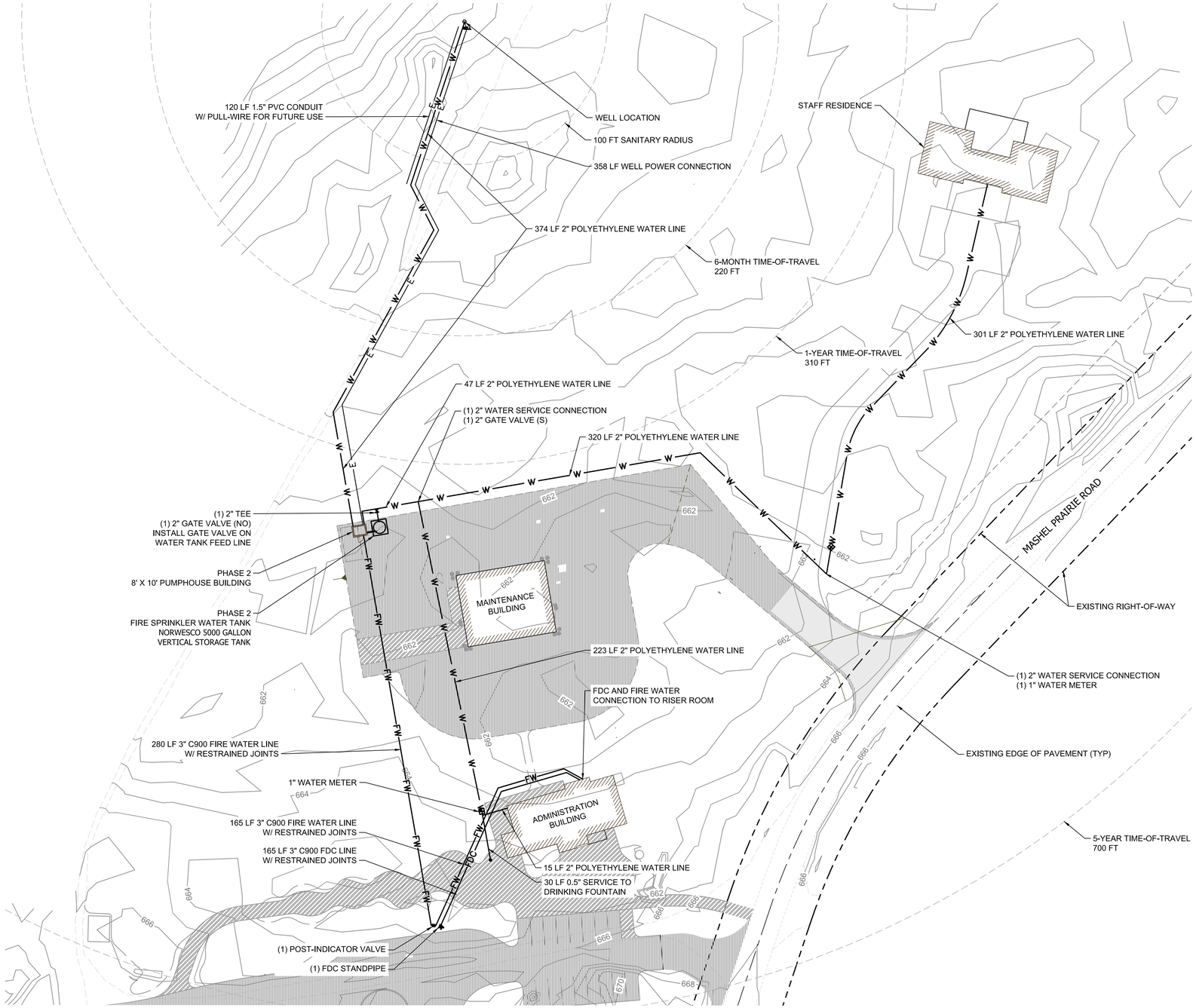
NEW FULL SERVICE PARK - PHASE 2

OVERALL WATER SYSTEM PLAN

W1

SCALE
300
0 SCALE IN FEET 600

PARKS FILE#



WATER IMPROVEMENTS PLAN

SCALE: 1" = 40'

LEGEND

- PROPOSED BUILDING
- EXISTING RIGHT-OF-WAY LINE
- EXISTING RIGHT-OF-WAY CENTERLINE
- EDGE OF PAVEMENT
- EDGE OF GRAVEL
- WATER MAIN — W — W —
- FIRE WATER LINE — FW —
- FIRE DEPARTMENT CONNECTION LINE — FDC —
- WATER METER
- ISOLATION VALVE
- POST-INDICATOR VALVE
- FIRE DEPARTMENT CONNECTION

FIRE SPRINKLER NOTE:

1. FIRE SPRINKLER TANK AND PUMP ARE FOR ADMINISTRATION BUILDING SPRINKLER SYSTEM. TANK AND PUMP SHOWN ARE TEMPORARY SUPPLY CONDITION UNTIL PHASE 3 OF CONSTRUCTION. DURING PHASE 3, THE FIRE SPRINKLER SUPPLY TO THE ADMINISTRATION BUILDING WILL BE REVISED TO BE CONNECTED TO THE WATER DISTRIBUTION SYSTEM.

ALREADY CONSTRUCTED - FOR CONTRACTOR INFORMATION ONLY

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CHECKED (HDQTS.)	XXX	XX/XX/XX

BENJAMIN E. A. ENDRES
STATE OF WASHINGTON
49448
REGISTERED
PROFESSIONAL ENGINEER
1-31-2023

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

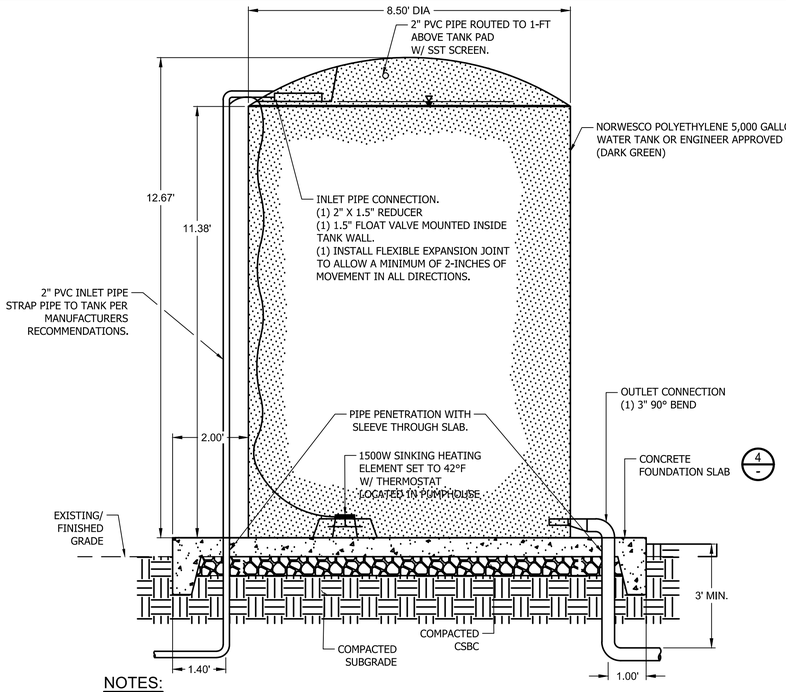
NEW FULL SERVICE PARK - PHASE 2

WELL AREA IMPROVEMENT PLAN

W2

SCALE 40
0 SCALE IN FEET 80

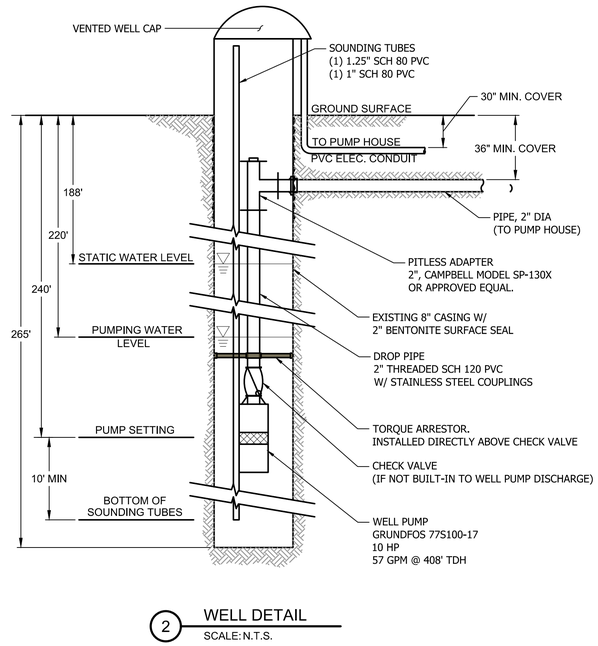
PARKS FILE#



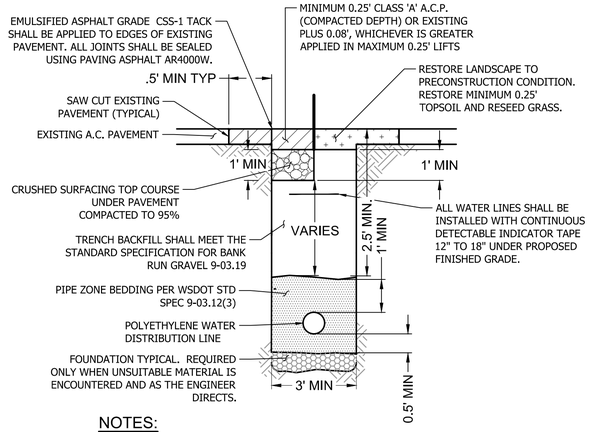
NOTES:

1. PENETRATIONS THROUGH CONCRETE SHALL BE SLEEVED. PENETRATIONS THOUGH TANK SHALL BE SEALED AND WATER-TIGHT.
2. ALL DIMENSIONS SHOWN ARE FOR SPECIFIED WATER TANK. DIFFERENT TANK MODELS WILL HAVE DIFFERENT DIMENSIONS.
3. MINIMUM STORAGE VOLUME: 4500 GALLONS
4. TANK LAYOUT SHOWN GRAPHICALLY. INTERIOR COMPONENT LAYOUT WILL SLIGHTLY VARY FROM THIS DETAIL.
5. ALL EXTERIOR PIPES SHALL BE INSTALLED WITH CONTINUOUS HEAT TAPE AND PIPE INSULATION.
6. COVER TANK EXTERIOR WITH 2" MIN FIBERGLASS INSULATION. COVER INSULATED STRUCTURE WITH RUBBER SHEETING. SECURE WITH STEEL BANDS EVERY 2 FT MIN. SEAL ALL JOINTS AND HOLES WITH WEATHER RESISTANT TAPE.
7. FLOAT VALVE SHALL BE WATTS MODEL 1500 W/ 10" DIA. FLOAT BALL (OR ENGINEER APPROVED EQUAL).

1 TEMPORARY SPRINKLER WATER TANK DETAIL
SCALE: 1" = 2'



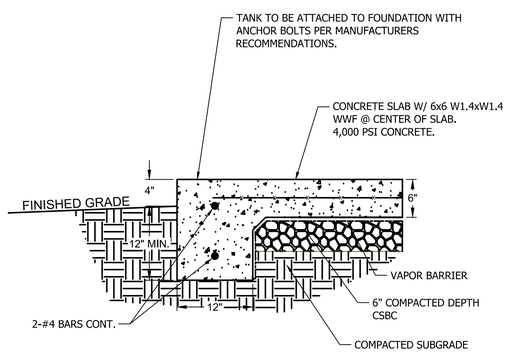
2 WELL DETAIL
SCALE: N.T.S.



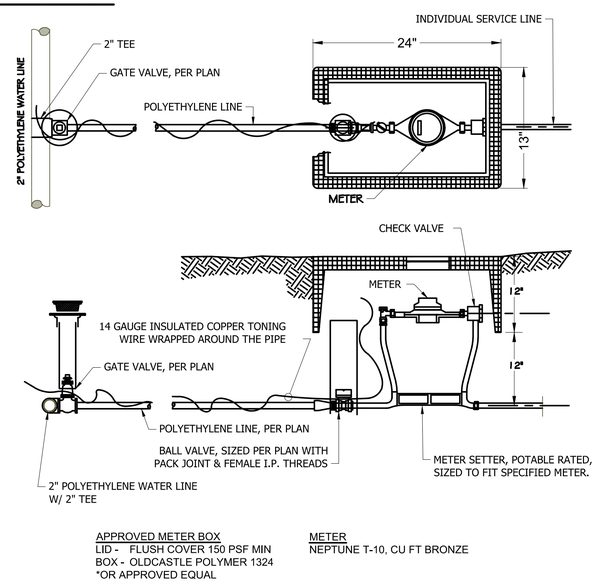
NOTES:

1. ALL MATERIALS, WORKMANSHIP, AND INSTALLATION SHALL BE IN CONFORMANCE WITH THE WSDOT STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION.
2. KEEP TRENCH BOTTOM COMPACTED WITH UNIFORM GRADE. NO TEMPORARY SUPPORTS, I.E. BLOCKS, WILL BE ALLOWED TO SUPPORT PIPE. TRENCH BOTTOM SHALL BE TO GRADE PRIOR TO PIPE INSTALLATION.
3. RESTORATION SHALL BE IN ACCORDANCE WITH ONE OF THE FOLLOWING:
   A. SELECT BACKFILL MEETING THE REQUIREMENTS OF THE STD SPEC 9-03.19 COMPACTED TO 95% DENSITY AND PLACED IN A MAXIMUM 6" LIFTS. WRITTEN VERIFICATION OF COMPACTION, BASED ACCEPTABLE TESTING METHODS, AND PLACEMENT OF THE BACKFILL WILL BE REQUIRED; OR
   B. NATIVE MATERIAL MAY BE USED AS BACKFILL MATERIAL IF IT COMPLIES WITH THE STANDARD SPECIFICATIONS.
4. ALL PAVEMENT PATCHES SHALL BE ROLLER COMPACTED. STEEL WHEEL ROLLERS SHALL BE NO WIDER THAN TRENCH PATCH WIDTH. SHOW THE MATERIAL MEETS THE REQUIREMENTS AS SPECIFIED ABOVE.

3 TRENCH & RESTORATION DETAIL
SCALE: N.T.S.



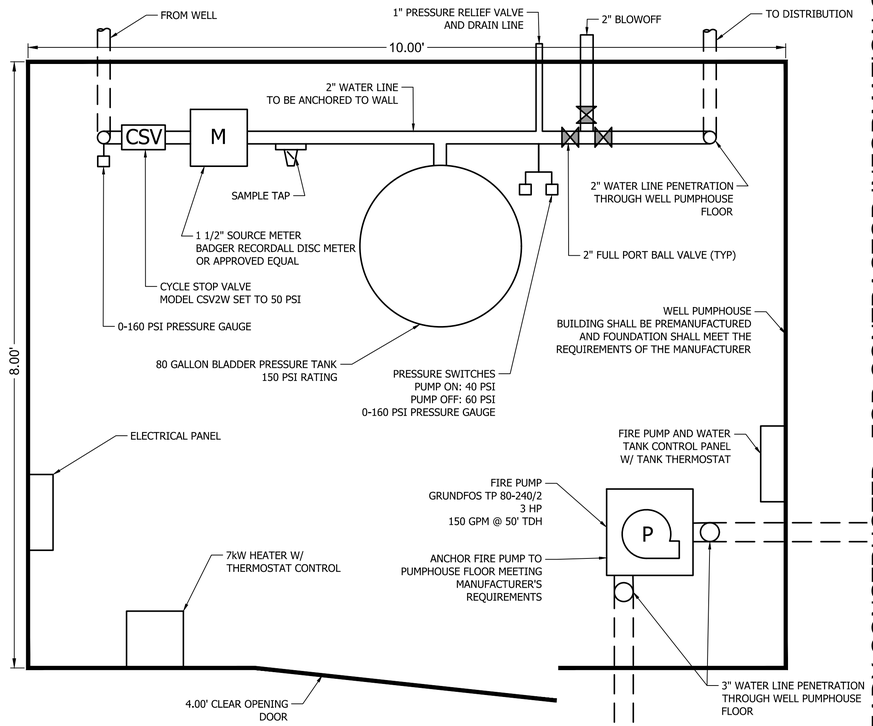
4 SLAB DETAIL
SCALE: N.T.S.



APPROVED METER BOX
LID - FLUSH COVER 150 PSF MIN
BOX - OLDCASTLE POLYMER 1324
*OR APPROVED EQUAL

METER
NEPTUNE T-10, CU FT BRONZE

5 SERVICE CONNECTION DETAIL
SCALE: N.T.S.



6 WELL PUMPHOUSE FLOOR PLAN
SCALE: N.T.S.

ALREADY CONSTRUCTED - FOR CONTRACTOR INFORMATION ONLY

CAD NO. PARKCODE-PROJECTCODE-YEAR-FILENAME

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ACTION	BY	DATE
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DRAWN	NA	01/06/23
CHECKED (FIELD)	BEE	01/06/23
CHECKED (HDQTS.)	XXX	XX/XX/XX

BENJAMIN E. A. ENDRES — STATE OF WASHINGTON — 49448 — REGISTERED PROFESSIONAL ENGINEER — 1-31-2023

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

NEW FULL SERVICE PARK - PHASE 2

WATER DETAILS

W3

SCALE
NTS

PARKS FILE#

ELECTRICAL SYMBOLS LEGEND

A / B	DETAIL/SECTION IDENTIFICATION: A = DETAIL/SECTION LETTER, B = SHEET NUMBER WHERE DETAIL/SECTION IS DRAWN.
A / B	EQUIPMENT CONNECTION CALLOUT. A,B EQUAL EQUIPMENT IDENTIFICATION ON MECHANICAL EQUIPMENT CONNECTION SCHEDULES. VERIFY EXACT EQUIPMENT REQUIREMENTS ON APPROVED SHOP DRAWING EQUIPMENT SUBMITTALS PRIOR TO ROUGH-IN. DO NO ROUGH-IN FOR EQUIPMENT PRIOR TO REVIEW OF SUBMITTALS. REPORT ANY DIFFERENCES IN REQUIREMENTS TO ENGINEER IN WRITING.
	CONDUIT CONCEALED. HASH MARKS INDICATE NUMBER OF #12 CONDUCTORS IN CODE SIZE CONDUIT. NO HASH MARKS INDICATES 2-#12 CONDUCTORS PLUS GROUND IN 3/4" CONDUIT, LONG HASH MARKS INDICATES NEUTRAL CONDUCTOR. ✓ INDICATES GROUND CONDUCTOR.
	CONDUIT STUBBED AND CAPPED BELOW GRADE.
	FLEXIBLE RACEWAY, PROVIDE GROUND CONDUCTORS PER NEC.
	A-1,3 ADJACENT TO ARROW INDICATES HOMERUN OF CONDUCTORS IN CONDUIT FOR CIRCUITS 1 AND 3 TO PANEL "A".
	LED EXIT LIGHT WITH BATTERY, UNIVERSAL MOUNTING.
	LED FLOODLIGHT WITH BATTERY.
	LED LIGHT FIXTURE, SURFACE MOUNTED ON CEILING.
	LED LIGHT FIXTURE, WITH EMERGENCY BATTERY PACK.
	LED LIGHT FIXTURE, WALL MOUNTED.
	LED LIGHT FIXTURE WALL MOUNT.
A1	LIGHT FIXTURE TYPE. A1 = SPECIFIC LIGHTING FIXTURE REFERENCED ON LIGHTING FIXTURE SCHEDULE.
J	JUNCTION BOX.
	POWER PANEL
	DUPLEX RECEPTACLE 20A, 125 VOLT WALL MOUNTED AT 18 INCHES AFF OR AS NOTED. G = GROUND FAULT INTERRUPTING, C = CEILING MOUNTED.
	DUPLEX RECEPTACLE 20A, 125 VOLT WALL MOUNTED HORIZONTALLY 2" ABOVE BENCH OR COUNTERTOP BACKSPLASH TO THE BOTTOM OF THE RECEPTACLE COVERPLATE.
	FOURPLEX RECEPTACLE 20A, 125 VOLT, WALL MOUNTED AT 18 INCHES AFF OR AS NOTED.
	SPECIAL RECEPTACLE. AMPERAGE AND VOLTAGE AS SHOWN.
	EQUIPMENT CONNECTION. PROVIDE PER NEC AND MANUFACTURERS REQUIREMENTS AND/OR RECOMMENDATIONS.
V OMX	OHOP MUTUAL POWER VAULT
V RCX	RAINIER CONNECT COMMUNICATIONS VAULT
V PVX	SECONDARY POWER VAULT. PVX = IDENTIFICATION.
V CVX	COMMUNICATION VAULT. CVX = IDENTIFICATION.
H PHX	SECONDARY POWER HANDHOLE. PHX = IDENTIFICATION.
H CHX	COMMUNICATIONS HANDHOLE. CHX = IDENTIFICATION.
SC	120V (WITH BATTERY BACKUP) COMBINATION SMOKE (PHOTOELECTRIC) AND CARBON MONOXIDE DETECTOR WITH INTEGRAL SOUNDER BASE AND SILENCING SWITCH.
SR	120V (WITH BATTERY BACKUP) SMOKE (PHOTOELECTRIC) DETECTOR WITH INTEGRAL SOUNDER BASE AND SILENCING SWITCH.
SB	UNIT COMMUNICATIONS SMART BOX
EWH XX	ELECTRIC WALL HEATER. SUBSCRIPT "XX" INDICATES WATTAGE. SEE MECHANICAL PLANS FOR MANUFACTURER/MODEL INFORMATION.
EF	EXHAUST FAN. SEE MECHANICAL PLANS FOR MANUFACTURER/MODEL INFORMATION.
TV	CABLE TV OUTLET.
S	LIGHT SWITCH TOGGLE TYPE, SINGLE POLE, SUBSCRIPTS; 3 = THREE WAY, D = DIMMER CONTROL, a, b, c, ETC = NUMBER OF SWITCHES AT THE LOCATION AND SPECIFIC FIXTURES CONTROLLED. MOUNT AT 42 INCHES AFF.
S_T	DIGITAL 0-12 HOUR TIMER SWITCH. WATTSTOPPER TS-400 OR EQUAL
S_Y	AUTOMATIC/MANUAL OCCUPANCY SENSOR AND SINGLE POLE TOGGLE SWITCH. WATT STOPPER DW-100 OR EQUAL. SWITCH SHALL BE PROGRAMMED FOR MANUAL ON, AUTOMATIC OFF.
S_M	WIRELESS LIGHT SWITCH, SINGLE POLE, SUBSCRIPTS; 3 = THREE WAY, D = DIMMER CONTROL, a, b, c, ETC = NUMBER OF SWITCHES AT THE LOCATION AND SPECIFIC FIXTURES CONTROLLED. MOUNT AT 42 INCHES AFF.
OS	WIRELESS AUTOMATIC OCCUPANCY SENSOR DEVICE.
PS	WIRELESS DAYLIGHT PHOTOSENSOR
	DISCONNECT SWITCH
	FUSED DISCONNECT SWITCH WITH FUSES.
S_m	MOTOR RATED TOGGLE SWITCH WITH OVERLOAD HEATER(S), SIZE PER NEC AND MANUFACTURERS REQUIREMENTS.
T	OHOP UTILITY TRANSFORMER
	GROUND PER NEC.
XXX	AVAILABLE FAULT CURRENT
T V S S	TRANSIENT VOLTAGE SURGE SUPPRESSION. TPS3-X-11-15-D2, SIEMENS OR EQUAL. "X" = VOLTAGE/ PHASE (VARIES), SEE POWER RISER DIAGRAM AND/OR PANEL SCHEDULES FOR VOLTAGE AND PHASE REQUIREMENTS.
WP	WEATHERPROOF (NEMA 3R IN USE)
UGEP	UNDERGROUND ELECTRICAL 12.47KV PRIMARY.
UGES	UNDERGROUND ELECTRICAL 600V SECONDARY.
UGC	UNDERGROUND COMMUNICATION.
TC	TIMECLOCK. TORK #EWZ201C-MB (2 CHANNEL, 7-DAY, PROGRAMMABLE) OR EQUAL
S	SMOKE DETECTOR (PHOTOELECTRIC).
H	HEAT DETECTOR
F	MANUAL FIRE ALARM PULL STATION. WALL MOUNT AT 42 INCHES AFF.
F XX	FIRE ALARM HORN/ADA STROBE. WALL MOUNT AT 80 INCHES AFF. SUBSCRIPT INDICATES CANDELA LEVEL.
L XX	FIRE ALARM MINI ADA STROBE, WALL MOUNT AT 80 INCHES AFF. SUBSCRIPT INDICATES CANDELA LEVEL.
X	FLUSH MOUNTED TELEPHONE/DATA OUTLET, MOUNT AT 18" AFF. PROVIDE 4-11/16" SQUARE BOX WITH 1-1/4" CONDUIT AND PULL STRING TO ACCESSIBLE CEILING SPACE. SUBSCRIPT X = QUANTITY OF DATA/TELEPHONE JACKS PER LOCATION.
FB	FLOOR BOX. PROVIDE 125V, 20A, FOURPLEX RECEPTACLE AND DUAL TELEPHONE/DATA OUTLET WITH 1-1/4" CONDUIT ONLY AND PULLSTRING TO ACCESSIBLE CEILING SPACE FOR DATA CABLE ROUTING.
WAP	WIRELESS ACCESS POINT

ALREADY CONSTRUCTED - FOR CONTRACTOR INFORMATION ONLY

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Info@crossengineers.com
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Job Number: 20-119

SHEET __ OF XX

CAD NO.

	DATE
	APP.
	INT.
	REVISIONS
	NO.

ACTION	BY	DATE
DESIGNED	GLW	12-16-22
DRAWN	JAE	12-16-22
CHECKED (FIELD)		
CHECKED (HDQTS.)		

STEVEN L. HUBBS
STATE OF WASHINGTON
29060
REGISTERED
PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 2

ELECTRICAL SYMBOLS LEGEND
E001

SCALE
AS NOTED

PARKS FILE#

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	LAMPS	WATTS	MOUNTING
A1	METALUX 4SNLED-LD5-30SL-LW- UNV-L835-CD1-U	LED	25	SURFACE/ CEILING/WALL
A2	METALUX 14FP4235C-FPSURF14	LED	38	SURFACE
A3	PINNACLE EX4DI-A-BW-835-835-12'- AC-ST-U-OL2-2-O-W	LED	102	SUSPENDED 8'-6" AFF
A4	OXYGEN 3-537-24	LED	14	WALL
A5	METALUX 24EN-LD2-40-UNV-L835-CD-1	LED	33	RECESSED
A6	METALUX 22EN-LD2-25-UNV-L835-CD-1	LED	20	RECESSED
A7	METALUX 8TSNLED-LD5-61SL- LW-UNV-L835-CD-1	LED	50	SURFACE/ CEILING
B1	LITON LCMPD7R-W-UE-D10-T35	LED	14	SURFACE
B2	SENSO LIGHTING 692-A90-645-60-35-20-07-SL-02- 02-952-02-02-02-LCS-120	LED	26	SUSPENDED
P1	LUMARK PFPRV-1-A25-T3-25-MSP/DIM-L30- HS/VERD-SS4A25SFM4	LED	87	5" CUSTOM POLE/CAMERA FIXTURE COMBINATION
R1	HALO SMD6R-12-9S-WH	LED	15	SURFACE
R2	OXYGEN 3-649-6	LED	28	SURFACE
R3	OXYGEN 3-620-24	LED	24	SURFACE
R4	HALO SMD6R-6-9S-WH	LED	9	SURFACE
UC	HALO HU30-ADV-36-P	LED	15	UNDERCABINET
W1	LUMARK AXCS3A-W-BK-PC1	LED	27	WALL +7'-0" AFG
W1X	SAME AS TYPE W1 WITH EMERGENCY BATTERY PACK			
W2	LITON LCMPD5R-B-UE-D10-T30	LED	11	SURFACE
W3	LITON DL360-B-L15-UE-DUN-T30-FR LPCMDL6-24-B	LED	21	PENDANT
X1	SURE-LITES LPX7WSPWG511	INCLUDED	3	UNIVERSAL
X2	SAME AS TYPE X1 WITH DUAL FACE	INCLUDED	3	UNIVERSAL
X3	SURE-LITES SEL50SDSQ	INCLUDED	3	WALL

GENERAL NOTES:

1. DO NOT SCALE ELECTRICAL DRAWINGS. REFER TO ARCHITECTURAL, LANDSCAPE, CIVIL AND STRUCTURAL DRAWINGS AND FIELD MEASUREMENTS TO COORDINATE THE EXACT LOCATION OF ALL ELECTRICAL EQUIPMENT, STRUCTURES, VAULTS, CONDUITS, TRENCHED ETC. NOTIFY ENGINEER IN THE EVENT OF A CONFLICT.
2. SEE DRAWING EXXX FOR CONDUIT AND CONDUCTOR SCHEDULE. NOT ALL CONDUIT AND CONDUCTORS ARE INDICATED ON THE SCHEDULES. SEE SITE PLANS, PARTIAL PLANS AND DETAILS FOR ADDITIONAL CONDUIT AND CONDUCTOR REQUIREMENTS. METALLIC CONDUITS, COUPLINGS AND JOINTS OF METALLIC CONDUITS EMBEDDED IN CONCRETE, EARTH OR ASPHALT SHALL BE 1/2 LAP TAPED 12" PAST JOINTS OR OTHERWISE MADE WATERTIGHT TO PREVENT INTRUSION OF MORTAR, WATER OR OTHER MATERIALS. TEST CONDUIT FOR ABSENCE OF ANY BLOCKAGE PRIOR TO AND WITHIN 24 HOURS OF COMPLETING A CONCRETE POUR OR ASPHALT PAVING.
3. CONTRACTOR SHALL INCLUDE IN THE BID ALL COSTS TO HAVE A DEPARTMENT OF LABOR AND INDUSTRIES APPROVED FIRM TO FIELD EVALUATE THE INSTALLATION, SAFETY, AND COMPLIANCE REQUIRED PER LABOR AND INDUSTRIES ELECTRICAL INSPECTION AND/OR PER W.A.C. 296-46B-901 FOR ANY EQUIPMENT SPECIFIED OR FURNISHED NOT UL LABELED.
4. THERE IS ADDITIONAL ELECTRICAL WORK SHOWN ON THE ARCHITECTURAL, LANDSCAPE, CIVIL AND STRUCTURAL DRAWINGS AND DESCRIBED IN THE SPECIFICATIONS. EXTENSIVE COORDINATION IS REQUIRED BY THE CONTRACTOR WITH GOVERNING AUTHORITIES, OTHER CONTRACTORS WORKING ON SITE. CONTRACTOR SHALL REVIEW ALL DRAWINGS AND SPECIFICATION SECTIONS AND INCLUDE COSTS FOR ALL COORDINATION AND RELATED WORK IN THE BID.
5. CONTRACTOR SHALL PROVIDE PULL TAPE IN ALL CONDUIT RUNS WITH POWER CONDUCTORS, COMMUNICATIONS CABLES OR EMPTY. PROVIDE COMPLETE LOOP OF ALL POWER AND COMMUNICATIONS CABLES AROUND ALL FOUR(4) WALLS OF VAULTS, HANDHOLES PRIOR TO CABLE EXITING. FOR POWER CONDUCTORS UPSIZED TO REDUCE VOLTAGE DROP AND LARGER THAN TERMINATION LUGS CONTRACTOR SHALL PROVIDE TERMINAL PINS (FINGER SPLICES) ON WIRE ENDS TO ACCOMMODATE TERMINATION.

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NISQUALLY STATE PARK

PHASE 2

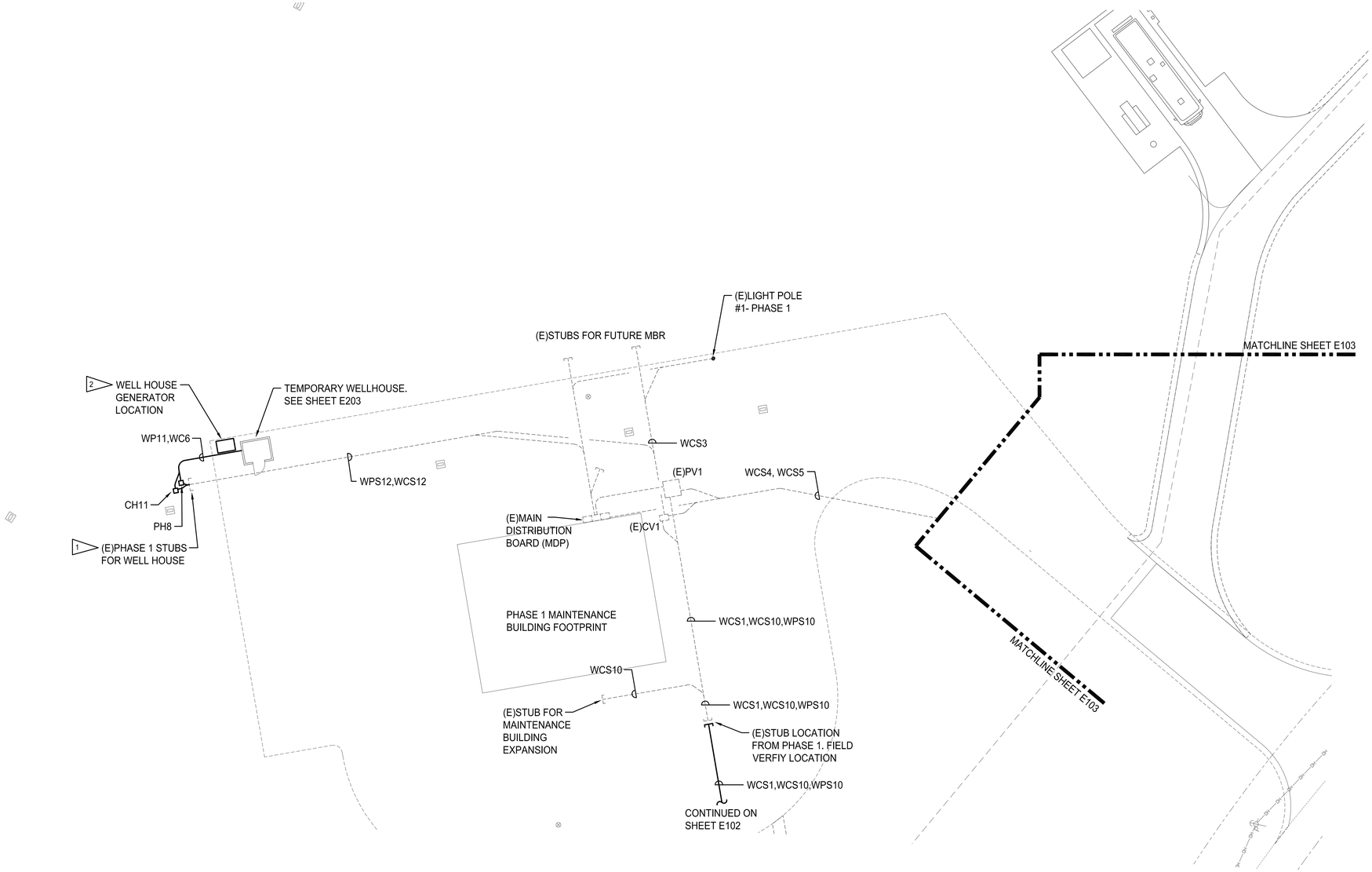
LIGHTING FIXTURE SCHEDULE
E002

SCALE
AS NOTED

PARKS FILE#

ELECTRICAL NOTES:

1. CONTRACTOR SHALL EXTEND (1)4" POWER AND (1)4" COMM. CONDUITS FROM STUBBED LOCATION TO NEW HANDHOLES PH8 AND CH11.
2. PROVIDE 10", REINFORCED, CONCRETE PAD BELOW GENERATOR. CONCRETE PAD SHALL BE 4" ABOVE FINISHED GRADE AND EXTEND 12" PAST FOOTPRINT OF GENERATOR ON ALL FOUR SIDES.



EXISTING/NEW ELECTRICAL SITE PLAN

SCALE: 1"=20'-0"

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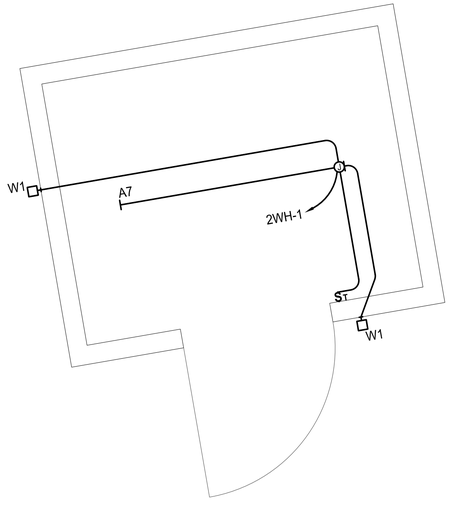
PHASE 2

EXISTING/ NEW ELECTRICAL SITE PLAN E101

SCALE
AS NOTED

PARKS FILE#



PUMP HOUSE LIGHTING FLOOR PLAN

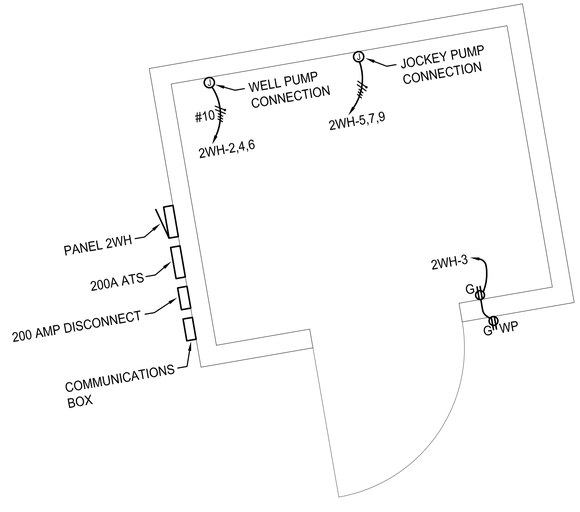
SCALE: 1/2"=1'-0"

N

GRAPHIC SCALE

1/2"=1'-0" 2 0 2 4

scale feet



PUMP HOUSE POWER/SIGNAL FLOOR PLAN

SCALE: 1/2"=1'-0"

N

GRAPHIC SCALE

1/2"=1'-0" 2 0 2 4

scale feet

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NISQUALLY STATE PARK

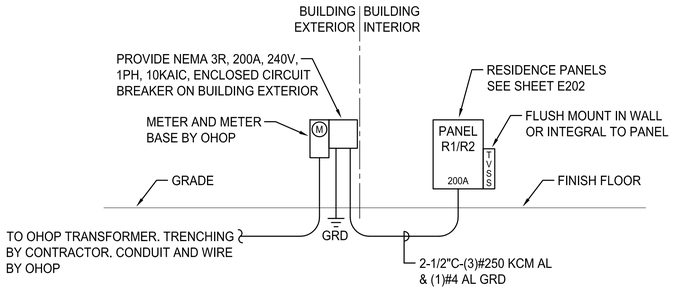
PHASE 2

PUMP HOUSE ELECTRICAL FLOOR PLANS E203

SCALE

AS NOTED

PARKS FILE#



RESIDENCE POWER RISER DIAGRAM TYPICAL OF R1 AND R2

NO SCALE

ELECTRICAL NOTES:

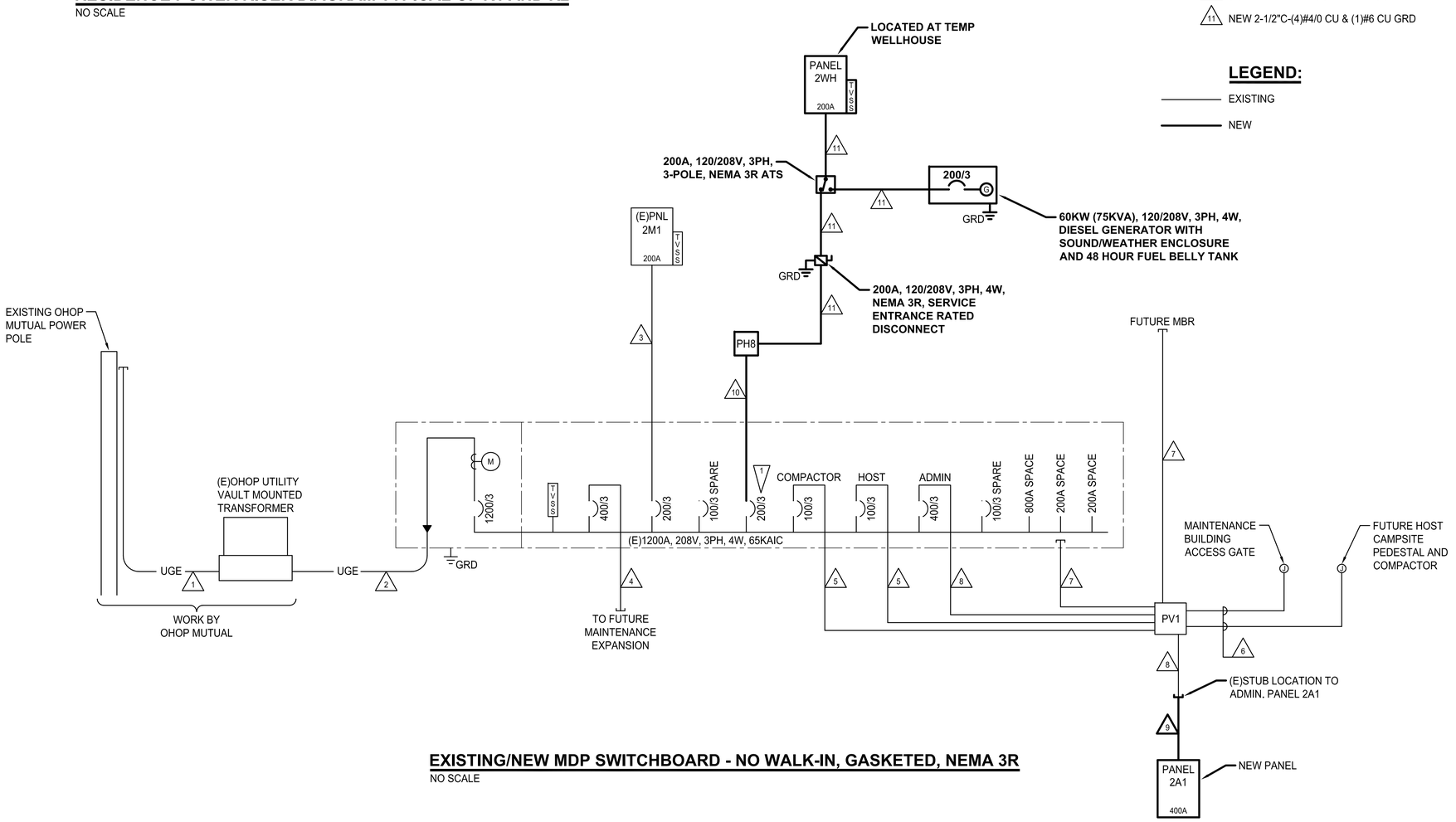
1. CONTRACTOR SHALL PROVIDE NEW 200A/3-POLE CIRCUIT BREAKER IN EXISTING SWITCHBOARD.

CONDUIT AND CONDUCTOR SCHEDULE:

1. (E)4"C-WIRE BY OHOP MUTUAL
2. (E)(4)4"C-(4)#500 KCM AL EACH (2)4"C.O.
3. (E)2"C-(4)#3/0 CU & (1)#4 CU GRD
4. (E)(2)4"C.O.
5. (E)2"C.O.
6. (E)1-1/4"C.O.
7. (E)(2)4"C.O.
8. (E)(1)4"C-WITH NEW (4)#600 KCM CU & (1)#2 CU GRD (E)(1)4"C-SPARE
9. (1)4"C-(4)#600 KCM CU & (1)#2 CU GRD (1)4"C-SPARE
10. (E)4"C-WITH NEW (4)#4/0 CU & (1)#6 CU GRD
11. NEW 2-1/2"C-(4)#4/0 CU & (1)#6 CU GRD

LEGEND:

- EXISTING
- NEW



EXISTING/NEW MDP SWITCHBOARD - NO WALK-IN, GASKETED, NEMA 3R

NO SCALE

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NISQUALLY STATE PARK

PHASE 2

POWER RISER DIAGRAMS E401

SCALE

AS NOTED

PARKS FILE#

SURFACE MOUNTING
22,000 AIC

PANEL SCHEDULE

NO. **2A1**
LOCATION: ADMINISTRATION BLDG.
SERVING: ADMINISTRATION BLDG.
120/208 VOLTS 3PHASE 4WIRE
400 AMPS WITH 400 MAIN BREAKER

	CKT NO.	LOAD DESCRIPTION	KVA	TRIP AMPS	TRIP AMPS	KVA	LOAD DESCRIPTION	CKT NO.	
	1	LIGHTS	1.22	20	20	.54	RECEPTACLES	2	
	3	LIGHTS	.75		2	.54	RECEPTACLES	4	
	5	RECEPTACLE	.18			.54	RECEPTACLES	6	
*	7	FIRE ALARM	.50			1.50	CAMIS SYSTEM	8	
	9	IDF EQUIPMENT	1.20			.54	RECEPTACLES	10	
	11	IDF EQUIPMENT	1.20			.54	RECEPTACLES	12	
	13	IDF EQUIPMENT	1.20			.50	DRINKING FOUNTAIN	14	
	15	RECEPTACLES	.90			.72	RECEPTACLES	16	
	17		.72			.72		18	
	19		.72			.72		20	
	21		.72			.18		22	
	23		.72		20	.36	RECEPTACLES	24	
	25	RECEPTACLES	.72		30	5.00	WH-1	26	
	27	COFFEE MAKER	1.20		2			28	
	29	COFFEE MAKER	1.20		20	1.14	ERV-1,HP-1B,1C,1D,	30	
	31	MICROWAVE	1.20		2		HP-2B,2C,2DS	32	
**	33	REFRIGERATOR	1.20	20	20	.31	CP-1,EF-1,EF-2	34	
	35	AC-1A/AC-1B	2.29	20		1.38	EWH-1,RCP-1,RCP-2	36	
	37			2		.25	SITE LIGHTS	38	
	39	HP-1A	7.49	60	20	1.50	DISCOVERY KIOSK	40	
	41			2	40	6.24	EV CHARGER	42	
	43	HP-2A	7.49	60	2			44	
	45			2	40	6.24	EV CHARGER	46	
	47	GATE CONTROLLED	2.50	30	2			48	
	49			2			SPACE	50	
**	51	DRINKING FOUNTAIN	.50	20			SPACE	52	
	53	SPACE					SPACE	54	
	55				20	.10	PUMP CNT. PANEL ALARM	56	
	57				40	3.50	SEPTIC PUMP DUPLEX	58	
	59				2			60	
	61				30		TVSS	62	
	63							64	
	65	SPACE			3			66	

REMARKS: .

CONNECTED LOAD: 68.4 KVA 190 AMPS
DEMAND LOAD: 56.6 KVA 157 AMPS

* PROVIDE CIRCUIT BREAKER HANDLE LOCK
** PROVIDE GFI CIRCUIT BREAKER

NEMA 3R

SURFACE MOUNTING
10,000 AIC

PANEL SCHEDULE

NO. **2WH**
LOCATION: TEMP WELL HOUSE
SERVING: EQUIPMENT
120/208 VOLTS 3PHASE 4WIRE
200 AMPS WITH MAIN LUGS

CKT NO.	LOAD DESCRIPTION	KVA	TRIP AMPS	TRIP AMPS	KVA	LOAD DESCRIPTION	CKT NO.
1	LIGHTS	.10	20	30	6.30	WELL PUMP (5HP)	2
3	RECEPTACLES	.36	20				4
5	JOCKEY PUMP (1.5HP)	2.48	15	3			6
7				20		SPARE	8
9			3	20		SPARE	10
11	SPACE					SPACE	12
13							14
15							16
17							18
19							20
21							22
23						SPACE	24
25				30		TVSS	26
27							28
29	SPACE			3			30

REMARKS: .

CONNECTED LOAD: 9.3 KVA 26 AMPS
DEMAND LOAD: 10.9 KVA 30 AMPS

TYPICAL OF PANELS R1 AND R2

FLUSH MOUNTING
22,000 AIC

PANEL SCHEDULE

NO. **R1**
LOCATION: R1
SERVING: R1
120/240 VOLTS 1PHASE 3WIRE
200 AMPS WITH MAIN LUGS

	CKT NO.	LOAD DESCRIPTION	KVA	TRIP AMPS	TRIP AMPS	KVA	LOAD DESCRIPTION	CKT NO.	
**	1	RECEPTACLES - KITCHEN	1.50	20	30	5.00	DRYER	2	
**	3	RECEPTACLES - KITCHEN	1.50		2			4	
**	5	REFRIGERATOR	1.20		20	1.50	WASHER	6	**
**	7	MICROWAVE/HOOD	1.20			1.20	RECEPTACLES/ LIGHTING	8	*
**	9	DISHWASHER/DISPOSAL	1.20	20		1.20	RECEPTACLES/ LIGHTING	10	*
	11	RANGE	8.00	50	20	1.20	RECEPTACLES/ LIGHTING	12	*
	13			2	30	5.00	WATER HEATER	14	
	15	BATH RECEPTACLE	.18	20	2			16	
*	17	RECEPTACLES/ LIGHTING	1.20		30	4.60	HP-3A/3B	18	
*	19	RECEPTACLES/ LIGHTING	1.20		2			20	
*	21	ERV-2	.16	20	30	1.00	EWH-2	22	
	23	SPACE			2			24	
	25	SPACE			20	1.00	EWH-1(2)	26	*
1	27	TVSS		30	20		SPARE	28	*
	29			2	20		SPARE	30	*

REMARKS: .

CONNECTED LOAD: 39.0 KVA 163 AMPS
DEMAND LOAD: 19.4 KVA 81 AMPS

* PROVIDE AFCI RATED CIRCUIT BREAKER.
** PROVIDE AFCI/GFCI RATED CIRCUIT BREAKER.

TYPICAL R1/R2 DWELLING LOAD CALCULATIONS (NEC 220-82B)

Service							Demand Load	
Lighting/Receptacles	1,286	sq.ft.	x	3	VA	=	3.86	KVA
Kitchen Receptacles	1.50	KVA	x	Qty of	2	=	3.00	KVA
Laundry Receptacles	1.50	KVA	x	Qty of	1	=	1.50	KVA
Range	8.00	KVA	x	Qty of	1	=	8.00	KVA
Dryer	5.00	KVA	x	Qty of	1	=	5.00	KVA
Microwave/Hood	1.20	KVA	x	Qty of	1	=	1.20	KVA
Dishwasher/ Disposal	1.20	KVA	x	Qty of	1	=	1.20	KVA
Refrigerator	1.20	KVA	x	Qty of	1	=	1.20	KVA
Portable AC Unit	1.20	KVA	x	Qty of	1	=	1.20	KVA
				Total			**26.16**	**KVA**
	(Subtract 100% of First 10.00 KVA)					-	10.00	KVA
							16.16	KVA
				(Subtract 40%)		x	40	%
							6.46	KVA
	(Addition 100% of First 10.00 KVA)						10.00	KVA
							16.46	KVA
				Heat Pump/ Heat Recovery Unit		=	2.95	KVA
				Total			**19.41**	**KVA**
							80.9	**Amps**
							@ 120/240V, 1PH	

ELECTRICAL NOTES:

1 PLUG-ON, BUSS STYLE, TVSS UNIT.
SIEMENS #QSPD-2-A-065P OR EQUAL.

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PHASE 2

PANEL SCHEDULES
E402

SCALE
AS NOTED

PARKS FILE#

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SHEET __ OF XX

CONDUIT AND CONDUCTOR SCHEDULE - EXISTING PHASE 1 WORK COMPLETED

	CIRCUIT ID	CONDUIT NO.	CONDUIT SIZE	CONDUIT TYPE	CONDUCTORS PER CONDUIT NO.	CONDUCTORS PER CONDUIT SIZE	CONDUCTORS PER CONDUIT TYPE	FROM	TO	REMARKS
	RCC1	1	2"	PVC	-	-	-	(E)PEDESTAL - RAINIER CONNECT	CH1	
	RCC2	2	2"	PVC	-	-	-	CH1	COMMUNICATIONS DEMARCATION CABINET	
2 3	WCS1	4	2"	PVC	-	-	-	STUB LOCATION SHEET E101 - PHASE 1	CV1	
	WCS2	2	2"	PVC	-	-	-	CV1	STUB LOCATION SHEET E101 - PHASE 1	FUTURE MBR
3	WCS3	1	1"	PVC	-	-	-	CV1	LIGHT POLE #1 SHEET E101 - PHASE 1	
2 3	WCS4	4	2"	PVC	-	-	-	CV1	CH3	
3	WCS5	1	1"	PVC	-	-	-	CV1	LIGHT POLE #2 SHEET E102 - PHASE 1	
2	WCS6	4	2"	PVC	-	-	-	CH3	CH2	
	WCS7	1	2"	PVC	-	-	-	CH2	FUTURE HOST CAMPSITE	
2	WCS8	4	2"	PVC	-	-	-	CH2	COMMUNICATIONS DEMARCATION CABINET	
	WCS9	1	2"	PVC	-	-	-	COMMUNICATIONS DEMARCATION CABINET	OHOP POWER POLE	
	WCS10	1	2"	PVC	-	-	-	STUB LOCATION E101 - PHASE 1	STUB LOCATION E101 - PHASE 1	FUTURE MAINT. BLDG EXPANS.
	WCS11	2	4"	PVC	-	-	-	COMMUNICATIONS DEMARCATION CABINET	STUB LOCATION SHEET E103 - PHASE 1	
	WCS12	1	4"	PVC	-	-	-	CV1	WELL STUB SHEET E101 - PHASE 1	
	WCS13	2	2"	PVC	-	-	-	COMMUNICATIONS DEMARCATION CABINET	STUB LOCATION SHEET E103 - PHASE 1	
	OM1	1	4"	PVC/GRS	-	-	-	(E)OHOP UTILITY POLE	OHOP UTILITY TRANSFORMER	
	WP1	4	4"	PVC	4	500	AL	OHOP TRANSFORMER	MDP	
	WP2	1	2"	EMT	4/1	3/0/4	CU	MDP	PANEL 2M1	
	WP3	1	1"	PVC	3/1	10/10	CU	PANEL 2M1	LIGHT POLE #1 AND CAMERA	
	WP4	1	1"	PVC	3/1	10/10	CU	PANEL 2M1	PV1	
	WP5	1	1"	PVC	3/1	10/10	CU	PV1	LIGHT POLE #2 AND CAMERA	
	WPS1	2	4"	PVC	-	-	-	MDP	MBR STUB SHEET E101 - PHASE 1	
	WPS2	1	2"	PVC	-	-	-	MDP	FUTURE COMPACTOR SHEET E101 - PHASE 1	
	WPS3	3	4"	PVC	-	-	-	MDP	FUTURE MAINTENANCE SHEET E301 - PHASE 1	
	WPS4	1	2"	PVC	-	-	-	MDP	PV1	
	WPS5	4	2"	PVC	-	-	-	MDP	PV1	
	WPS6	1	2"	PVC	-	-	-	PANEL 2M1	PV1	
	WPS7	2	2"	PVC	-	-	-	PV1	PH1	
	WPS8	1	2"	PVC	-	-	-	PH1	FUTURE HOST CAMPSITE	
	WPS9	2	4"	PVC	-	-	-	MDP	PV1	
	WPS10	2	4"	PVC	-	-	-	MDP	FUTURE ADMIN SHEET E101 - PHASE 1	
	WPS11	2	4"	PVC	-	-	-	OHOP TRANSFORMER	MDP	
	WPS12	1	4"	PVC	-	-	-	MDP	WELL STUB SHEET E101 - PHASE 1	
	WPS13	2	2"	PVC	-	-	-	OHOP TRANSFORMER	STUB LOCATION SHEET E103 - PHASE 1	

SCHEDULE ABBREVIATION LEGEND:

RCC	=	RAINIER CONNECT COMMUNICATIONS CONDUIT
WC	=	WASHINGTON STATE PARKS COMMUNICATIONS CONDUIT
WCS	=	WASHINGTON STATE PARKS SPARE COMMUNICATIONS CONDUIT
WP	=	WASHINGTON STATE PARKS POWER CONDUIT
WPS	=	WASHINGTON STATE PARKS SPARE POWER CONDUIT
OM	=	OHOP MUTUAL MEDIUM VOLTAGE
FOC	=	FIBER OPTIC CABLE
PVC	=	SCHEDULE 40 PVC CONDUIT
GRS	=	GALVANIZED RIGID STEEL CONDUIT
EMT	=	ELECTRICAL METALLIC TUBING
CV	=	COMMUNICATIONS VAULT
CH	=	COMMUNICATIONS HANDHOLE
PV	=	POWER VAULT
PH	=	POWER HANDHOLE
MDP	=	MAIN DISTRIBUTION POWER SWITCHBOARD
SPC	=	SEPTIC PUMP POWER/CONTROLS

NEW WORK NOTES:

1. IN (1) EXISTING 2"C PROVIDE MAXCELL EDGE DETECTABLE INNERDUCT #MXED52223 OR EQUAL.
2. IN (1) CELL OF MAXCELL INNERDUCT PROVIDE (1) OUTSIDE PLANT 24 COUNT, SINGLE MODE, FIBER OPTIC CABLE, CORNING OR EQUAL.
3. IN (1) CELL OF MAXCELL INNERDUCT PROVIDE (1) OUTSIDE PLANT 2 COUNT, SINGLE MODE, FIBER OPTIC CABLE, CORNING OR EQUAL.

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CAD NO.

NO.	REVISIONS	INT.	APP.	DATE

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DESIGNED	GLW	12-16-22
DRAWN	JAE	12-16-22
CHECKED (FIELD)		
CHECKED (HDQTS.)		

STEVEN L. HUBBS STATE OF WASHINGTON 0029060 REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 2

CONDUIT AND CONDUCTOR SCHEDULE E501

SCALE

AS NOTED

PARKS FILE#

CROSS ENGINEERS, INC
923 MLK Jr. Way
Tacoma, WA 98405
info@crossengineers.com
Phone: (253) 759-0118
Job Number: 20-119

CONDUIT AND CONDUCTOR SCHEDULE

CIRCUIT ID	CONDUIT			CONDUCTORS PER CONDUIT			FROM	TO	REMARKS
	NO.	SIZE	TYPE	NO.	SIZE	TYPE			
OM2	2	3"	PVC	-	-	-	OMV1	OMV2	(2)
OM3	2	3"	PVC	-	-	-	OMV2	OMV3	(2)
OM4	1	3"	PVC	-	-	-	OMV3	RESIDENCE #1 OHOP METER	(2)
OM5	1	3"	PVC	-	-	-	OMV3	RESIDENCE #2 OHOP METER	(2)
RCC3	2	2"	PVC	-	-	-	(E)COMM. DEMARC. CAB. - SEE SHEET E103	RCV1	(1)
RCC4	2	2"	PVC	-	-	-	RCV1	RCV2	(1)
RCC5	2	2"	PVC	-	-	-	RCV2	RCV3	(1)
RCC6	1	2"	PVC	-	-	-	RCV3	RESIDENCE 1	(1)
RCC7	1	2"	PVC	-	-	-	RCV3	RESIDENCE 2	(1)
SPC1	1	1"	PVC/GRS	4/1	8/10	CU	PUMP CONTROL PANEL	WET WELL	
SPC2	1	1"	PVC/GRS	(5)	(5)	(5)	PUMP CONTROL PANEL	WET WELL	(4)
WP6	1	1"	PVC	2/1	8/10	CU	PANEL 2A1	PH2	
WP6A	1	3/4"	PVC	2/1	8/10	CU	PH2	PH3	
WP6B	1	3/4"	PVC	2/1	8/10	CU	PH3	LIGHT POLE #1	
WP7	1	1"	PVC	4/1	6/10	CU	PANEL 2A1	PH2	
WP7A	1	1"	PVC	4/1	6/10	CU	PH2	EV CHARGING STATION	
WP8	1	1"	PVC	3/1	8/10	CU	PANEL 2A1	PH2	
WP8A	1	1"	PVC	3/1	8/10	CU	PH2	PH3	
WP8B	1	1"	PVC	3/1	8/10	CU	PH3	GATE CONTROLLER	
WP9	1	1"	PVC	2/1	8/10	CU	PH2	PH4	
WP9A	1	1"	PVC	2/1	8/10	CU	PH4	LIGHT POLE #2	
WP9B	1	1"	PVC	2/1	8/10	CU	PH3	PH5	
WP9C	1	1"	PVC	2/1	8/10	CU	PH5	LIGHT POLE #3	
WP10	1	2"	PVC	2/1	6/10	CU	TRANS. DISCONNECT ELECTRICAL ROOM	PH2	
WP11	1	2-1/2"	PVC/GRS	4/1	0000/6	CU	PH8	PANEL 2WH (WELL HOUSE)	
WP12	1	1"	PVC	2/1	10/10	CU	PANEL 2A1	PH2	
WP13	1	1"	PVC	2/1	10/10	CU	PH2	DISCOVERY PASS KIOSK	
WPS8	1	2"	PVC	-	-	-	(E)PH1	(E)STUBBED LOCATION - SHEET E103 - PHASE 1	(7)
WPS9	2	4"	PVC	4/1	600/2	CU	(E)MDP - PHASE 1	(E)PV1 - PHASE 1	(6)
WPS10	2	4"	PVC	4/1	600/2	CU	(E)PV1 - PHASE 1	ADMIN. BUILDING PANEL 2A1	(5)
WPS11	2	4"	PVC	-	-	-	(E)OHOP UTILITY TRANSFORMER	(E)MDP - PHASE 1	(3)
WPS12	1	4"	PVC	-	-	-	(E)MDP	(E)STUBBED LOCATION - SHEET E103 - PHASE 1	(6)
WPS13	2	2"	PVC	-	-	-	(E)OHOP UTILITY TRANSFORMER	(E)STUBBED LOCATION - SHEET E103 - PHASE 1	(8)
WPS14	1	2"	PVC	-	-	-	PH6	PH7	
WPS15	1	2"	PVC	-	-	-	PH7	STUB LOCATION - SHEET E103	
WPS16	1	1"	PVC	-	-	-	PANEL 2A1	PH2	
WPS17	1	1"	PVC	-	-	-	PH2	STUB LOCATION - SHEET E102	
WC1	1	1"	PVC	-	-	-	COMMUNICATIONS ROOM	CH5	
WC1A	1	1"	PVC	-	-	-	CH5	CH6	
WC1B	1	1"	PVC	-	-	-	CH5	CH7	
WC1C	1	1"	PVC	-	-	-	CH5	CH8	
WC2	2	2"	PVC	-	-	-	COMMUNICATIONS ROOM	CH5	(9)
WC2A	1	1"	PVC	-	-	-	CH6	LIGHT POLE #1	
WC2B	1	1"	PVC	-	-	-	CH7	LIGHT POLE #2	
WC2C	1	1"	PVC	-	-	-	CH8	LIGHT POLE #3	
WC3	1	1"	PVC	-	-	-	CH5	GATE CONTROLLER	
WC4	1	1"	PVC	-	-	-	GATE CONTROLLER	GATE CONTROLLER - KEYPAD	
WC5	1	1"	PVC	-	-	-	GATE CONTROLLER	GATE OPENING SENSOR	
WC6	1	2"	PVC	-	-	-	CH11	WELL HOUSE	
WC7	1	2"	PVC	-	-	-	CH9	CH10	
WC8	1	2"	PVC	-	-	-	CH10	CV3	
WC9	1	2"	PVC	-	-	-	CV3	CV4	
WC10	1	2"	PVC	-	-	-	CV4	STAFF RESIDENCE PARKS COMMUNICATIONS BOX	
WC11	1	2"	PVC	-	-	-	CV4	STAFF RESIDENCE PARKS COMMUNICATIONS BOX	
WC12	1	1"	PVC	-	-	-	COMMUNICATIONS ROOM	CH5	
WC13	1	1"	PVC	-	-	-	CH5	DISCOVER PASS KIOSK	
WCS1	4	2"	PVC	-	-	-	ADMIN. BUILDING	(E)CV1	(10)
WCS7	1	2"	PVC	-	-	-	(E)CH2	(E)STUBBED LOCATION - SHEET E103 - PHASE 1	(12)
WCS10	1	2"	PVC	-	-	-	ADMIN. BUILDING	(E)STUB LOCATION TO MAINTENANCE SHEET E101	(10)
WCS12	1	4"	PVC	-	-	-	(E)CV1	(E)STUB LOCATION - SHEET E101	(11)
WCS13	1	2"	PVC	-	-	-	CH10	(E)STUB LOCATION - SHEET E103	

SCHEDULE ABBREVIATION LEGEND:

RCC = RAINIER CONNECT COMMUNICATIONS CONDUIT

WC = WASHINGTON STATE PARKS COMMUNICATIONS CONDUIT

WCS = WASHINGTON STATE PARKS SPARE COMMUNICATIONS CONDUIT

WP = WASHINGTON STATE PARKS POWER CONDUIT

WPS = WASHINGTON STATE PARKS SPARE POWER CONDUIT

OM = OHOP MUTUAL MEDIUM VOLTAGE

FOC = FIBER OPTIC CABLE

PVC = SCHEDULE 40 PVC CONDUIT

GRS = GALVANIZED RIGID STEEL CONDUIT

EMT = ELECTRICAL METALLIC TUBING

CV = COMMUNICATIONS VAULT

CH = COMMUNICATIONS HANDHOLE

PV = POWER VAULT

PH = POWER HANDHOLE

MDP = MAIN DISTRIBUTION POWER SWITCHBOARD

SPC = SEPTIC PUMP POWER/CONTROLS

SCHEDULE NOTES:

(1) COMMUNICATIONS CABLE BY RAINIER CONNECT.

(2) SECONDARY CABLING PROVIDED/INSTALLED BY OHOP.

(3) SECONDARY CONDUCTORS FROM OHOP PADMOUNT TRANSFORMER TO UTILITY METER BY OHOP UTILITY.

(4) FLOAT CONTROLS WIRING PER MANUFACTURERS REQUIREMENTS.

(5) EXTENSION OF EXISTING CONDUITS STUBBED AND CAPPED IN PHASE 1 TO NEW ADMINISTRATION BUILDING ELECTRICAL/MECHANICAL ROOM. PROVIDE NEW POWER WIRING IN ONE(1) EXISTING CONDUIT FOR CONNECTION TO PANEL 2A1 AS PART OF THIS PHASE.

(6) EXTENSION OF EXISTING CONDUIT STUBBED AND CAPPED IN PHASE 1 TO NEW POWER HANDHOLE PH8. PROVIDE NEW POWER WIRING (4)#4/0 CU & (1)#6 CU GRD IN EXISTING CONDUIT AS PART OF THIS PHASE.

(7) EXTENSION OF EXISTING CONDUIT STUBBED AND CAPPED IN PHASE 1 TO NEW POWER HANDHOLE PH6.

(8) EXTENSION OF EXISTING CONDUIT STUBBED AND CAPPED IN PHASE 1 TO NEW OHOP MUTUAL VAULT OMV1.

(9) PROVIDE (1) 3-CELL, EDGE DETECTABLE INNERDUCT IN (1)2" CONDUIT. MAXCELL #MXED52223 OR EQUAL.

(10) EXTENSION OF EXISTING CONDUITS STUBBED AND CAPPED IN PHASE 1 TO NEW ADMINISTRATION BUILDING DATA/MDF ROOM. PROVIDE NEW WIRING IN EXISTING CONDUIT AS PART OF THIS PHASE.

(11) EXTENSION OF EXISTING CONDUITS STUBBED AND CAPPED IN PHASE 1 TO NEW COMMUNICATIONS HANDHOLE CH11. PROVIDE NEW WIRING IN EXISTING CONDUIT AS PART OF THIS PHASE.

(12) EXTENSION OF EXISTING CONDUITS STUBBED AND CAPPED IN PHASE 1 TO NEW COMMUNICATIONS HANDHOLE CH9.

ALREADY CONSTRUCTED - FOR CONTRACTOR INFORMATION ONLY

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Info@crossengineers.com
Phone: (253) 759-0118
Job Number: 20-119

SHEET __ OF XX

CAD NO.

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DRAWN	JAE	12-16-22
CHECKED (FIELD)		
CHECKED (HDQTS.)		

STEVEN L. HUBBS STATE OF WASHINGTON 29060 REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 2

CONDUIT AND CONDUCTOR SCHEDULE
E502

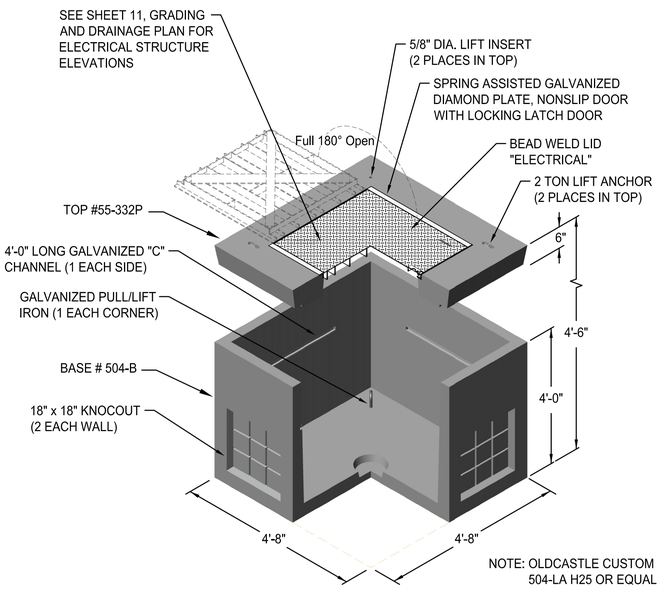
SCALE
AS NOTED

PARKS FILE#

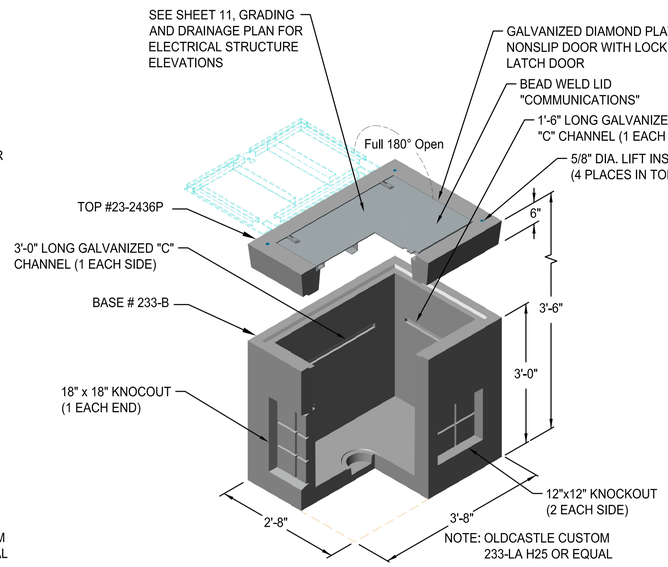
VAULT AND HANDHOLE SCHEDULE			
ID	DESCRIPTION	LOADING	NOTES
OMV1,2	CUSTOM POWER VAULTS, SEE DETAIL A, THIS SHEET	MINIMUM H25	1 2 3 4 5 6
CV3,4	CUSTOM COMMUNICATION VAULTS SEE DETAIL B, THIS SHEET	MINIMUM H25	1 2 3 4 5 6
PH2,3,4,5,6,7,8	CUSTOM POWER HANDHOLE, SEE DETAIL C, THIS SHEET	MINIMUM H25	1 2 3 4 5 6
RCV1,2,3 CH5,6,7,8,9,10,11	CUSTOM COMMUNICATIONS HANDHOLE, SEE DETAIL C, THIS SHEET	MINIMUM H25	1 2 3 4 5 6

VAULT SCHEDULE NOTES:

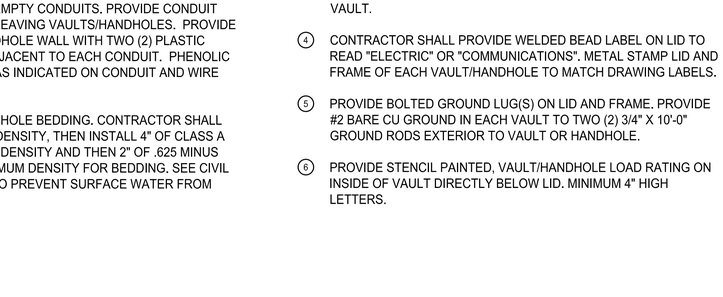
1. ALL CONDUITS ENTERING OR LEAVING VAULTS SHALL USE BLOCK-OUTS WITH BELL ENDS AND GROUTED. PROVIDE REMOVABLE FOAM FILL IN ALL EMPTY CONDUIT OPENINGS. PROVIDE PULL STRINGS IN ALL EMPTY CONDUITS. PROVIDE CONDUIT LABELS FOR ALL CONDUITS ENTERING AND LEAVING VAULTS/HANDHOLES. PROVIDE PHENOLIC LABEL ATTACHED TO VAULT/HANDHOLE WALL WITH TWO (2) PLASTIC INSERTS AND STAINLESS STEEL SCREWS ADJACENT TO EACH CONDUIT. PHENOLIC LABEL SHALL HAVE CONDUIT ID ENGRAVED AS INDICATED ON CONDUIT AND WIRE SCHEDULE DRAWINGS.
2. POWER AND COMMUNICATIONS VAULT/HANDHOLE BEDDING. CONTRACTOR SHALL COMPACT SUBGRADE TO 95% OF MAXIMUM DENSITY, THEN INSTALL 4" OF CLASS A BACKFILL COMPACTED TO 95% OF MAXIMUM DENSITY AND THEN 2" OF .625 MINUS CRUSHED ROCK COMPACTED TO 100% MAXIMUM DENSITY FOR BEDDING. SEE CIVIL AND SLOPE ALL GRADES AWAY FROM LIDS TO PREVENT SURFACE WATER FROM ENTERING VAULT.
3. ALL WIRE (POWER AND COMMUNICATIONS) SHALL COMPLETELY LOOP AROUND VAULT/HANDHOLE WALLS PRIOR TO EXITING VAULT.
4. CONTRACTOR SHALL PROVIDE WELDED BEAD LABEL ON LID TO READ "ELECTRIC" OR "COMMUNICATIONS". METAL STAMP LID AND FRAME OF EACH VAULT/HANDHOLE TO MATCH DRAWING LABELS.
5. PROVIDE BOLTED GROUND LUG(S) ON LID AND FRAME. PROVIDE #2 BARE CU GROUND IN EACH VAULT TO TWO (2) 3/4" X 10'-0" GROUND RODS EXTERIOR TO VAULT OR HANDHOLE.
6. PROVIDE STENCIL PAINTED, VAULT/HANDHOLE LOAD RATING ON INSIDE OF VAULT DIRECTLY BELOW LID. MINIMUM 4" HIGH LETTERS.



A E601 **POWER VAULT**
NO SCALE



B E601 **COMMUNICATIONS VAULT**
NO SCALE



C E601 **POWER/COMMUNICATIONS HANDHOLE**
NOT TO SCALE

ALREADY CONSTRUCTED - FOR CONTRACTOR INFORMATION ONLY

CROSS ENGINEERS, INC
923 MLK Jr. Way
Tacoma, WA 98405
info@crossengineers.com
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STEVEN L. HUBBS STATE OF WASHINGTON 0029060 REGISTERED PROFESSIONAL ENGINEER

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WASHINGTON STATE PARKS AND RECREATION COMMISSION

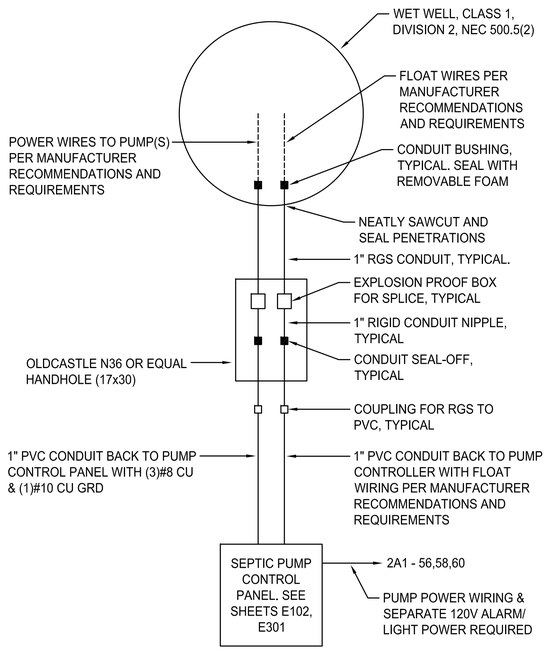
NISQUALLY STATE PARK

PHASE 2

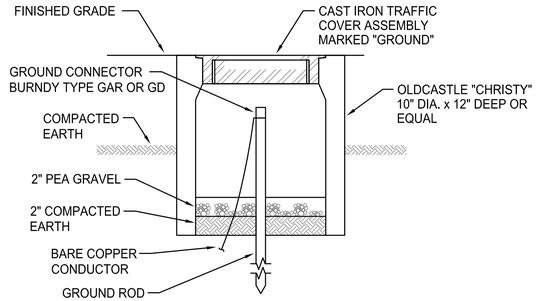
ELECTRICAL SITE DETAILS E601

SCALE
AS NOTED

PARKS FILE#

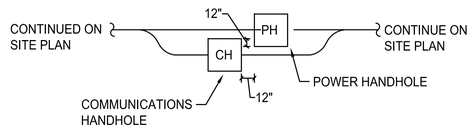


A E603 **WET WELL ELECTRICAL CONNECTION**
NO SCALE

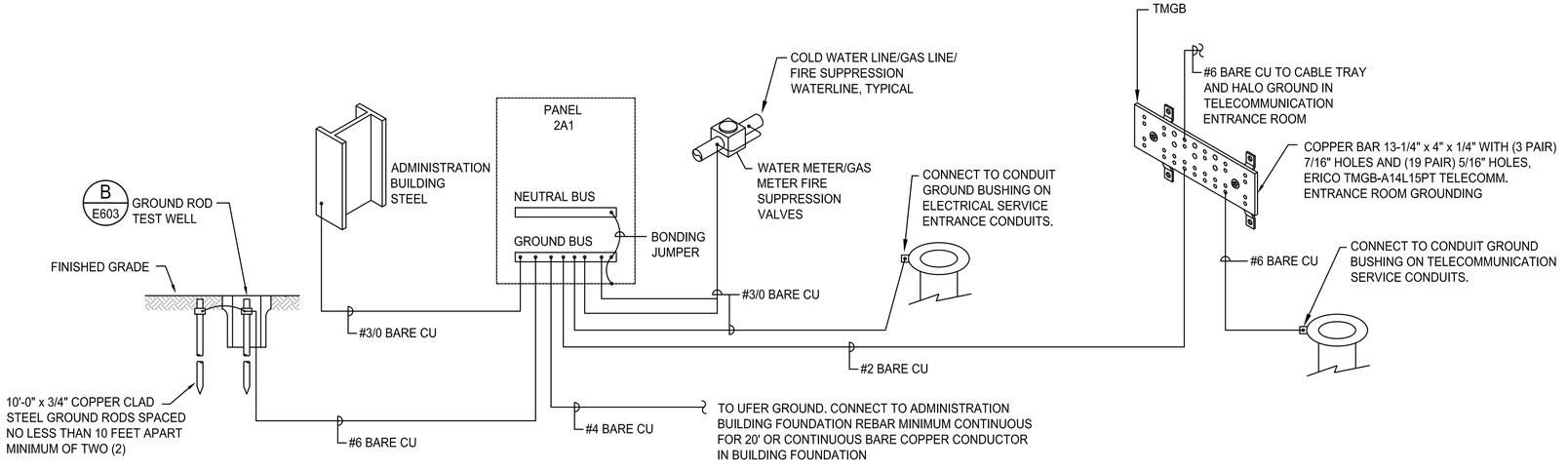


B E603 **GROUND ROD TEST WELL**
NO SCALE

NOTES:
1. MINIMUM HANDHOLE SEPARATION SHALL BE 12".
2. SLOPE GRADE TO DRAIN AWAY FROM HANDHOLE.
3. TAC WELD COVER TO FRAME ON EACH NON HINGED COVER SIDE.
4. POWER OR COMM. CABLES SHALL HAVE A MINIMUM 360 DEGREE WRAP AROUND HANDHOLE PRIOR TO EXITING.



C E603 **TYPICAL HANDHOLE INSTALLATION**
NOT TO SCALE



ADMINISTRATION BUILDING SERVICE GROUNDING TYPICAL
NO SCALE

ALREADY CONSTRUCTED - FOR CONTRACTOR INFORMATION ONLY

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REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 2

ELECTRICAL DETAILS E603

SCALE
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PARKS FILE#

CROSS ENGINEERS, INC
923 MLK Jr. Way
Tacoma, WA 98405
info@crossengineers.com
Phone: (253) 759-0118
Job Number: 20-119

SHEET __ OF XX

NISQUALLY STATE PARK
LEAD ASSESSMENT OF BORROW PIT

Conducted On:
NISQUALLY STATE PARK BORROW PIT
LATITUDE: 46.861251, LONGITUDE: -122.321474
MASHEL PRAIRIE ROAD
EATONVILLE, WASHINGTON 98328

MARCH 7, 2023
PROJECT NUMBER: 0223-03

Prepared for:
RWD | LANDSCAPE ARCHITECTS
BOB DROLL, PLA, ASLA, PRESIDENT
4405 7TH AVENUE SE, SUITE 203
LACEY, WA 98503
O: 360.456.3813 | C: 360.481.6479
BOB@RWDROLL.COM

AND

WASHINGTON STATE PARKS
1111 ISRAEL ROAD SW
TUMWATER, WA 98501-6512

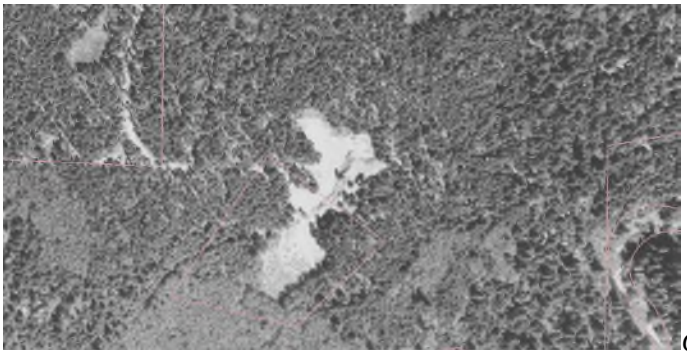
Prepared by:
ADESA, LLC
197 Central Avenue E
Tenino, WA 98589

Assessment Summary

ADESA has completed the preliminary lead assessment of a borrow pit located at approximate latitude: 46.861251 and longitude: -122.321474 within Nisqually State Park, Mashel Prairie Road, Eatonville, Washington 98328. The borrow pit is an approximately 1.58-acre (68,758.85 SF) portion of Pierce County Assessor Parcel Number 0416201006 (Subject Property/borrow pit). This assessment is being performed for RWD Landscape Architects and Washington State Parks to aid in the determination regarding the suitability of the material in the borrow pit for use as fill material.

Figure 1.0: Property Location Map

Based on the limited review of aerial photographs, it appears that the borrow pit was first developed circa 1970, possibly in conjunction with the adjoining former town of Eatonville Landfill site (Ecology Facility Site ID No. 85933) to the south beyond a narrow power utility corridor. Aerial photographs of the area suggest that the former landfill was in operation by 1955 or earlier. The landfill is currently undergoing remedial investigation to determine the extent of contaminate impacts to soil and groundwater by Weyerhaeuser and the town of Eatonville.



Gravel Pit and Adjacent Landfill Circa 1970

ADESA Environmental ▪ 197 Central Avenue East ▪ Tenino, WA ▪ 98589
Phone: 360-701-8797 ▪ Email: wrutherford@adesa-wa.com

Prior sampling of the Subject Property occurred in 2021, when GSI Water Solutions, Inc., while performing a remedial investigation on the adjoining former landfill, collected and analyzed one 30-point composite sample of surficial soil from the borrow pit. The sample exhibited a concentration of lead at 6,000 mg/kg, well above the Washington State Department of Ecology MTCA Method A Cleanup Level in soil of 250 mg/kg. Based on the indications that the pit was historically used as a shooting range (spent shells/casings), it was suggested that this was the source of the lead. Elevated levels of lead have also been discovered in the surficial soil of the landfill. The GSI Water Solutions, Inc. results are provided in "Figure 9-2 Soil Analytical Results – ISM" (2021), which is attached in the Appendix.

Due to the similar historical and proposed uses of the Subject Property, the entire area was considered a single Decision Unit (DU).

Pursuant to an inquiry by RWD Landscape Architects, on February 20, 2023, ADESA established a 53 ft (northeast/southwest) by 64.25 ft (northwest/southeast) sampling grid over the 1.58 acre area (Decision Unit 1/DU1), and collected a total of 28 soil samples from grid locations at a depth of 6 inches below the surface ("s" samples collected from every location) and 12 inches below the surface ("d" samples collected from every 4th location). The soil samples were collected using clean, stainless steel hand tools and placed in labeled, laboratory supplied four-ounce glass jars with Teflon-lined lids. All of the soil samples were submitted, under chain of custody, to Libby Environmental Inc. for lead analysis by EPA Method 6020B. **Samples 9s and 18s were destroyed/broken by the laboratory and were consequently not analyzed as part of this assessment.**

The results of the sample analysis and sample location map are presented on the following pages. The results of the assessment are summarized below:

- The average lead concentration calculated for the entire DU was 107.8 mg/kg.
- Lead concentrations in excess of the Washington State Department of Ecology MTCA Method A Cleanup Level for Unrestricted Land Use (250 mg/kg) were detected in samples 8s, 8d and 20s.
- The greatest single lead concentration within the DU was 591.0 mg/kg in sample 20s.
- The lead concentrations discovered in the remaining samples within the DU were below the cleanup level established by Ecology.

Recommendations

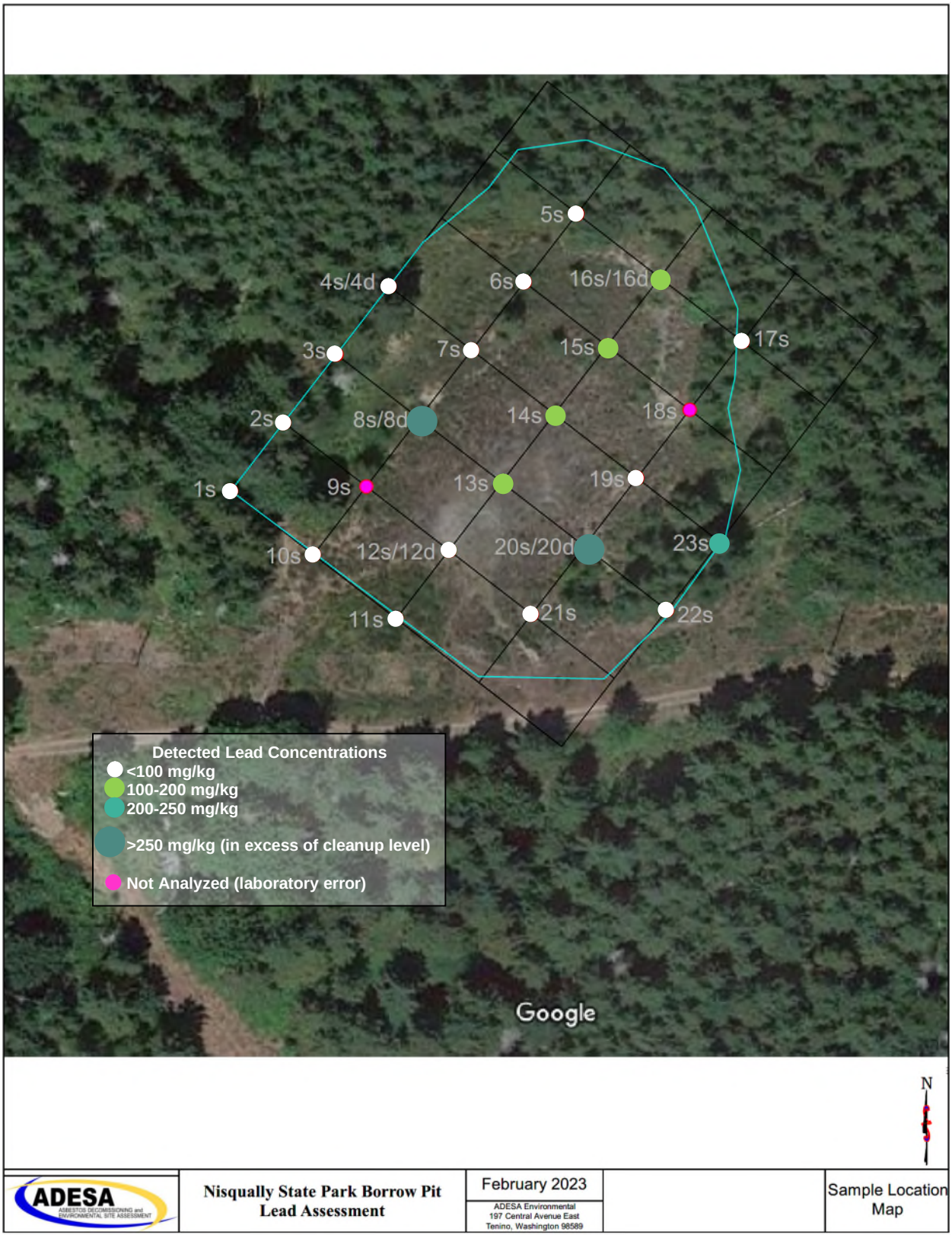
Based on the findings of this assessment ADESA recommends additional sampling to further delineate and characterize the lead impacted areas. The Washington State Department of Ecology should be notified of the findings of this assessment.

ADESA Environmental ▪ 197 Central Avenue East ▪ Tenino, WA ▪ 98589
Phone: 360-701-8797 ▪ Email: wrutherford@adesa-wa.com

Sample ID	Latitude	Longitude	Lead Concentration (mg/kg)	Location ID
1s	46.8612	-122.322	34.50	1
2s	46.8613	-122.322	17.40	2
3s	46.8614	-122.322	6.81	3
4s	46.8615	-122.322	10.90	4
4d	46.8615	-122.322	8.13	4
5s	46.8616	-122.321	6.25	5
6s	46.8615	-122.321	47.40	6
7s	46.8614	-122.322	49.20	7
8s	46.8613	-122.322	266.00	8
8d	46.8613	-122.322	258.00	8
9s	46.8612	-122.322	not analyzed	9
10s	46.8611	-122.322	17.40	10
11s	46.8610	-122.322	16.50	11
12s	46.8611	-122.322	36.00	12
12d	46.8611	-122.322	45.40	12
13s	46.8612	-122.321	190.00	13
14s	46.8613	-122.321	173.00	14
15s	46.8614	-122.321	192.00	15
16s	46.8615	-122.321	185.00	16
16d	46.8615	-122.321	61.00	16
17s	46.8614	-122.321	81.80	17
18s	46.8613	-122.321	not analyzed	18
19s	46.8612	-122.321	18.20	19
20s	46.8611	-122.321	591.00	20
20d	46.8611	-122.321	203.00	20
21s	46.8610	-122.321	25.50	21
22s	46.8610	-122.321	26.50	22
23s	46.8611	-122.321	235.00	23

Results depicted in red represent concentrations in excess of current state cleanup levels. The laboratory documentation is presented in the Appendix.

ADESA Environmental ▪ 197 Central Avenue East ▪ Tenino, WA ▪ 98589
Phone: 360-701-8797 ▪ Email: wrutherford@adesa-wa.com



ADESA Environmental ▪ 197 Central Avenue East ▪ Tenino, WA ▪ 98589
Phone: 360-701-8797 ▪ Email: wrutherford@adesa-wa.com

References

Pierce County Public GIS Online Property Information for Subject Property. March 2023.

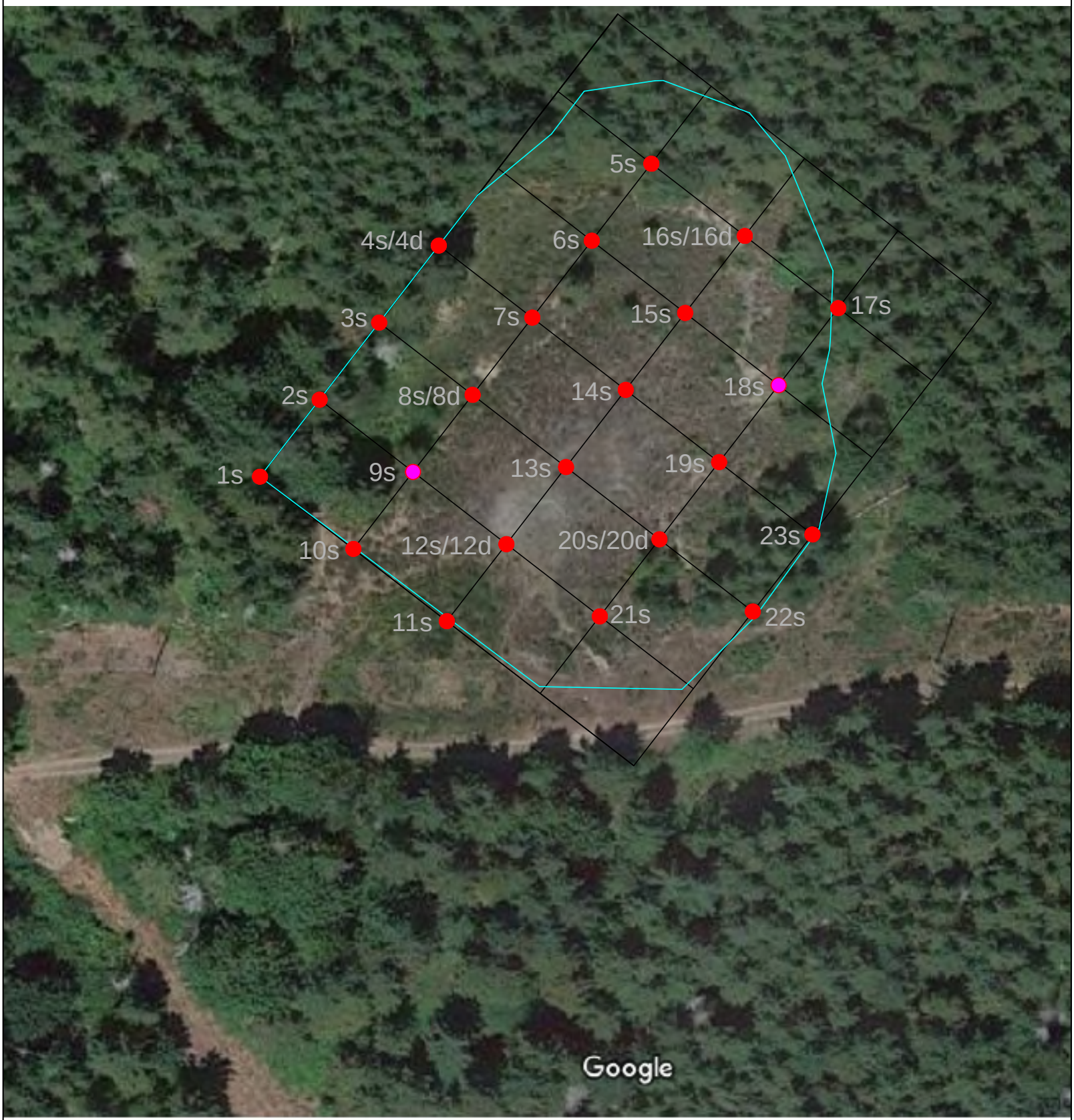
Washington State Department of Ecology. 1995. Guidance on Sampling and Data Analysis Methods – Publication 94-49. January.

Washington State Department of Ecology. Washington Administrative Code 173-340, Washington State Model Toxics Control Act (MTCA). 2013.

Washington State Department of Ecology (WDOE). Washington State Everett and Tacoma Smelter Search Map. https://fortress.wa.gov/ecy/smeltersearch/. February 2023

ADESA Environmental ▪ 197 Central Avenue East ▪ Tenino, WA ▪ 98589
Phone: 360-701-8797 ▪ Email: wrutherford@adesa-wa.com

APPENDIX A
FIGURES



N

ADESA ASBESTOS DECOMISSIONING and ENVIRONMENTAL SITE ASSESSMENT	**Nisqually State Park Borrow Pit Lead Assessment**	February 2023		Sample Location Map
		ADESA Environmental 197 Central Avenue East Tenino, Washington 98589		

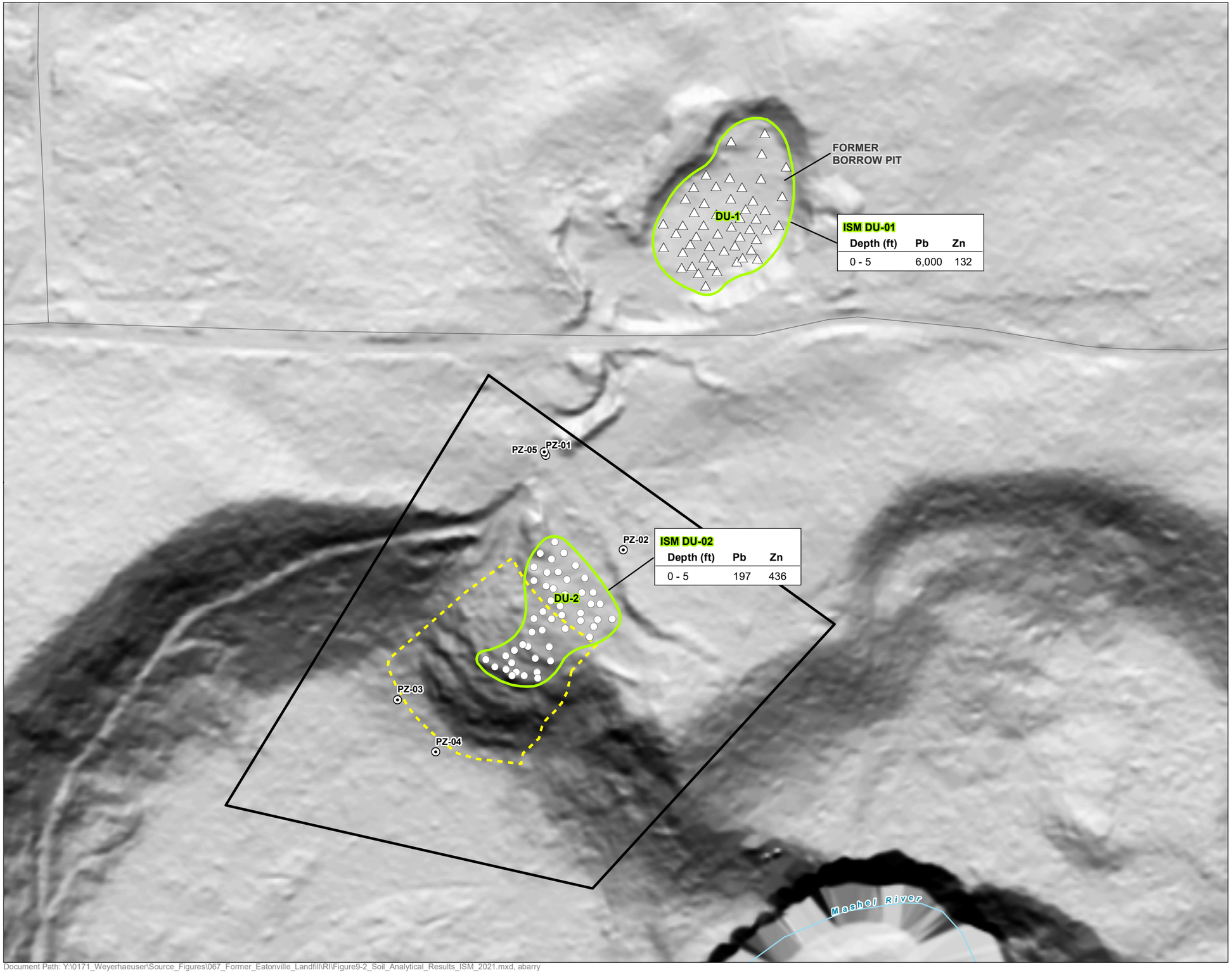


FIGURE 9-2

Soil Analytical Results - ISM (2021)

Remedial Investigation

Former Eatonville Landfill

Eatonville, WA

LEGEND

- Property Boundary
- Location of Former Landfill
- ISM Decision Unit Boundary
- Groundwater Monitoring Well

ISM Sample Locations

- ISM DU-1 (Borrow Pit)
- ISM DU-2 (Historic Landfill Cover)

All Other Features

- Road
- Watercourse

NOTES

1. Site features are approximate.
2. Results are shown in milligrams per kilogram.

Pb: Lead
Zn: Zinc

N

0 80 160
Feet

Date: February 8, 2022
Data Sources: USGS, ESRI, DNR (2011), Pierce Co.

GSI Water Solutions, Inc.

Document Path: Y:\0171_Weyerhaeuser\Source_Figures\067_Former_Eatonville_Landfill\RI\Figure9-2_Soil_Analytical_Results_ISM_2021.mxd, abarry

APPENDIX B
LABORATORY DOCUMENTION

Libby Environmental, Inc.
3322 South Bay Road NE • Olympia, WA 98506-2957

March 3, 2023

William Rutherford
ADESA
P.O. Box 1009
Tenino, WA 98589

Dear William Rutherford:

Please find enclosed the analytical data report for the NSP – Gravel Pit project located in Eatonville, Washington.

The results of the analyses are summarized in the attached tables. Applicable detection limits and QA/QC data are included. The sample(s) will be disposed of within 30 days unless we are contacted to arrange long term storage.

Libby Environmental, Inc. appreciates the opportunity to have provided analytical services for this project. If you have any further questions about the data report, please give me a call. It was a pleasure working with you on this project, and we are looking forward to the next opportunity to work together.

Sincerely,

Sherry L. Chilcutt
Senior Chemist
Libby Environmental, Inc.

Phone (360) 352-2110 • Fax (360) 352-4154 • libbyenv@gmail.com

Libby Environmental, Inc.

3322 South Bay Road NE
Olympia, WA 98506
Ph: 360-352-2110
Fax: 360-352-4154

Chain of Custody Record

www.LibbyEnvironmental.com

Date: 2/21/2023 Page: 1 of 2

Client: ADESA
Address: 197 Central Ave E
City: Tenino State: WA Zip: 98589
Phone: 360-201-8797 Fax:
Client Project # 0223-03

Project Manager: WW Rutherford
Project Name: NSP - Gravel Pit
Location: Eatonville - NSP City, State: Eatonville, WA
Collector: WW Rutherford Date of Collection: 2/20/2023
Email: wrutherford@adesa-wa.com

	Sample Number	Depth	Time	Sample Type	Container Type	VOC 8260	PCE & Daughter Prod.	NWTPH-Gx	BTEX (8260) / (8021)	NWTPH-HCID	NWTPH-Dx / Dx	PCB 8082	MTCA 5 Metals	RCRA 8 Metals	c PAH 8270	PAH 8270	Semi Vol 8270	Lead 6010 6020 or 6200 per Ecology		Field Notes
1	1s	0-6 in			4oz												X			
2	2s	0-6in			↓												X			
3	3s	↓															X			
4	4s	↓															X			
5	4d	6-12in															X			
6	5s	0-6in															X			
7	6s	↓															X			
8	7s	↓															X			
9	8s	↓															X			
10	~~8~~ 8d	6-12in															X			
11	9s	0-6in															X			Unable to perform analysis sample container broke at subcontracted lab.
12	10s	↓															X			
13	11s	↓															X			
14	12s	↓															X			
15	12d	6-12in															X			
16	13s	0-6in															X			
17	14s	↓			↓												X			

Relinquished by:	Date / Time	Received by:	Date / Time
	2/21/23		2.21.23 1218
Relinquished by:	Date / Time	Received by:	Date / Time
Relinquished by:	Date / Time	Received by:	Date / Time

Sample Receipt

Good Condition?	Y	N
Cooler Temp.		°C
Sample Temp.		°C
Total Number of Containers		

Remarks:

TAT: 24HR 48HR 5-DAY

LEGAL ACTION CLAUSE: *In the event of default of payment and/or failure to pay, Client agrees to pay the costs of collection including court costs and reasonable attorney fees to be determined by a court of law.*

Distribution: White - Lab, Yellow - Originator

Libby Environmental, Inc.

3322 South Bay Road NE
Olympia, WA 98506
Ph: 360-352-2110
Fax: 360-352-4154

Chain of Custody Record

www.LibbyEnvironmental.com

Date: 2/21/23 Page: 2 of 2

Client: ADESA
Address: 197 Central Ave E
City: Tenino State: WA Zip: 98589
Phone: 360-701-8797 Fax:
Client Project # 0223-03

Project Manager: WW Rutherford
Project Name: NSP - Gravel Pit
Location: Eatonville - NSP City, State: Eatonville, WA
Collector: WW Rutherford Date of Collection: 2/20/2023
Email: wwrutherford@adesa-wa.com

	Sample Number	Depth	Time	Sample Type	Container Type	VOC 8260	PCE & Daughter Prod.	NWTPH-Gx	BTEX (8260) / (8021)	NWTPH-HCID	NWTPH-Dx / Dx	PCB 8082	MTCA 5 Metals	RCRA 8 Metals	c PAH 8270	PAH 8270	Semi Vol 8270	Lead 6010, 6020 or 6200 per Ecology		Field Notes
1	15s	0-6in															X			
2	16s	↓															X			
3	16d	6-12in															X			
4	17s	0-6in															X			
5	18s	↓															~~X~~			Unable to perform analysis sample container broke at subcontracted lab.
6	19s	↓															X			
7	20s	↓															X			
8	20d	6-12in															X			
9	21s	0-6in															X			
10	22s	↓															X			
11	23s	↓															X			
12																				
13																				
14																				
15																				
16																				
17																				

Relinquished by:	Date / Time	Received by:	Date / Time
[signature]	2/21/23	[signature]	2.21.23 1218
Relinquished by:	Date / Time	Received by:	Date / Time
Relinquished by:	Date / Time	Received by:	Date / Time

Sample Receipt

Good Condition?	Y	N
Cooler Temp.		°C
Sample Temp.		°C
Total Number of Containers		

Remarks:

TAT: 24HR 48HR 6-DAY

LEGAL ACTION CLAUSE: *In the event of default of payment and/or failure to pay, Client agrees to pay the costs of collection including court costs and reasonable attorney fees to be determined by a court of law.*

Distribution: White - Lab, Yellow - Originator

Libby Environmental, Inc.

3322 South Bay Road NE
Olympia, WA 98506
Phone: (360) 352-2110
FAX: (360) 352-4154
Email: libbyenv@gmail.com

NSP - GRAVEL PIT PROJECT
ADESA
Libby Project # L23B086
Date Received 2/21/2023
Time Received 12:18 PM

Received By RJK

Sample Receipt Checklist

Chain of Custody

1. Is the Chain of Custody is complete?	☑ Yes	☐ No	
2. How was the sample delivered?	☑ Hand Delivered	☐ Picked Up	☐ Shipped

Log In

3. Cooler or Shipping Container is present.	☑ Yes	☐ No	☐ N/A
4. Cooler or Shipping Container is in good condition.	☑ Yes	☐ No	☐ N/A
5. Cooler or Shipping Container has Custody Seals present.	☐ Yes	☑ No	☐ N/A
6. Was an attempt made to cool the samples?	☑ Yes	☐ No	☐ N/A
7. Temperature of cooler (0°C to 8°C recommended)	8.2 °C		
8. Temperature of sample(s) (0°C to 8°C recommended)	10.1 °C		
9. Did all containers arrive in good condition (unbroken)?	☑ Yes	☐ No	
10. Is it clear what analyses were requested?	☑ Yes	☐ No	
11. Did container labels match Chain of Custody?	☑ Yes	☐ No	
12. Are matrices correctly identified on Chain of Custody?	☑ Yes	☐ No	
13. Are correct containers used for the analysis indicated?	☑ Yes	☐ No	
14. Is there sufficient sample volume for indicated analysis?	☑ Yes	☐ No	
15. Were all containers properly preserved per each analysis?	☑ Yes	☐ No	
16. Were VOA vials collected correctly (no headspace)?	☐ Yes	☐ No	☑ N/A
17. Were all holding times able to be met?	☑ Yes	☐ No	

Discrepancies/ Notes

18. Was client notified of all discrepancies? ☐ Yes ☐ No ☑ N/A

Person Notified: _____ Date: _____

By Whom: _____ Via: _____

Regarding: _____

19. Comments. _____

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Libby Environmental
Sherry Chilcutt
3322 South Bay Road NE
Olympia, WA 98506

RE: NSP - Gravel Pit
Work Order Number: 2302398

March 03, 2023

Attention Sherry Chilcutt:

Fremont Analytical, Inc. received 28 sample(s) on 2/22/2023 for the analyses presented in the following report.

Sample Moisture (Percent Moisture)
Total Metals by EPA Method 6020B

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *03/03/2023*

CLIENT: Libby Environmental
Project: NSP - Gravel Pit
Work Order: 2302398

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2302398-001	1s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-002	2s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-003	3s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-004	4s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-005	4d	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-006	5s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-007	6s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-008	7s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-009	8s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-010	8d	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-011	9s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-012	10s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-013	11s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-014	12s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-015	12d	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-016	13s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-017	14s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-018	15s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-019	16s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-020	16d	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-021	17s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-022	18s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-023	19s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-024	20s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-025	20d	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-026	21s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-027	22s	02/21/2023 12:00 AM	02/22/2023 10:30 AM
2302398-028	23s	02/21/2023 12:00 AM	02/22/2023 10:30 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2302398**
Date: **3/3/2023**

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2302398**
Date Reported: **3/3/2023**

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-001 **Collection Date:** 2/21/2023
Client Sample ID: **1s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	34.5	0.932		mg/Kg-dry	1	2/27/2023 5:21:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	16.1	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-002 **Collection Date:** 2/21/2023
Client Sample ID: **2s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	17.4	1.05		mg/Kg-dry	1	2/27/2023 5:28:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	23.8	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-003 **Collection Date:** 2/21/2023
Client Sample ID: **3s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	6.81	0.952		mg/Kg-dry	1	2/27/2023 5:30:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	17.9	0.500		wt%	1	2/22/2023 12:15:03 PM

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-004 **Collection Date:** 2/21/2023
Client Sample ID: **4s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	10.9	1.01		mg/Kg-dry	1	2/27/2023 5:32:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	22.9	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-005 **Collection Date:** 2/21/2023
Client Sample ID: **4d** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	8.13	0.962		mg/Kg-dry	1	2/27/2023 5:35:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	18.8	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-006 **Collection Date:** 2/21/2023
Client Sample ID: **5s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	6.25	0.927		mg/Kg-dry	1	2/27/2023 5:37:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	14.4	0.500		wt%	1	2/22/2023 12:15:03 PM

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-007 **Collection Date:** 2/21/2023
Client Sample ID: **6s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	47.4	0.942		mg/Kg-dry	1	2/27/2023 5:39:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	17.1	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-008 **Collection Date:** 2/21/2023
Client Sample ID: **7s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	49.2	0.868		mg/Kg-dry	1	2/27/2023 5:42:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	10.7	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-009 **Collection Date:** 2/21/2023
Client Sample ID: **8s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	266	2.66	D	mg/Kg-dry	10	3/3/2023 2:34:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	9.94	0.500		wt%	1	2/22/2023 12:15:03 PM

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-010 **Collection Date:** 2/21/2023
Client Sample ID: **8d** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39546		Analyst: JR
Lead	258	8.76	D	mg/Kg-dry	10	3/3/2023 2:37:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	8.64	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-012 **Collection Date:** 2/21/2023
Client Sample ID: **10s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	17.4	0.922		mg/Kg-dry	1	2/28/2023 12:24:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	13.9	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-013 **Collection Date:** 2/21/2023
Client Sample ID: **11s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	16.5	0.845		mg/Kg-dry	1	2/28/2023 12:39:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	10.4	0.500		wt%	1	2/22/2023 12:15:03 PM

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-014 **Collection Date:** 2/21/2023
Client Sample ID: **12s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	36.0	0.840		mg/Kg-dry	1	2/28/2023 12:41:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	7.68	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-015 **Collection Date:** 2/21/2023
Client Sample ID: **12d** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	45.4	0.797		mg/Kg-dry	1	2/28/2023 12:43:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	7.69	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-016 **Collection Date:** 2/21/2023
Client Sample ID: **13s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	190	8.73	D	mg/Kg-dry	10	3/1/2023 11:23:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	9.85	0.500		wt%	1	2/22/2023 12:15:03 PM

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-017 **Collection Date:** 2/21/2023
Client Sample ID: **14s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	173	9.30	D	mg/Kg-dry	10	3/1/2023 11:26:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R82018		Analyst: ET
Percent Moisture	14.0	0.500		wt%	1	2/22/2023 12:15:03 PM

Lab ID: 2302398-018 **Collection Date:** 2/21/2023
Client Sample ID: **15s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	192	8.30	D	mg/Kg-dry	10	3/1/2023 11:28:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	10.8	0.500		wt%	1	2/22/2023 1:09:56 PM

Lab ID: 2302398-019 **Collection Date:** 2/21/2023
Client Sample ID: **16s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	185	9.25	D	mg/Kg-dry	10	3/1/2023 11:30:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	14.9	0.500		wt%	1	2/22/2023 1:09:56 PM

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-020 **Collection Date:** 2/21/2023
Client Sample ID: **16d** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	61.0	0.863		mg/Kg-dry	1	2/28/2023 12:58:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	8.75	0.500		wt%	1	2/22/2023 1:09:56 PM

Lab ID: 2302398-021 **Collection Date:** 2/21/2023
Client Sample ID: **17s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	81.8	1.03		mg/Kg-dry	1	2/28/2023 1:00:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	27.3	0.500		wt%	1	2/22/2023 1:09:56 PM

Lab ID: 2302398-023 **Collection Date:** 2/21/2023
Client Sample ID: **19s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	18.2	0.880		mg/Kg-dry	1	2/28/2023 1:02:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	10.6	0.500		wt%	1	2/22/2023 1:09:56 PM

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-024 **Collection Date:** 2/21/2023
Client Sample ID: **20s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	591	8.58	D	mg/Kg-dry	10	3/1/2023 11:33:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	11.7	0.500		wt%	1	2/22/2023 1:09:56 PM

Lab ID: 2302398-025 **Collection Date:** 2/21/2023
Client Sample ID: **20d** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	203	8.81	D	mg/Kg-dry	10	3/1/2023 11:35:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	12.0	0.500		wt%	1	2/22/2023 1:09:56 PM

Lab ID: 2302398-026 **Collection Date:** 2/21/2023
Client Sample ID: **21s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	25.5	1.16		mg/Kg-dry	1	2/28/2023 1:09:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	32.3	0.500		wt%	1	2/22/2023 1:09:56 PM

CLIENT: Libby Environmental
Project: NSP - Gravel Pit

Lab ID: 2302398-027 **Collection Date:** 2/21/2023
Client Sample ID: **22s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	26.5	0.920		mg/Kg-dry	1	2/28/2023 1:11:00 PM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	16.4	0.500		wt%	1	2/22/2023 1:09:56 PM

Lab ID: 2302398-028 **Collection Date:** 2/21/2023
Client Sample ID: **23s** **Matrix:** Soil

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020B				Batch ID: 39565		Analyst: JR
Lead	235	8.40	D	mg/Kg-dry	10	3/1/2023 11:37:00 AM
Sample Moisture (Percent Moisture)				Batch ID: R82022		Analyst: ET
Percent Moisture	11.8	0.500		wt%	1	2/22/2023 1:09:56 PM

Work Order: 2302398
CLIENT: Libby Environmental
Project: NSP - Gravel Pit

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **MB-39546**	SampType: **MBLK**	Units: **mg/Kg**	Prep Date: **2/27/2023**	RunNo: **82118**
Client ID: **MBLKS**	Batch ID: **39546**		Analysis Date: **2/27/2023**	SeqNo: **1704828**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	1.00									

Sample ID: **LCS-39546**	SampType: **LCS**	Units: **mg/Kg**	Prep Date: **2/27/2023**	RunNo: **82118**
Client ID: **LCSS**	Batch ID: **39546**		Analysis Date: **2/27/2023**	SeqNo: **1704829**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	19.0	0.800	20.00	0	95.0	80	120				

Sample ID: **2302441-001AMS**	SampType: **MS**	Units: **mg/Kg-dry**	Prep Date: **2/27/2023**	RunNo: **82118**
Client ID: **BATCH**	Batch ID: **39546**		Analysis Date: **2/27/2023**	SeqNo: **1704832**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	94.3	3.65	91.14	9.634	92.9	75	125				

Sample ID: **2302441-001AMSD**	SampType: **MSD**	Units: **mg/Kg-dry**	Prep Date: **2/27/2023**	RunNo: **82118**
Client ID: **BATCH**	Batch ID: **39546**		Analysis Date: **2/27/2023**	SeqNo: **1704833**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	93.5	3.59	89.78	9.634	93.4	75	125	94.28	0.791	20	

Sample ID: **MB-39565**	SampType: **MBLK**	Units: **mg/Kg**	Prep Date: **2/28/2023**	RunNo: **82137**
Client ID: **MBLKS**	Batch ID: **39565**		Analysis Date: **2/28/2023**	SeqNo: **1705419**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	1.00									

Work Order: 2302398
CLIENT: Libby Environmental
Project: NSP - Gravel Pit

QC SUMMARY REPORT

Total Metals by EPA Method 6020B

Sample ID: **LCS-39565**	SampType: **LCS**			Units: **mg/Kg**		Prep Date: **2/28/2023**			RunNo: **82137**		
Client ID: **LCSS**	Batch ID: **39565**					Analysis Date: **2/28/2023**			SeqNo: **1705420**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	21.1	0.781	19.53	0	108	80	120				

Sample ID: **2302398-012AMS**	SampType: **MS**			Units: **mg/Kg-dry**		Prep Date: **2/28/2023**			RunNo: **82137**		
Client ID: **10s**	Batch ID: **39565**					Analysis Date: **2/28/2023**			SeqNo: **1705425**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	36.6	0.867	21.67	17.40	88.6	75	125				

Sample ID: **2302398-012AMSD**	SampType: **MSD**			Units: **mg/Kg-dry**		Prep Date: **2/28/2023**			RunNo: **82137**		
Client ID: **10s**	Batch ID: **39565**					Analysis Date: **2/28/2023**			SeqNo: **1705426**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	40.1	0.914	22.86	17.40	99.5	75	125	36.59	9.25	20	

Sample Log-In Check List

Client Name:	**LIBBY**	Work Order Number:	**2302398**
Logged by:	**Clare Griggs**	Date Received:	**2/22/2023 10:30:00 AM**

Chain of Custody

1.	Is Chain of Custody complete?	Yes	☑	No ☐	Not Present	☐
2.	How was the sample delivered?	UPS				

Log In

3.	Coolers are present?	Yes	☑	No ☐	NA	☐
4.	Shipping container/cooler in good condition?	Yes	☑	No ☐		
5.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes	☐	No ☐	Not Present	☑
6.	Was an attempt made to cool the samples?	Yes	☑	No ☐	NA	☐
7.	Were all items received at a temperature of >2°C to 6°C *	Yes	☑	No ☐	NA	☐
8.	Sample(s) in proper container(s)?	Yes	☑	No ☐		
9.	Sufficient sample volume for indicated test(s)?	Yes	☑	No ☐		
10.	Are samples properly preserved?	Yes	☑	No ☐		
11.	Was preservative added to bottles?	Yes	☐	No ☑	NA	☐
12.	Is there headspace in the VOA vials?	Yes	☐	No ☐	NA	☑
13.	Did all samples containers arrive in good condition(unbroken)?	Yes	☑	No ☐		
14.	Does paperwork match bottle labels?	Yes	☑	No ☐		
15.	Are matrices correctly identified on Chain of Custody?	Yes	☑	No ☐		
16.	Is it clear what analyses were requested?	Yes	☑	No ☐		
17.	Were all holding times able to be met?	Yes	☑	No ☐		

Special Handling (if applicable)

18.	Was client notified of all discrepancies with this order?	Yes	☑	No ☐	NA	☐

Person Notified:	Emily Bushlen	Date:	2/23/2023
By Whom:	Brianna Barnes	Via:	☑ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:	Volume was spilled for 9s and 18s before analysis was started.		
Client Instructions:	Proceed with other samples.		

19. Additional remarks:

Item Information

Item #	Temp °C
Sample	2.1

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Libby Environmental, Inc.

3322 South Bay Road NE • Olympia, WA 98506-2957

SUBCONTRACT ORDER L23B086

Sending Laboratory:

Libby Environmental, Inc.
3322 South Bay Road NE
Olympia, WA 98506
Phone: 360-352-2110
Fax: 360-352-4154

Project Manager: Sherry Chilcutt
LibbyEnv@gmail.com

Subcontracted Laboratory: 2302398

Fremont Analytical, Inc.
3600 Fremont Ave N
Seattle, WA 98103
Phone: (206) 352-3790
Fax:

Requested Turnaround (TAT) STD

Project: NSP - Gravel Pit

Analysis	Comments
Client Sample ID: 1s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-01
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 2s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-02
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 3s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-03
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 4s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-04
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 4d ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-05
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 5s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-06
Metals SUB Pb	6000 Series
Containers Supplied:	

Released By — Date: 2.21.23

Received By — Date: 2/22/23 10:30

2.21.23

Libby Environmental, Inc.
3322 South Bay Road NE • Olympia, WA 98506-2957

SUBCONTRACT ORDER L23B086
(Continued)

Project: NSP - Gravel Pit

2302398

Analysis	Comments
Client Sample ID: 6s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-07
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 7s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-08
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 8s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-09
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 8d ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-10
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 9s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-11
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 10s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-12
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 11s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-13
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 12s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-14
Metals SUB Pb	6000 Series
Containers Supplied:	

Released By	Date	Received By	Date
	2.21.23		2/22/23 10:30

Project: NSP - Gravel Pit

2302398

Analysis	Comments
Client Sample ID: 12d ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-15
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 13s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-16
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 14s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-17
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 15s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-18
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 16s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-19
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 16d ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-20
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 17s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-21
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 18s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-22
Metals SUB Pb	6000 Series
Containers Supplied:	

Released By — Date: 2-21-23 — Received By — Date: 2/22/23 10:30

Libby Environmental, Inc.

3322 South Bay Road NE • Olympia, WA 98506-2957

SUBCONTRACT ORDER L23B086 (Continued)

Project: NSP - Gravel Pit

2302398

Analysis	Comments
Client Sample ID: 19s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-23
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 20s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-24
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 20d ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-25
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 21s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-26
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 22s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-27
Metals SUB Pb	6000 Series
Containers Supplied:	
Client Sample ID: 23s ***Soil Sampled: 02/21/2023 00:00***	Lab ID: L23B086-28
Metals SUB Pb	6000 Series
Containers Supplied:	

Released By — Date: 2.21.23

Received By — Date: 2/22/23 10:30

For Earth, For Life

Kubota

Revised Budgetary Proposal for

Nisqually State Park WWTP

Washington

Kubota

Membrane Bioreactor System

December 18, 2024

Prepared By:

Kubota Membrane USA
11807 North Creek Parkway S., Suite B-109
Bothell, WA 98011
425-898-2858

Local Representation By:

Goble Sampson Associates, Inc.
Doug Allie
206-999-8436
dallie@goblesampson.com

December 18, 2024

For Earth, For Life
Kubota

Brian Bunker
Parametrix
360 620-0093
1019 39th Avenue SE,
Suite 100
Puyallup, WA 98374

I am pleased to present the attached the materials for your consideration regarding the revised proposal for the Kubota membrane bioreactor (MBR) system for the Nisqually State Park WWTP project. Kubota Membrane USA (KMU) is a company with a strong history in the U.S., backed by Kubota Corporation's extensive wastewater experience worldwide. The Kubota MBR system has unique features that will save your client time through simple and reliable operation.

The following revisions have been made to this proposal.

- Budgetary prices have been updated, and are included in the attached proposal.

With the Kubota name comes a long history of excellence in MBR wastewater treatment. We are happy to put you in touch with operators and engineers who can share their experiences with our product. If you have any questions regarding our proposal, please feel free to contact us or our local representative, Doug Allie with Goble Sampson Associates, Inc. at 206-999-8436, or dallie@goblesampson.com.

Regards,

Hiro Kuge.
Technology Manager
KUBOTA Membrane USA Corporation
425-919-3308
hiroo.kuge@kubota.com

Table of Contents

Tables

Figures

1 Introduction

Kubota Membrane USA (KMU) would like to thank you for the opportunity to present the enclosed budgetary proposal to supply a membrane bioreactor (MBR) system and associated components for the Nisqually State Park WWTP project. Included below is an overview of Kubota's Submerged Membrane Unit and the system proposed for this project. A scope of supply and budgetary price are also included.

2 Technology Description

2.1 Membrane Product Information

For this project, we have developed a proposed system design based on Kubota's FS125 Submerged Membrane Unit. The FS series is based largely on Kubota's ES series which was launched in 1991. The FS series adopted all of the features of the ES series with the exception of a shorter diffuser case to reduce the required sidewater depth. This modification was tailored largely to the market in Japan for in-building wastewater treatment systems.

Ideal for smaller facilities and indoor installation, the FS series offers high quality effluent with simple maintenance and operation. Kubota's philosophy of learning from our extensive experience in MBR systems worldwide is one of our greatest advantages, setting us apart from more newly developed membrane manufacturers. A basic overview of the FS series of Submerged Membrane Units and of the Kubota membrane cartridge is included in the figure below.

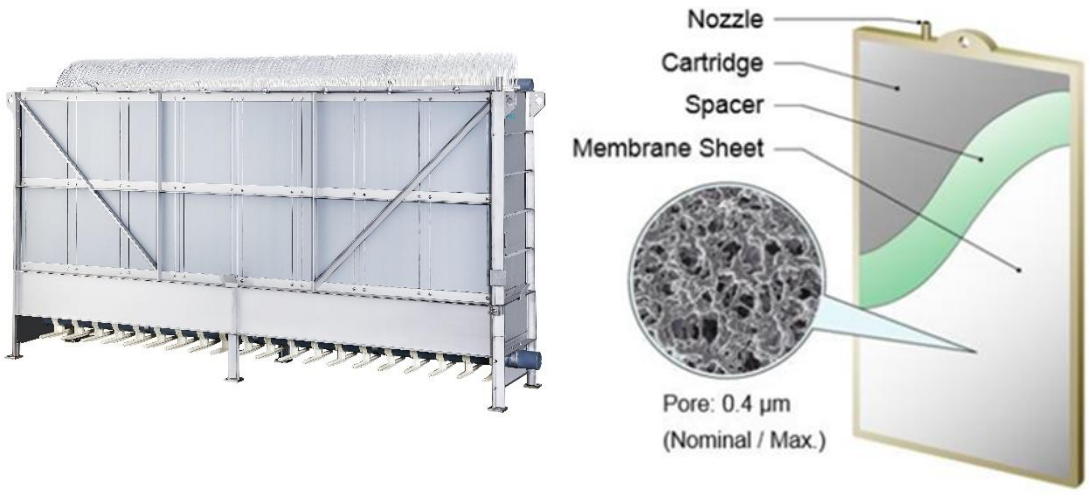


Figure 1: Kubota FS Series (left), and Membrane Cartridge Structure (right)

Kubota's membrane sheet is made from chlorinated polyethylene with an average pore size of 0.2 micron (maximum 0.4 micron). Kubota's membrane is much thicker than other membranes to provide long-lasting durability and features high porosity to enable high flow. This pore size has been designed as the optimum balance between water quality and quantity. Kubota's membrane sheet has Title 22 approval for water reuse in California.

The membrane sheet is welded on an ABS structural panel, and these panels are carefully aligned and spaced within the modules. This structure allows for very efficient self-cleaning from the air supplied by the diffuser. The spacing between each membrane is fixed to avoid uneven aeration and fouling.

Figure 2: Fixed spacing between each membrane cartridge provides efficient air scour

3 Design Overview

3.1 Influent Design Flow

The following flow conditions were used for the preliminary design of the system.

Table 1: Design Flow Conditions

Condition	Design Flow	Unit
Maximum Month Flow (MMF)	11,372	GPD
Peak Hourly Flow (PHF) (assumed)	22,744	GPD

The wastewater characteristics used for the preliminary design are listed in the table below.

Table 2: Influent and Effluent Characteristics

Constituent	Influent Concentrations (Max Month)	Influent Loading (Max Month)	Anticipated Permit Limits
Biological Oxygen Demand (BOD)	532 mg/L	50 lb/d	< 30 mg/L
Total Suspended Solids (TSS)	450 mg/L	43 lb/d	< 30 mg/L
Total Nitrogen (TN)	147 mg/L	14 lb/d	< 10 mg/L

3.2 MBR Specifications

The proposed MBR system is designed to be similar to the Dosewallips WWTP facility, and was designed with the following parameters.

Table 3: Membrane Equipment Specifications

Component	Specifications
Membrane Model	FS125
Membrane Surface Area per Unit	1,076 ft^2 per Unit
Design MLSS at MBR	13,000 mg/L
Number of Membrane Tanks	1 Tank
Total Number of Submerged Membrane Units	2 Units
Minimum Wastewater Temperature in Process Tanks	12°C

3.3 Preliminary Layout

This system design is a near-copy of the current Dosewallips WWTP facility. This keeps the same tank sizes and flow schemes as the Dosewallips facility, but updates the old ES membrane units to the current FS membrane units. We have checked the updated flows and loads with this process tank sizing.

This system is designed as a four-stage process flow with one biological train. This train consists of a pre-anoxic tank, pre-aeration tank, post-anoxic tank, and membrane tank. Additionally, there will be a sludge holding tank connected after the MBR tank. process flow is shown in the figure below.

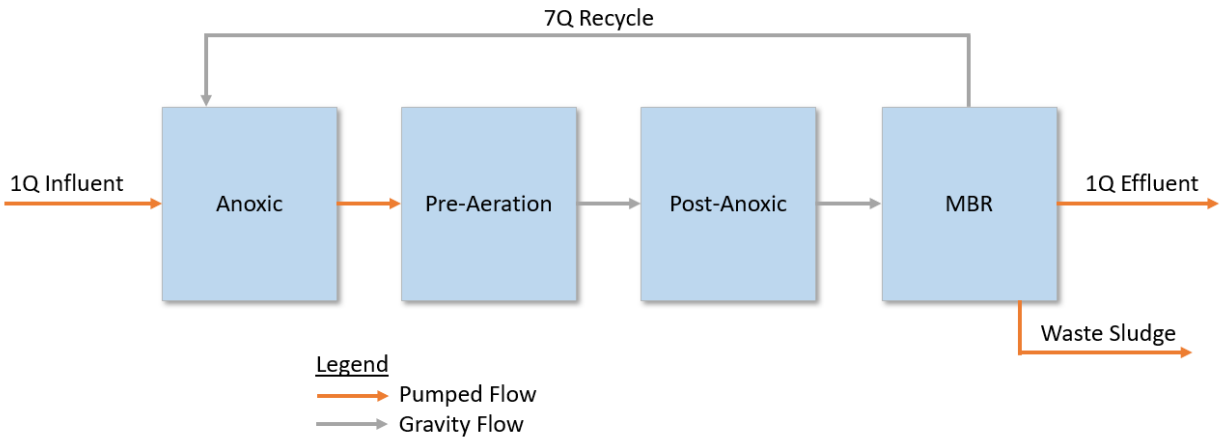


Figure 3: Process Flow Diagram

Tank dimensions and specifications can be seen in the table below.

Table 4: Tank Dimensions and Hydraulic Retention Times

Tank Name	Dimensions (L' x W')	SWD (ft)	Volume per Tank	Number of Tanks	Total Tank Volume
Pre-Anoxic	10' x 11'	7.5'	6,200 gal	1	6,200 gal
Aeration	16.5' x 11'	9.5'	12,900 gal	1	12,900 gal
Post-Anoxic	9' x 11'	8.5'	6,300 gal	1	6,300 gal
MBR	9.5' x 11'	8.5'	6,600 gal	1	6,600 gal
Total					**32,000 gallons**

4 Scope of Supply

4.1 Equipment Included in Kubota's Scope

Please reference the attachment for the scope list.

4.2 Direct Services

The following services are included in KMU's scope of supply:

Design Support

- Support during preliminary and final design.
- One day on-site design meeting.
- Construction submittals including shop drawings.
- Preparation and submittal of a system O&M manual for KMU supplied systems and equipment.
- Equipment delivery coordination with the contractor.
- One day on-site delivery inspection of Submerged Membrane Units.

Commissioning

- 15 days on-site for installation inspection, start-up, and commissioning including dry and wet equipment checks, clean water testing, and support during seeding and start-up.
- Additional days are available as needed.

Training

- 3 days of on-site, hands-on operator training using a mix of classroom and field time. See Table 7 below for list of training topics.

Table 5: Training and Workshops Included in KMU's Scope of Supply

Training/Workshop	Brief Summary
HMI	1. Navigation of all HMI screens and menus. 2. Review of automatic operations and controls. 3. Changing process set points. 4. Overriding controls from the HMI. 5. Manual operation of the system in the event of a power failure.
CIP training	1. Navigation of CIP (Clean-In-Place), in-situ maintenance chemical cleaning. 2. Control from HMI and operation of manual valve. 3. Adjust set points of chemical flow.
Troubleshooting	1. Case study of troubleshooting 2. Recovery from trouble 3. "Fish bone" approach
Daily testing	1. Filterability test 2. Viscosity measurement

Workshop/Additional Training Available (No Charge)

- In addition to our standard training at commissioning, Kubota Membrane USA will host an annual regional operator workshop in which operators meet to exchange ideas and learn about the latest developments in MBR technology.
- Customized individual training, such as membrane disassembly training, is also available upon request.

4.3 Exclusions to KMU's Scope of Supply

The following items are not currently included in the KMU scope of supply:

- Sales Tax.
  - ✓ Applicable sales tax will be added at the time of sale, including any new tariff, duties, or taxes that may apply at the time of sale.
- Bid bond and payment bond.
- Equipment unloading, handling, storage, and installation.
- Any equipment or services not expressly listed above.
- Civil works including installation of equipment, piping, and wiring.
- Platform for Fine screening equipment.
- Pretreatment/Headworks (grit removal, DAF, etc.).
- Flow equalization system.
- Electrical system (main electrical, generators, etc.).
- Solids handling equipment and digesters.
- Disinfection System
- Tanks, building construction.
- All piping that is outside of the MBR tanks, including permeate, air scour and diffuser cleaning headers.
- Wall pipe, link seal, sleeve, and any kind of penetration seal.
- Chemical epoxy or glue for anchor bolts.
- Chemical storage tanks.
- Flow conditioners for flow meters.
  - ✓ All flow meters will include a compact mounted housing (i.e., mounted directly on the meter). The scope of supply assumes piping configurations can provide the manufacturer recommended straight pipe run upstream and downstream from the meter. If these requirements cannot be met, flow conditioners will be required which can be provided by KMU at an additional cost.
- MCC, VFDs, motor starters for the motors not in Kubota's scope.
- Equipment lifts or hoists except for Kubota SMU.
- Seismic bracing for equipment, if needed.
- Any systems for operation in a classified area. All supplied systems will be "unclassified" in accordance NFPA Standard 820.

5 Warranty

Equipment Warranty

KMU's standard 2-year membrane warranty and 1-year mechanical equipment warranty is included in the main budgetary price proposed and goes into effect at the commencement date of commissioning. The warranty included is a guarantee that the products supplied by Kubota are free from defect in material or workmanship.

6 Budgetary Price

The estimated budgetary price for the equipment and instrumentation described herein is shown below. The pricing herein is for budgetary purposes only and does not constitute an offer of sale.

Table 6: Budgetary Price for Proposed KMU MBR Equipment

Budgetary Prices	
Budgetary Price	Not for Reference

The pricing herein is for budgetary purposes only and does not constitute an offer of sale. Tax, freight, and duties are not included. Tax will be added to this total at the time of sale based on the applicable tax rate.

7 24/7 Technical Support

24/7 phone support is available in addition to support during regular business hours. 24-hour technical support calls are shared within the KMU staff so that you can rest assured knowing that knowledgeable engineers and technicians are just a phone call away.

8 Additional Services (Optional)

The following service plans are optional and may be added to KMU's scope of supply if desired for an additional cost.

Kubota Custom Membrane Support Plan

KMU can customize your support/service package to meet your needs. The following table shows a variety of our available services:

Table 7: KMU's Available Services

Service	Note
Periodical technical support	Monthly, Quarterly, Annually
24/7 phone support	Always Available
HMI monitoring	Weekly, Monthly, Quarterly
Periodical site visit	Quarterly, Semi-annually, Annually
Membrane inspection	Annual, Semi-annual, 3x per year
Program (HMI, etc.) update	Based on hydraulic changes, such as increases in flow or changes in operation.

KUBOTA Membrane USA Corporation

GENERAL TERMS & CONDITIONS

1. **Precedence of Terms.** These general terms and conditions shall apply to this Contract, except that provisions set forth on the face hereof shall take precedence over any inconsistent or contrary provisions set forth in these General Terms and Conditions. No conditions contrary to or in addition to those set forth in this General Terms and Conditions shall be binding upon the Seller unless expressly approved in writing by Seller. Performance by Seller shall not be construed as accepting any different or additional terms.

2. **Quality and Quantity.** Seller shall not be responsible for any damage to or deterioration in the quality or loss in weight or units of the Goods during transit or due to natural causes.

3. **Shipment.** Shipment within the time stipulated on the face hereto shall be subject to the availability of vessel's space. In case FCA or FOB INCOTERMS apply to this Contract and Buyer fails to obtain space in time to fulfill the stipulated shipment date, Buyer shall be responsible for all costs, expenses and damages resulting directly or indirectly therefrom, including, without limitation, all increases in freight and insurance charges, losses, and other damages incurred by Seller prior to or after such failure by Buyer. The date of the Bill of Lading or the Waybill shall be conclusive evidence of the shipment date.

4. **Risk of Loss and Transfer of Title.** Risk of loss or damage to the Goods shall pass from Seller to Buyer in accordance with the INCOTERMS set forth on face hereof. Title to and the right to possess the Goods shall pass from the Seller to the Buyer at the same time when the risk of loss or damage to the Goods is passed to the Buyer as stipulated above, however, that the title to and the right to repossess the Goods are to be retained by Seller until Seller has received the full contract amount due to Seller pursuant to this Contract.

5. **Payment.** Payment by Buyer to Seller under this Contract shall be made by means of telegraphic transfer in immediately available funds to such bank account as designated by Seller or a confirmed, irrevocable, without recourse documentary letter of credit, in favor of Seller and with terms any satisfactory to Seller. If Buyer desires to pay Seller by means of a letter of credit, the letter of credit shall (i) cover the full contract amount (ii) be established through a prime-bank immediately after the date of this Contract, (iii) be negotiable on sight draft, and (iv) be valid for negotiation against the relative draft for at least fifteen (15) days after the end of the last month in which the Goods are shipped.

The letter of credit shall authorize reimbursement to Seller for any expenses incurred by Seller on account of Buyer pursuant hereto, and shall authorize partial payment against partial delivery. Any bank charges arising in connection with payment hereunder shall be borne by Buyer. If Buyer fails to satisfy any payment terms of this Contract, Seller at its sole discretion and at Buyer's expense and risk may resell all or any part of the Goods on account of Buyer, hold all or any part of the Goods on account of Buyer, cancel all or any part of this Contract and/or claim any damages resulting from such breach.

In the event of late payment of any amount due hereunder, Seller shall, in addition to any other remedy it may have hereunder or pursuant to applicable law, be entitled to receive interest at the maximum rate allowed by law in the country/state of Buyer or eighteen percent (18%) per annum, whichever is greater, on such late payment until payment is received in full.

6. **Increased Costs.** Any new, additional or increased freight rates, surcharges (bunker, currency, congestion or other surcharges), taxes, customs duties, export or import surcharges or other governmental charges, or insurance premiums, which may be incurred by Seller with respect to the Goods after the date of this Contract, shall be for the account of Buyer and shall be reimbursed to Seller by Buyer within a reasonable time on demand.

7. **Force Majeure.** Seller shall not be liable for failure or delay to perform its obligations hereunder due to any reason including, but not limited to, acts of God, earthquake, fire, flood, prohibition of exportation, refusal to issue export license, war, blockade, revolution, insurrection, sub vendor manufacturing delays, civil commotion, riots, mobilization, strikes, lockout, plague, other epidemics, pandemics, or any other causes beyond the control of Seller, and may, at its option, extend the time of shipment or delivery of the Goods or terminate unconditionally and without liability of this Contract to the extent so affected or prevented.

8. **Cancellation.** If Buyer fails to carry out any of the terms of this and/or any other contract with Seller, or in the event of the death, bankruptcy or insolvency of Buyer, liquidation, modification or reorganization of the corporate structure of Buyer, or nonpayment for any shipment, Seller shall have the right to cancel this and/or any other contract with Buyer or to postpone the shipment, or to stop the Goods in transit, and Buyer shall indemnify, defend and hold Seller harmless from all losses, costs, and expenses resulting from Seller taking any such actions.

9. **Intellectual Property Rights.** Buyer shall defend, indemnify and hold Seller harmless from any and all liability, loss or expense (including reasonable attorney's fees) arising from or in connection with any actual or alleged infringement of any patent, trademark, copyright, industrial design, registered pattern, trade secret or other similar intellectual property rights used or owned by Seller.

10. **Liability of Agent.** If this Contract is signed by an agent or on behalf of a principal as Buyer hereunder, whether the principal is disclosed or otherwise, the agent shall be liable not only as agent but also as principal for the performance of the obligations of Buyer under this Contract. This provision shall not affect Buyer's obligation as principal under this Contract.

11. **Construction.** The meanings of the terms UCPDC or INCOTERMS, when used in this Contract shall be determined in accordance with the Uniform Customs and Practice for Documentary Credit ("UCPDC") and Incoterms® ("INCOTERMS") adopted by the International Chamber of Commerce in effect on the date of this Contract. This Contract shall be governed by the laws of the state of Washington, USA without giving effect to any conflicts of laws principles. This Contract shall not be governed by the United Nations Contracts for the International Sales of Goods, the application of which is expressly excluded.

12. **Inspection.** Unless otherwise stated on the face of this Contract, any export inspections by Japanese authorities, Seller's suppliers or Seller shall be considered as final. When Buyer requires special inspection by an independently appointed inspector, Buyer shall inform Seller in writing the details of such special inspection including without limitation the name of such inspector at the time of this Contract. Such especial inspection shall be made promptly upon delivery of the Goods but in any event within two (2) weeks after delivery of the Goods, and all inspection fees and costs therefor shall be borne by Buyer.

13. **Warranty.** Seller warrants that any Goods delivered hereunder are free from defects in material and workmanship and, if Seller's specifications are set forth or incorporated by reference on the face hereof, or separately provided to Buyer, will meet such Seller's specifications.

Unless otherwise specified in Seller's warranty statement set forth or incorporated by reference on the face hereof, or separately provided to Buyer, Seller's liability under this warranty is limited to repair or replacement of any Goods delivered hereunder that do not conform to this warranty.

Buyer shall not be entitled to any remedy for lack of conformity of the Goods, including latent defects, under this warranty if he fails to notify Seller thereof within a six months period commencing on the shipment date of the Goods (and if there are more than one shipment dates, the first shipment date). Such notification shall contain full particulars of such lack of conformity of the Goods to the Seller's reasonable satisfaction.

Notwithstanding anything herein contained to the contrary, Seller shall have no liability under this warranty i) for minor deviations from Seller's specifications (if applicable) that do not affect the performance of the Goods, or ii) for any lack of conformity of the Goods caused by misuse, neglect, improper installation, handling, operation, or maintenance, repair, alteration, fair wear and tear, erosion or corrosion, or accident, including any damage or loss of the whole or a part of the Goods that occurs after the shipment date.

14. **Limitation of Liability.** EXCEPT AS EXPRESSLY STATED IN SECTION 13, SELLER HEREBY DISCLAIMS ALL REPRESENTATIONS AND WARRANTIES WITH RESPECT TO THE GOODS, WHETHER EXPRESS, IMPLIED OR STATUTORY (EXCEPT AS TO TITLE) INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT AND OTHER IMPLIED WARRANTIES UNDER ANY APPLICABLE LAWS, RULES OR REGULATIONS. SECTION 13 SETS FORTH THE FULL EXTENT OF SELLER'S LIABILITY TO BUYER OR ANY OTHER PARTY FOR ANY BREACH OF WARRANTY WITH RESPECT TO THE GOODS.

NOTHWITHSTANDING ANY OTHER PROVISION OF THIS CONTRACT, SELLER'S AGGREGATE AND CUMULATIVE LIABILITY ARISING OUT OF OR RELATING TO THIS CONTRACT, INCLUDING WITHOUT LIMITATION ON ACCOUNT OF PERFORMANCE OR NON-PERFORMANCE OF OBLIGATIONS, REGARDLESS OF THE FORM OF THE CAUSE OF ACTION, WHETHER IN CONTRACT, TORT (INCLUDING WITHOUT LIMITATION NEGLIGENCE), STATUTORY OR OTHERWISE WILL BE LIMITED TO DIRECT DAMAGES AND SHALL NOT EXCEED THE FULL CONTRACT AMOUNT OF GOODS STATED ON THE FACE HEREOF.

SELLER SHALL HAVE NO LIABILITY FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL OR SIMILAR DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE SALE, DELIVERY,NONDELIVERY,STORAGE,USE,MAINTENANCE, CONDITION OR POSSESSION OF THE GOODS.

15. **Arbitration.** All disputes or controversies which may arise between the parties hereto, out of or in relation to or in connection with this Contract, shall be negotiated in good faith and settled by agreement between both parties as promptly as possible. If not amicably settled within 14 days after the first negotiation day, such disputes or controversies shall be settled by arbitration in Seattle, Washington by arbitration administered by the American Arbitration Association in accordance with its Commercial Arbitration Rules including the Optional Rules for Emergency Measures of Protection, and judgment on the award rendered by the arbitrators shall be final and binding and may be entered in any court having jurisdiction thereof. All arbitration proceedings shall be held in the English language.

16. **Governing Law.** These Terms and Conditions shall be governed by and construed in accordance with the laws of the State of Washington, USA, for both domestic and international sales contract. All buyers agree that jurisdiction and venue shall be Seattle, Washington State.

17. **Liability for Delays and Return Trips.** Buyer agrees that if Seller or any of its representative's must make an additional service trip due to the site conditions not being ready for installation check, start up, or training to compensate them for their cost for additional travel expenses and pay for additional labor at their published labor rates. Additionally, should Buyer (or any of its representative's) cancel an installation check, start up, or training trip with less than 72 hours' notice, that Buyer will be liable for any additional travel costs and that the cancelling party will be liable for unused labor at their published labor rates.

18. **Change Orders.** If it is determined that the Seller needs to supply any other equipment or services not specified in the Sellers Project Proposal, shall warrant a change order.

Attachment
Kubota Scope List

Power is supplied by MBR MCP unless otherwise noted

VFD driven • • • • added on 12/15/22 to show the motor(s) are driven by VFD(s). Also see the P&ID

Equipment Location	Category	Function	Name	Type	Required Size/Capacity	Chosen Size/Capacity	Unit	Material	Manufacturer	Model/ Specification	Motor HP	Voltage	FLA for each motor	QTY
Headworks (HW) Equipment														
HW	Other Equipment	Fine Screen	Fine Screen	Internally Fed Drum	28	28	gpm	316SS	CleanTek	RS11 w/ 4inch plain inlet, 3/4" strainer, 1/2"isolation valve, field disconnect	0.33	208 VAC	1.75 FED BY FINE SCREEN LCP	2
HW	Other Equipment	Fine Screen Misc	Fine screen extended legs					304SS	CleanTek					2
HW	Other Equipment	Fine Screen Misc	Fine screen screening chute					304SS	CleanTek					2
HW	Flow Sensor	Flow Measurement	Ifluent Flow Meter	Electromagnetic	2.0	2		Alu, CS	E+H	Promag		120 VAC	0.2	1
HW	Other Valve	Valve	Plant water isolation	Manual Ball	1.5	1.5" SOCx SOC	inch	PVC	Asahi					1
HW	Other Equipment	Compactor	Compactor					316SS	CleanTek	SCP-156 Shaftless Screw w/ bagging system, 1/2" strainer, 1/2" isolation valve, field disconnect	1.5	208VAC	5.35 FED BY FINE SCREEN LCP	1
HW	Other Equipment	Screening collection	Screenings discharge and Bagging unit					304SS	CleanTek					1
HW	Auto Valve	ON/OFF switch	Spray Washer on/off switch valves	Solenoid	0.75"	0.75"		Bronze	CleanTek	Magnatrol, NC		120VAC	1.3 FED BY FINE SCREEN LCP	2
HW	Auto Valve	ON/OFF switch	Spray Washer on/off switch valves	Solenoid	0.5"	0.5"		Bronze	CleanTek	Magnatrol, NC		120VAC	1.3 FED BY FINE SCREEN LCP	1
HW	InD. Service	Field Service	Field Service - Cleantek						CleanTek					1
HW	Control Panel	Control Panel	Local Control Panel for fine screen and compactor with local switches	Nema 4X				304SS	CleanTek	42H X 36W X 12D		208VAC	POWERED BY PLANT LP	1
~~**Equalization (EQ) Equipment**~~														
~~**Anaerobic (AN) Equipment**~~														
Pre-Anoxic (AX) Equipment														
AX1	Mixer	Basin Mixing	AX1 Mixer	Submersible	6171	10 x 11 x 7.5	gallons		ABS	XRW 2121 - PA 18/4 - 60 Hz	2.41	208VAC	8.1	1
AX1	Option	Mixer Support	AX1 Mixer Guiderail Assembly	Floor Mount				SS	ABS					1
AX1	Option	Mixer Hoist(common)	Mixer Hoist(common)	Manual winch					ABS	with socket				1
AX1	Option	Mixer Relay	AX1 Mixer Relay	Relay				SS	ABS					1
AX1	InD. Service	Field Service	Field Service	Requested RFP				SS	ABS					1
AX1	Gauge, Switch	Level Measurement	AX1 Level Switch	Float				PU	Conery	2902 - B3 - S2		LOOP PWER		2
AX1	Gauge, Transmitter	Level Measurement	AX1 Level Level Transmitter	Hydrostatic				SS	Wika	c/w full option		LOOP PWER		1
AX1	Other Instrument	pH Measurement	AX1 pH Probe	Digital				PEEK	HACH	pHD sc DPD1P1				1
AX1	Other Instrument	pH Measurement	Pole mount system						HACH					1
AX1	Other Instrument	DO Measurement	AX1 DO Probe	Digital			mg/L DO	SS	HACH	LDO Model 2				1
AX1	Other Instrument	Hach Transmitter	AX1 pH/ORP Transmitter					PEEK	HACH	SC4500 w/ sun shield		120 VAC	1	1
AX1	Other Instrument	Hach Transmitter	AX1 DO Transmitter						HACH	SC4500 w/ sun shield		120 VAC	1	1
AX1	Other Instrument	DO Measurement	Pole mount system						HACH					1
AX1	Other Instrument	ORP Measurement	AX1 ORP Probe	Digital			mv ORP	SS	HACH					1
AX1	Other Instrument	ORP Measurement	Pole mount system						HACH					1
Post-Anoxic (Post-AX) Equipment														
AX2	Mixer	Basin Mixing	AX2 Mixer	Submersible	6295	9 x 11 x 8.5	gallons		ABS	XRW 2121 - PA 18/4 - 60 Hz	2.41	208VAC	8.1	1
AX2	Option	Mixer Support	AX2 Mixer Guiderail Assembly	Floor Mount				SS	ABS					1
AX2	Option	Mixer Relay	AX2 Mixer Relay	Relay				SS	ABS					1
AX2	InD. Service	Field Service	Field Service	Requested RFP				SS	ABS					1
AX2	Other Instrument	DO Measurement	AX2 DO Probe	Digital			mg/L DO	SS	HACH	LDO Model 2				1
AX2	Other Instrument	DO Measurement	Pole mount system						HACH					1
AX2	Other Instrument	DO Measurement	Extension Cable		100		ft		HACH					1

Equipment Location	Category	Function	Name	Type	Required Size/Capacity	Chosen Size/Capacity	Unit	Material	Manufacturer	Model/ Specification	Motor HP	Voltage	FLA for each motor	QTY	
~~De-Oxygenation (DeOX)~~ Equipment															
Pre-Aeration (PA) Equipment															
PA	Diffuser	Aeration	PA Diffuser	Fine Bubble	105		scfm	EPDM	EDI	FlexAir Minipanel				1	
PA	InD. Service	Field Service	Field Service											1	
PA	Mixer	Basin Mixing	PA Mixer	Submersible	12,898.00	11 x 16.5 x 9.5	gallons		ABS	XRW 2121 - PA 18/4 - 60 Hz	2.41	208VAC	8.1	1	
PA	Option	Mixer Support	PA Mixer Guiderail Assembly	Floor Mount				SS	ABS					1	
PA	Gauge, Switch	Level Measurement	PA Level Switch	Float				PU	Conery	2902 - B3 - S2		LOOP POWER		1	
PA	Other Instrument	DO Measurement	PA DO Probe	Digital			mg/L DO	SS	HACH	LDO Model 2				1	
PA	Other Instrument	DO Measurement	PA DO Transmitter (common shared with Post-AX DO probe)						HACH	SC4500 w/ sun shield		120 VAC	1	1	
PA	Other Instrument	DO Measurement	Extension Cable		25		ft		HACH					1	
PA	Other Instrument	DO Measurement	Pole mount system						HACH					1	
MBR Equipment															
MBR	SMU	Membrane Filtration	MBR SMU	Flat Plate	FS125			304SS	KUBOTA	FS125				2	
MBR	SMU	SMU Maintenance	MBR SMU Lifting Tool	Lifting Tool				304SS	KUBOTA	TG125				1	
MBR	Auto Valve	Diffuser Cleaning	MBR Diffuser Cleaning Valve	ON/OFF Plug	2	2	inch	CI	Bray/Buna			120 VAC	1.0	1	
MBR	Other Valve	Isolation Valve	MBR Air inlet Isolation Valve	ON/OFF Butterfly	2	2" wafer	inch	CI	Bray					2	
MBR	Other Valve	Isolation Valve	MBR Air outlet Isolation Valve	ON/OFF Ball	2	2" SOCx SOC	inch	PVC	ASAHI					2	
MBR	Other Valve	Isolation Valve	MBR PRMT Branch Isolation Valve	ON/OFF Ball	2	2" SOCx SOC	inch	PVC	ASAHI					2	
MBR	Other Valve	Isolation Valve	CIP chemical cleaning iso valve	ON/OFF Ball	1	1" SOCx SOC	inch	PVC	Asahi					2	
MBR	Other Valve	Isolation Valve	CIP pressure release valve	ON/OFF Ball	1	1" SOCx SOC	inch	PVC	Asahi					2	
MBR	Other Valve	Isolation Valve	Permeate header iso valve	ON/OFF Ball	2	2" SOCx SOC	inch	PVC	Asahi					1	
MBR	Gauge, Switch	Level Measurement	MBR Level Switch	Float				PU	Conery	2902 - B3 - S2		LOOP POWER		1	
MBR	SMU	Fabrication	Lifitng Chains					304SS	Kubota					2	
MBR	Fabrication	Fabrication	MBR SMU Guide & Stabilizer					304SS						2	
MBR	Fabrication	Fabrication	MBR SMU Fasteners					304SS						20	
MBR	Fabrication	Fabrication	MBR In-Basin Pipe&Supports (Permeate Drop Pipe)					PVC, 304SS		3" PVC for diff. cleaning header 2" PVC for diff. cleaning riser 2" PVC for permeate drop				2	
MBR	Fabrication	Fabrication	MBR In-Basin Pipe&Supports (Air Drop Pipe)					304SS						4	
Permeate (PRMT) Control Equipment															
PRMT	Permeate Pump	Permeate Extraction	PRMT Pump	Self-Priming Centrifugal	30.5	40	gpm	CI	AMT	285P-95	0.75	208V AC	3.5	2	VFD driven
PRMT	InD. Service	Field Service	Field Service	Requested RFP										1	
PRMT	Other Valve	Isolation Valve	Pump Isolation	ON/OFF Butterfly	2	2" wafer	inch	CI	Bray					4	
PRMT	Other Valve	Valve	Ball Check	Ball Check Vlave	2	2" SOCx SOC	Inch	PVC	Asahi					2	
PRMT	Auto Valve	Flow Control	PRMT Flow Control Valve	Modulating Butterfly	2	2" wafer	inch	SS	Bray			120VAC	0.8	1	
PRMT	Gauge, Switch	Pressure Gauge	PRMT Pump Inlet Pressuge Gauge		-15inHg - 15psi	1/4 NTP	inch	SS	Wika	232.50, 233.50, NS 63 [2 1⁄2"],				2	
PRMT	Gauge, Switch	Pressure Gauge	PRMT Pump Outlet Pressuge Gauge		-15inHg - 15psi	1/4 NTP	inch	SS	Wika	232.50, 233.50, NS 63 [2 1⁄2"],				2	

Equipment Location	Category	Function	Name	Type	Required Size/Capacity	Chosen Size/Capacity	Unit	Material	Manufacturer	Model/ Specification	Motor HP	Voltage	FLA for each motor	QTY	
PRMT	Pressure Sensor	TMP Measurement	PRMT Pump Pressure Transmitter	Diaphragm			psi		E+H					1	
PRMT	Flow Sensor	Flow Measurement	PRMT Flow Meter	Electromagnetic	2	2	inch	PU	E+H	Promag		120 VAC	0.2	1	
PRMT	Other Instrument	Turbidity Measurement	PRMT Turbidity Meter	Laser			NTU		HACH	TU5300sc				1	
PRMT	Other Instrument	Turbidity Measurement	Turbidity Meter Maintenance Kit						HACH					1	
PRMT	Other Instrument	Turbidity Measurement	Bubble trap, tubes, brackets						HACH					1	
PRMT	Other Instrument	Turbidity Measurement	Turbidity Transmitter						HACH	SC4500		120 VAC	1	1	
~~Internal Recycle (IR) Control Equipment~~															
Feed Forward (FF) Control Equipment															
FF	Sludge Transfer Pump	Sludge Feed Forward	FF Pump w/ VFD	Submersible	170		gpm		ABS	XFP80C CB1 (wet pit) w/ guide rails, elbows and pump safe relay	2.68	208VAC	9.3	2	VFD driven
FF	Option	Pump Relay	FF pump Relay	Relay				SS	ABS					2	
FF	Option	Pump Hoist(common)	Pump Hoist(common)	Manual winch					ABS	with socket				1	
FF	Gauge, Switch	Pressure Gauge	FF Pump Pressuge Gauge		-15inHg - 15psi	1/4 NTP	inch	SS	Wika	232.50, 233.50, NS 63 [2 1⁄2"],				2	
FF	Flow Sensor	Flow Measurement	FF Flow Meter	Electromagnetic	3		inch	PU		Promag		120VAC	0.2	1	
FF	Other Valve	Pump Isolation	Manual Ball	Ball Valve	3	3" SOCxSOC	inch	PVC	Asahi					2	
FF	Other Valve	Flow Direction	Ball Check	Ball Check Vlave	3	3" SOCxSOC	inch	PVC	Asahi					2	
FF	Other Valve	Sh Basin Bypass	Manual Ball	Ball Valve	3	3" SOCxSOC	inch	PVC	Asahi					1	
FF	Other Valve	Pre-air bypass	Manual Ball	Ball Valve	3	3" SOCxSOC	inch	PVC	Asahi					1	
FF	Other Valve	Pre-air Isolation	Manual Ball	Ball Valve	3	3" SOCxSOC	inch	PVC	Asahi					1	
~~Return Activated Sludge (RAS)~~ Control Equipment															
Waste Activated Sludge (WAS) Control Equipment															
WAS	Other Pump	Waste Activated Sludge	WAS Air Lift Pump				gpm	PVC		FABRICATED				1	
WAS	Other Valve	Air iso valve	Valves	ON/OFF Ball	1.0	1" SOCx SOC	inch	SS	Bray	Flowtek				2	
WAS	Other Equipment	"Air pump"	WAS air pump	Pressure	2		scfm	PVC	Hiblow	HP-100LL-0110			0.5	2	
WAS	Diffuser	Aeration	SHB aeration diffuser	Coarse Bubble	30-60		scfm		EDI					1	
WAS	Gauge, Switch	Level Measurement	SHB Pit Level Switch	Float				PU	Conery	2902 - B3 - S2		LOOP POWER		2	
WAS	Blower	Blower	SHB Blower	Regenerative	60		scfm	Alu	Republic	HRC602	4.6	208 VAC	14.0	1	
MBR Blower															
MBR BLW	Blower	Blower	MBR Blower	Regenerative	95		scfm	Alu	Republic	HRC902	8.4	208 VAC	26.6	1	VFD driven
MBR BLW	Option	Blower Flow Control	MBR Blower Check Valve	With Blower										1	
MBR BLW	Option	MBR Blower Pressure Relief	Pressure Release Valve	With Blower										1	
MBR BLW	Flow Sensor	Air Flow Measurement	MBR Blower Flow Meter	Thermal Mass	3	3	inch	PU	E+H	t-mass F 300 w/ integrated flow conditioner, compactmount		120 VAC	0.2	1	
MBR BLW	Other Valve	MBR Air Isolation	Butterfly Valve	ON/OFF Butterfly	2	3" wafer	inch	CI	Bray					1	
PA Blower															
PA BLW	Blower	Blower	PA Blower	Regenerative	105		scfm	Alu	Republic	HRC902	8.4	208 VAC	26.6	2	VFD driven
PA BLW	Option	Blower Pressure	PA Blower Pressure Gauge	With Blower										2	
PA BLW	Option	Blower Flow Control	PA Blower Check Valve	With Blower										2	

Equipment Location	Category	Function	Name	Type	Required Size/Capacity	Chosen Size/Capacity	Unit	Material	Manufacturer	Model/ Specification	Motor HP	Voltage	FLA for each motor	QTY
PA BLW	Option	MBR Blower Pressure Relief	Pressure Release Valve	With Blower										2
PA BLW	Other Valve	Manual Valves	Butterfly Valve	ON/OFF Butterfly	3	3" wafer	inch	CI	Bray					3
EQ Blower														
Cleain-In-Place Equipment														
SMU CIP	Chemical Injection	Chemical Injection	SMU CIP pump	Submersible	9.9 gpm x 20'TDH			PP	Dayton	3YU56	0.85	120VAC	4	1
SMU CIP	Other Equipment	Solution Tank	CIP Solution Tank	Tank	99	100	gallons	Plastic	Snyder	0.5% NaClO, ASM TK100V x 30				1
SMU CIP	Other Valve	Isolation Valve	CIP Pump Iso Valve	Ball Valve	1	1" SOCx SOC	Inch	PVC	ASAHI					1
SMU CIP	Other Valve	Flow throttle Valve	CIP flow throttle Valve	Diaphragm	1	1" SOCx SOC	Inch	PVC	ASAHI					1
SMU CIP	Other Equipment	Spill Containment	Chemical containment		100	100	gal	PVC	Grainger	Ultratech 52” x 57” x 5.75”				1
Chemical Dose Equipment														
DOSE	Chemical Injection	Caustic Soda Injection	Caustic Soda Injection pump	Metering Pump	0.2	0.5GPH @ 260PSIG	gph	PVC, VITON	Jesco	Magdos-LP2		120 VAC	3.6	1
DOSE	Other Equipment	Storage tank	Caustic Soda25% storage tank		40	40	gal		Assman	CFS40 w/ containment				1
DOSE	Chemical Injection	Caustic Soda Injection	MicroC Injection pump	Metering Pump	0.2	0.5GPH @ 260PSIG	gph	PVC, VITON	Jesco	Magdos-LP2		120 VAC	3.6	1
DOSE	Other Equipment	Storage tank	Micro C storage tank		40	40	gal		Assman	CFS40 w/ containment				1
UV Disinfection Equipment														
UV	Other Equipment	Disinfection	UV Disinfection System	B1810E Medium Pressure	30.5	30.5	gpm		Aquionics	Proline WW IL-100 (one duty and one stand-by)				2
UV	Other Equipment	Control panel	UV Disinfection System	Nema12					Aquionics	Nema12 Control Panel, EtherNet/IP		208 VAC	10 FED BY PLANT LP	2
UV	Other Valve	Pump Isolation Valve	UV Bypass Valve	ON/OFF Butterfly	2	2" wafer	inch	CI	Bray					2
UV	Other Valve	Pump Isolation Valve	UV Isolation Valve	ON/OFF Butterfly	2	2" wafer	inch	CI	Bray					4
~~**MBT Equipment**~~														
~~**Other Equipment**~~														
System Control Equipment														
CONTROL	Control Panel	Control Panel	Control Panel	Nema12, PLC, HMI						FACTORY TALK VIEW, 72” x 36” x 18”		120VAC		1
CONTROL	Control Panel	Motor Control Panel	Control Panel	Nema12, VFD, motor starters, power supply for instruments						72” x 48” x 18”		208 VAC		1
Direct Service														
D. SERVICE	D. Service	Direct Service	Direct Service											1

DESIGN TEAM:

OWNER/CLIENT:

WASHINGTON STATE PARKS
AND RECREATION COMMISSION
1111 ISRAEL ROAD SW
P.O. BOX 42650
OLYMPIA, WA 98504-2650

OWNER'S REPRESENTATIVE:

WASHINGTON STATE PARKS
AND RECREATION COMMISSION
SPECIAL PROJECTS
1111 ISRAEL ROAD SW
PO BOX 42650
OLYMPIA, WA 98504-2650

BRIAN YEAROUT
PROJECT MANAGER
TEL (360) 725-9763

Parametrix

A/E PROJECT MANAGER:

PARAMETRIX, INC.
1019 39TH AVE SE, SUITE 100
PUYALLUP, WA 98374

BRIAN BUNKER, P.E.
TEL (253) 604-6798
CELL (360) 620-0093
BBUNKER@PARAMETRIX.COM

CIVIL:

PARAMETRIX, INC.
1019 39TH AVE SE, SUITE 100
PUYALLUP, WA 98374

BRIAN BUNKER, P.E.
TEL (253) 604-6798
CELL (360) 620-0093
BBUNKER@PARAMETRIX.COM

ELECTRICAL:

PARAMETRIX, INC.
1019 39TH AVENUE SE, SUITE 100
PUYALLUP, WA 98374

MARVIN CASANOVA, P.E.
TEL (253) 604-6559
CELL (253) 255-8201
MCASANOVA@PARAMETRIX.COM

MECHANICAL:

PARAMETRIX, INC.
1019 39TH AVENUE SE, SUITE 100
PUYALLUP, WA 98374

BRIAN BUNKER, P.E.
TEL (253) 604-6798
CELL (360) 620-0093
BBUNKER@PARAMETRIX.COM

STRUCTURAL:

PARAMETRIX, INC.
1019 39TH AVENUE SE, SUITE 100
PUYALLUP, WA 98374

JACOB LINKE, P.E.
TEL (253) 528-9911
JWLINKE@PARAMETRIX.COM

ARCHITECT:

KMB ARCHITECTS
906 COLUMBIA ST SW, SUITE 400
OLYMPIA, WA 98501

MBR FACILITY EQUIPMENT:

KUBOTA MEMBRANE USA
11807 NORTH CREEK PARKWAY S
SUITE B-109
BOTHELL, WA 98011

SHINGO KUBO, M.S.
TEL (425) 534-1006
SHINGO.KUBO@KUBOTA.COM

SHEET INDEX

BID SET REVIEW

Items Included with Kubota's scope of supply are designated in GREEN Highlight

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SHEET __ OF __

CAD NO.

NO.	REVISIONS	INT.	APP.	DATE

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DRAWN	KT	01/03/25
CHECKED (FIELD)		
CHECKED (HDQTS.)		

PRELIMINARY
BRIAN E BUNKER
STATE OF WASHINGTON
46055
REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

DRAWING INDEX AND DESIGN TEAM

B-G2.0

SCALE
NO SCALE

PARKS FILE#

LEGEND

DESCRIPTION	EXISTING	NEW
FENCE		
EDGE OF PAVEMENT		
EDGE OF GRAVEL		
EDGE OF CONCRETE		
WATER LINE		W — X" WATER (HDPE)
SANITARY SEWER		SS — X" SS (PVC)
SANITARY SEWER FORCE MAIN		SSFM — X" SSFM (HDPE)
PERMEATE		PE — X" PE (HDPE)
ODOROUS AIR		OA — X" OA (PVC)
NON POTABLE WATER		NPW — X" NPW (HDPE)
DRAIN		D — X" D (PVC)
INDEX CONTOUR	220	150
INTERMEDIATE CONTOUR		146
CLEARING LIMITS		
CAP		
SS CLEAN OUT (CO)		CO
SS MANHOLE		
GATE VALVE		
HOSE BIBB		
BOLLARD		
DIRECTIONAL FLOW & SLOPE		
SILT FENCE		
TREE PROTECTION		
TREE REMOVAL		
AC PAVEMENT		
GRAVEL		
CONCRETE		

GENERAL NOTES

1. CONSTRUCTION ON HOLIDAY WEEKENDS MUST BE AUTHORIZED BY THE OWNER IN ADVANCE.
2. PRIOR TO START OF CONSTRUCTION, CONTRACTOR SHALL LOCATE AND IDENTIFY ALL EXISTING UTILITIES. NOTIFY ENGINEER OF ANY CONFLICTS.

HDPE PIPE GENERAL NOTES

DR = BEND RATIO		7.3 20	9 20	11 25
PIPE SIZE (INCHES)	OUTSIDE DIAMETER (INCHES)	MINIMUM BEND RADIUS (FEET)		
1 1/4	1.660	3.0	3.0	3.5
1 1/2	1.900	3.0	3.0	4.0
2	2.375	4.0	4.0	4.9
3	3.500	6.0	6.0	7.3
4	4.500	8.0	8.0	9.4

ABBREVIATIONS

ACP	ASPHALT CONCRETE PAVING
@	AT
BLDG	BUILDING
BP	BEGINNING POINT
BV	BUTTERFLY VALVE
CI	CAST IRON
CIP	CAST IRON PIPE
CLR	CLEAR
CO	CLEANOUT
CONC	CONCRETE
CONST	CONSTRUCTION
CSBC	CRUSHED SURFACING BASE COURSE
CSTC	CRUSHED SURFACING TOP COURSE
CV	CHECK VALVE
CY	CUBIC YARD
DBL	DOUBLE
DIA	DIAMETER
DIM	DIMENSION
DI, DIP	DUCTILE IRON PIPE
DN	DOWN
DOH	DEPARTMENT OF HEALTH
DS	DOWNSPOUT
EA	EACH
EFF	EFFLUENT
EL	ELEVATION
EP	END POINT
EQ	EQUAL
EX,EXIST	EXISTING
FD	FLOOR DRAIN
FIN FL	FINISH FLOOR
FL	FLANGE
FM	FORCE MAIN
FT	FOOT, FEET
FTG	FOOTING
G	GAS
GAL	GALLON
GPD	GALLONS PER DAY
GPM	GALLONS PER MINUTE
GALV	GALVANIZED
GV	GATE VALVE
HT	HEIGHT
HDPE	HIGH DENSITY POLYETHYLENE
HP	HORSE POWER
IE	INVERT ELEVATION
LBS	POUNDS
LF	LINEAL FEET
MAX	MAXIMUM
MBR	MEMBRANE BIOREACTOR
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
N.I.C.	NOT IN CONTRACT
NO.	NUMBER
NOM	NOMINAL
NPW	NON-POTABLE WATER
NTS	NOT TO SCALE
O.C.	ON CENTER
PARKS	WASHINGTON STATE PARKS AND RECREATION COMMISSION
PE	PERMEATE
PP	PRIMARY POWER
PUD	PUBLIC UTILITY DISTRICT
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE PIPE
REINF	REINFORCING
REQ	REQUIRED
SCH	SCHEDULE
SHT	SHEET
SIM	SIMILAR
SP	SINGLE PHASE POWER
SPEC	SPECIFICATIONS
SS	SANITARY SEWER
SSFM	SANITARY SEWER FORCE MAIN
STA	STATION
TBM	TEMPORARY BENCH MARK
TESC	TEMPORARY EROSION AND SEDIMENTATION CONTROL
TYP	TYPICAL
U/G	UNDERGROUND
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W	WATER
WM	WATER METER
W/	WITH
W/O	WITHOUT

BID SET REVIEW

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REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

LEGEND, ABBREVIATIONS, AND NOTES

B-G3.0

SCALE
NO SCALE

PARKS FILE#

DESIGN DATA SUMMARY FOR NISQUALLY MBR SYSTEM

DESCRIPTION	VALUE
DESIGN FLOWS (GPD)	
DOH INFLUENT DESIGN FLOW (PEAK DAY)	11,400
PLANT PEAK DAY CAPACITY (FOR FUTURE FLOWS)	22,700
DESIGN LOADINGS (LBS/DAY)	
PEAK MONTH	
BOD	50
TSS	43
TKN	14
PEAK DAY	
BOD	100
TSS	86
TKN	28
EFFLUENT REQUIREMENTS (mg/L)	
BOD	30
TSS	30
TKN	10
SAMPLING MANHOLE	
INSIDE DIAMETER (FT)	4
INFLUENT SAMPLER	REFRIGERATED COMPOSITE WITH HEATED ENCLOSURE
INFLUENT FLOW METER	
TYPE	MAGNETIC FLOW METER
INFLUENT PUMP STATION	
NUMBER	2
MOTOR SIZE, HP	3
CAPACITY, GPM	120
TDH, FT	29
WETWELL, INSIDE DIAMETER (FT)	5
EQUALIZATION TANK	
EQUALIZATION VOLUME	
LENGTH, FT	40
WIDTH, FT	16
DEPTH, FT	9
MAXIMUM SIDE WATER DEPTH, FT	8.0
NORMAL FLUID CAPACITY, GALS	30,000
AIR MIXING COMPRESSOR, HP	0.5
FINE SCREENS	
NUMBER	2
TYPE	DRUM
SCREEN OPENING	2 MM
CAPACITY, GPM	140
MOTOR SIZE, HP	0.33
CONVEYOR/WASHER/COMPACTOR	
NUMBER	1
MOTOR SIZE, HP	0.33 / 1.5
MBR FEED PUMP STATION	
NUMBER	2
MOTOR SIZE, HP	2
CAPACITY, GPM	25
TDH, FT	30
WETWELL, INSIDE DIAMETER (FT)	5

DESIGN DATA SUMMARY FOR NISQUALLY MBR SYSTEM

DESCRIPTION	VALUE
MBR SYSTEM - KUBOTA	
INFLUENT FLOW METER	
TYPE	MAGNETIC FLOW METER
DIAMETER, INCHES	2
PRE-ANOXIC BASIN	
LENGTH, FT	10
WIDTH, FT	11
DEPTH, FT	12
SIDE WATER DEPTH, FT	8.5
VOLUME, GAL	6,200
MIXER	
TYPE	SUBMERSIBLE PROPELLER
NUMBER	1
MOTOR SIZE, HP	2.14
CAPACITY, GALLONS	7,800
PRE-AERATION BASIN	
LENGTH, FT	16.5
WIDTH, FT	11
DEPTH, FT	12
SIDE WATER DEPTH, FT	9.5
VOLUME, GAL	12,400
MIXER	
TYPE	SUBMERSIBLE PROPELLER
NUMBER	1
MOTOR SIZE, HP	2.14
CAPACITY, GALLONS	12,900
AERATION SYSTEM	
DIFFUSER TYPE	FINE BUBBLE DISK GRID
NUMBER OF DIFFUSERS	14
CAPACITY, SCFM	78
ALPHA	0.62
BETA	0.95
SOTE, %	19
AERATION TANK BLOWER	
NUMBER	1
CAPACITY, SCFM	88
MOTOR SIZE, HP	8.7
OPERATING PRESSURE, FT	19.42
POST-ANOXIC BASIN	
LENGTH, FT	9.0
WIDTH, FT	11
DEPTH, FT	12
SIDE WATER DEPTH, FT	VARIES
VOLUME, GAL	6,300
MIXER	
TYPE	SUBMERSIBLE PROPELLER
NUMBER	1
MOTOR SIZE, HP	2.14
CAPACITY, GALLONS	6,700

DESIGN DATA SUMMARY FOR NISQUALLY MBR SYSTEM

DESCRIPTION	VALUE
MBR SYSTEM - KUBOTA (CONTINUED)	
MEMBRANE BIOREACTOR BASIN	
NUMBER	1
LENGTH, FT	9.5
WIDTH, FT	11
DEPTH, FT	12
SIDE WATER DEPTH, FT	8.5
VOLUME, GAL	7,700
MEMBRANES	
MEMBRANE MODULES, NUMBER	2
AREA PER MEMBRANE MODULE, FT2	1075
TOTAL MEMBRANE AREA, FT2	2150
MEMBRANE NOMINAL PORE SIZE	0.45 µm
DESIGN MLSS, mg/L	8000
FLUX RATES, GAL/FT2 AT 15oC	
DESIGN	14.7
PEAK	29.4-36.7
HYDRAULIC CAPACITY, GFD	7-20
TMP, PSIG	
DESIGN	0.3
MAXIMUM	3
MEMBRANE BIOREACTOR BASIN AERATION SYSTEM	
NUMBER OF BLOWERS	2
MOTOR SIZE, HP	8.7
CAPACITY, SCFM	88
OPERATING PRESSURE, PSI	6.8
MASS AIR FLOW METER, SCFM/IN	200/4
PRE-ANOXIC BASIN RECYCLE PUMPS	
NUMBER	2
MOTOR SIZE, HP	2.3
CAPACITY, GPM	130
TDH, FT	15
EFFLUENT (PERMEATE PUMPS)	
NUMBER (OPERATING/STANDBY)	1/1
MOTOR SIZE, HP	0.75
CAPACITY, GPM	35
TDH, FT	41
CHEMICAL FEED PUMPS, SUBMERSIBLE	
NUMBER (OPERATING/STANDBY)	1/0
MOTOR SIZE, HP	0.33
CAPACITY, GPM	31
TDH, FT	10
CHEMICAL FEED PUMPS, ALKALINITY	
NUMBER (OPERATING/STANDBY)	1/0
MOTOR SIZE, HP	<0.33
CAPACITY, GPH @ 100 PSI	1.0
CHEMICAL FEED PUMPS, CARBON ADDITION	
NUMBER (OPERATING/STANDBY)	1/0
MOTOR SIZE, HP	<0.33
CAPACITY, GPH @ 30 PSI	3.3

UV DISINFECTION SYSTEM	
TYPE:	AQUIONICS INLINE
NUMBER OF CONTACT VESSELS	2
INSIDE DIAMETER, INCHES	2
HYDRAULIC CAPACITY, GPD	50,000
POWER CONSUMPTION, PEAK, KW	0.5
UV DOSE, MJ/SQ CM	35
DESIGN UVT PERCENT	70

DESIGN DATA SUMMARY FOR NISQUALLY MBR SYSTEM

DESCRIPTION	VALUE
EFFLUENT FLOW SAMPLER	
TYPE:	REFRIGERATED COMPOSITE, INDOOR
EFFLUENT FLOW METER	
TYPE:	MAGNETIC FLOW METER
DIAMETER, INCHES	3
WAS SLUDGE STORAGE AND PUMPING SYSTEM	
SLUDGE HOLDING BASIN	
LENGTH, FT	9
WIDTH, FT	11
SIDE WATER DEPTH, FT	8.5
VOLUME, GAL	6,300
WAS AERATION SYSTEM	
COARSE BUBBLE DIFFUSER	
NUMBER	3
CAPACITY, SCFM	15
WAS BLOWER	
CAPACITY, SCFM	30
MOTOR SIZE, HP	2.4
SLUDGE HOLDING BASIN PUMP	
NUMBER (OPERATING/STANDBY)	1
MOTOR SIZE, HP	0.75
CAPACITY, GPM	100
TDH, FT	20
MISCELLANEOUS PUMPING SYSTEMS	
NON-POTABLE WATER PUMPS	
NUMBER (OPERATING/STANDBY)	1/1
MOTOR SIZE, HP	2
CAPACITY, GPM	~30
TDH, FT	~115
PLANT DRAIN PUMP	
NUMBER (OPERATING/STANDBY)	1/0
MOTOR SIZE, HP	0.75
CAPACITY, GPM	100
TDH, FT	20
ODOR CONTROL SYSTEM	
NUMBER	1
FAN MOTOR SIZE, HP	2
MEDIA UNIT DIA., FT	4
MEDIA UNIT HEIGHT, FT	6
CARBON MEDIA DEPTH, FT	2
PERMANGANATE MEDIA DEPTH, FT	1
STANDBY GENERATOR	
NUMBER	1
TYPE	DIESEL
CAPACITY, KW	125
STORAGE TANK	
GALLONS	4,000

*ALL VALUES SUBJECT TO CHANGE BASED ON ACTUAL SITE CHARACTERISTICS AND DETAILS.

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BRIAN E BUNNELL
STATE OF WASHINGTON
46055
REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

MBR SYSTEM DESIGN DATA

B-P1.0

SCALE

NO SCALE

PARKS FILE#

INSTRUMENT IDENTIFICATION LETTERS (NOTE 2)

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR PROCESS VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE			CONTROL	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE	MOMENTARY			MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE,RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, OR LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

LINE SYMBOLS

LINE	DESCRIPTION
	MAIN PROCESS FLOW (WITH TYPICAL DIRECTION OF FLOW SHOWN)
	MAIN (EXISTING)
	SUBSIDIARY PROCESS FLOW
	SUBSIDIARY (EXISTING)
	INSTRUMENT SUPPLY, PROCESS TAPS, NON PROCESS FLOW
// //	PNEUMATIC SIGNAL (ANALOG)
	ELECTRIC SIGNAL (ANALOG)
X X	PNEUMATIC SIGNAL (DISCRETE)
-/---/---/---	ELECTRIC SIGNAL (DISCRETE)
x x	CAPILLARY TUBE OR FILLED SYSTEM
	ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
	ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
	SOFTWARE OR DATA LINK
	MECHANICAL LINK
	HYDRAULIC
120V	ELECTRIC POWER SUPPLY 120VAC, 60HZ U.N.O.
XX	SERVICE AIR OR INSTRUMENT AIR SUPPLY
	STRUCTURES AND SPECIAL EQUIPMENT

MECHANICAL — OR — ELECTRICAL

CONNECTED

NOT CONNECTED

VALVES

- GATE VALVE
- 3 WAY VALVE
- BALL VALVE
- 3 WAY BALL VALVE
- GLOBE VALVE
- 3 WAY GLOBE VALVE
- PLUG VALVE
- ECCENTRIC PLUG VALVE
- NEEDLE VALVE
- BUTTERFLY VALVE
- DIAPHRAM VALVE
- SWING CHECK VALVE
- WAFER CHECK VALVE
- BALL CHECK VALVE
- PINCH VALVE
- REGULATED SIDE
- SELF ACTUATED REGULATING VALVE
- SELF ACTUATED REGULATING VALVE W/ EXTERNAL TAP
- COMBINATION AIR/VAC RELEASE VALVE
- PRESSURE SAFETY VALVE
- MUD VALVE
- AIR RELEASE VALVE
- VACUUM RELEASE VALVE

VALVE IDENTIFIERS

B / C / A

A = TAG
B = SIZE
C = NORMAL STATE

VALVE OPERATORS

- HAND
- M — MOTORIZED
- CYLINDER OPERATOR
- S — SOLENOID
- DIAPHRAGM

INSTRUMENT & MECHANICAL EQUIPMENT SYMBOLS & MISCELLANEOUS

- CENTRIFUGAL PUMP
- SUBMERSIBLE PUMP - RAIL MOUNTED
- VERTICAL PUMP
- METERING PUMP
- PROGRESSING CAVITY PUMP
- SUBMERSIBLE PUMP
- ROTARY PUMP
- BLOWER
- CALIBRATION CHAMBER
- SILENCER
- MOTOR
- SUBMERSIBLE MIXER
- INTAKE SCREEN/FILTER
- EXPANSION JOINT, FLEXIBLE SPOOL
- HOSE
- IXXX (E) (N) — INTERFACE CONTROL (E) = EXISTING (N) = NEW
- MIXER
- SLUICE GATE — NO NC
- FLAP GATE
- SLIDE GATE — NO NC
- STOP GATE — NO NC
- INJECTOR
- F — FILTER OR SEPARATOR
- T — DRIP TRAP
- HOSE BIBB CONNECTION
- DIAPHRAGM SEAL
- RUPTURE DISK, PRESSURE
- RUPTURE DISK, VACUUM
- IN-LINE PRESSURE SENSOR
- PUMP SEAL OR VALVE WATER SUPPLY, PLANT WATER
- FLANGE
- UNION
- Y STRAINER
- FLOW STRAIGHTENING VANE
- HOSE CONNECTION
- CAP OR PLUG
- BLIND FLANGE
- P — PURGE
- DRAIN
- THERMOWELL
- AIR COMPRESSOR
- PULSATION DAMPENER
- REDUCER
- STATIC MIXER
- HEAT TRACE
- I 3 — INTERLOCK, NUMBER IS THE NOTE IDENTIFIER (NOTE 2)
- X | DWG # / DESCRIPTION — CONNECTION TO PROCESS WITHIN PROJECT
- SYSTEM CONNECTION OUTSIDE PROJECT

GENERAL INSTRUMENT OR FUNCTION SYMBOLS (NOTE 2)

	FIELD MOUNTED	PRIMARY LOCATION, ACCESSIBLE TO OPERATOR	AUXILIARY LOCATION, ACCESSIBLE TO OPERATOR	NORMALLY INACCESSIBLE OR BEHIND THE PANEL
DISCRETE INSTRUMENTS	○	⊖	○	⊖
SHARED DISPLAY, SHARED CONTROL	○	⊖	○	⊖
COMPUTER FUNCTION	⬡	⬡	⬡	⬡
PROGRAMMABLE LOGIC CONTROL	□	□	□	□

C / A B / E D

A INSTRUMENT IDENTIFICATION LETTERS (SEE TABLE ABOVE)
B LOOP NUMBER
C MODIFIER
D SEQUENCE
E USER

FLOW ELEMENTS

- ORIFICE PLATE
- SINGLE PORT PITOT TUBE OR PITOT-VENTURI TUBE
- AVERAGING PITOT TUBE
- FLUME
- WEIR
- TURBINE OR PROPELLER-TYPE PRIMARY ELEMENT
- ROTAMETER
- POSITIVE DISPLACEMENT TYPE FLOW TOTALIZING INDICATOR
- VORTEX SENSOR
- TARGET TYPE SENSOR
- FLOW NOZZLE
- M — MAGNETIC FLOWMETER
- SONIC FLOWMETER
- D — DENSITY METER
- VENTURI

PIPE SIZE, SERVICE, AND MATERIAL IDENTIFICATION

(FOR REFERENCE ONLY. SEE SITE AND MECHANICAL DRAWINGS)

NOMINAL PIPE DIAMETER IN INCHES — 4" RS

FLOW STREAM ABBREVIATION

NOTES:

1. THIS IS A GENERALIZED LEGEND SHEET. THIS PROJECT MAY NOT USE ALL INFORMATION SHOWN.
2. INSTRUMENT SYMBOLS AND IDENTIFICATION ARE BASED ON INSTRUMENT SOCIETY OF AMERICA STANDARD ANSI/ISA 5.1-1984 (R 1992)

ABBREVIATIONS

AAS	- ALKALINITY ADJUSTMENT SOLUTION
AC	- ACID
AL	- ALUM
AMP	- AMPERE
AS	- AIR SUPPLY
BW	- BELT WASH WATER
BWR	- BELT WASH WATER RECYCLE
CD	- CONDENSATE
CDR	- CONDENSER RETURN
CDS	- CONDENSER SUPPLY
CHF	- CHEMICAL FEED
CLS	- CHLORINE SOLUTION
CP	- CONTROL PANEL
CWR	- CHILLED WATER RETURN
CWS	- CHILLED WATER SUPPLY
D	- DRAIN
DE	- DISINFECTED EFFLUENT
DIS	- DISTILLED WATER
DS	- DIGESTED SLUDGE
ECR	- EFFLUENT COOLING RETURN
ECS	- EFFLUENT COOLING SUPPLY
ED	- EQUIPMENT DRAIN
EE	- ENGINE EXHAUST
EFF	- EFFLUENT
ETM	- ELAPSED TIME METER
ES	- ELECTRICAL SUPPLY
F	- FIRE SPRINKLER
FC	- FAIL CLOSED
FD	- FLOOR DRAIN
FE	- FINAL EFFLUENT
FIL	- FILTRATE
FM	- FORCEMAIN
FO	- FAIL OPEN
GR	- GRIT
GRC	- GAS RECIRCULATION
HOA	- HAND-OFF-AUTO
HOH	- HIGH PRESSURE HYDRAULIC OIL
HOL	- LOW PRESSURE HYDRAULIC OIL
HOR	- HAND-OFF-REMOTE
HRR	- HEAT RESERVOIR RETURN
HRS	- HEAT RESERVOIR SUPPLY
HWS	- DOMESTIC HOT WATER SUPPLY
IA	- INSTRUMENT AIR
I/O	- ON/OFF
JOR	- JOG-OFF-REMOTE
LCP	- LOCAL CONTROL PANEL
LOR	- LOCAL-OFF-REMOTE
LSR	- LOWER-STOP-RAISE
ML	- MIXED LIQUOR
MUD	- MUD VALVE
MV	- MOTORIZED VALVE
NaOH	- SODIUM HYDROXIDE
NC	- NORMALLY CLOSED
NG	- NATURAL GAS
NO	- NORMALLY OPEN
OA	- ODOROUS AIR
OF	- OVERFLOW
OSC	- OPEN-STOP-CLOSE
PA	- PROCESS AIR
PD	- PUMPED DRAINAGE
PE	- PLANT EFFLUENT
PLC	- PROGRAMMABLE LOGIC CONTROLLER
POL	- POLYMER SOLUTION
PRS	- PROCESS SAMPLING
PSV	- PRESSURE SAFETY VALVE
PV	- PNEUMATIC VALVE
PVC	- POLYVINYL CHLORIDE
RP	- RAW POLYMER
RS	- RAW SEWAGE
SA	- SERVICE AIR
SC	- SCUM
SD	- STORM DRAIN
SE	- SECONDARY EFFLUENT
SG	- SLUICE GATE
SLG	- SLIDE GATE
SN	- SUPERNANANT
SRS	- SCREENED/DEGRITTED RAW SEWAGE
SS	- SANITARY SEWER
STG	- STOP GATE
SV	- SOLENOID VALVE
TD	- TANK DRAIN
THS	- THICKENED SLUDGE
TO	- THICKENER OVERFLOW
TURB	- TURBIDITY
UNO	- UNLESS NOTED OTHERWISE
V	- VENT
VAC	- VACUUM
VFD	- VARIABLE FREQUENCY DRIVE
W1	- POTABLE
W2	- NON-POTABLE
WAS	- WASTE ACTIVATED SLUDGE
WML	- WASTE MIXED LIQUOR

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PRELIMINARY — BRIAN E BUNDY — STATE OF WASHINGTON — 46055 — REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

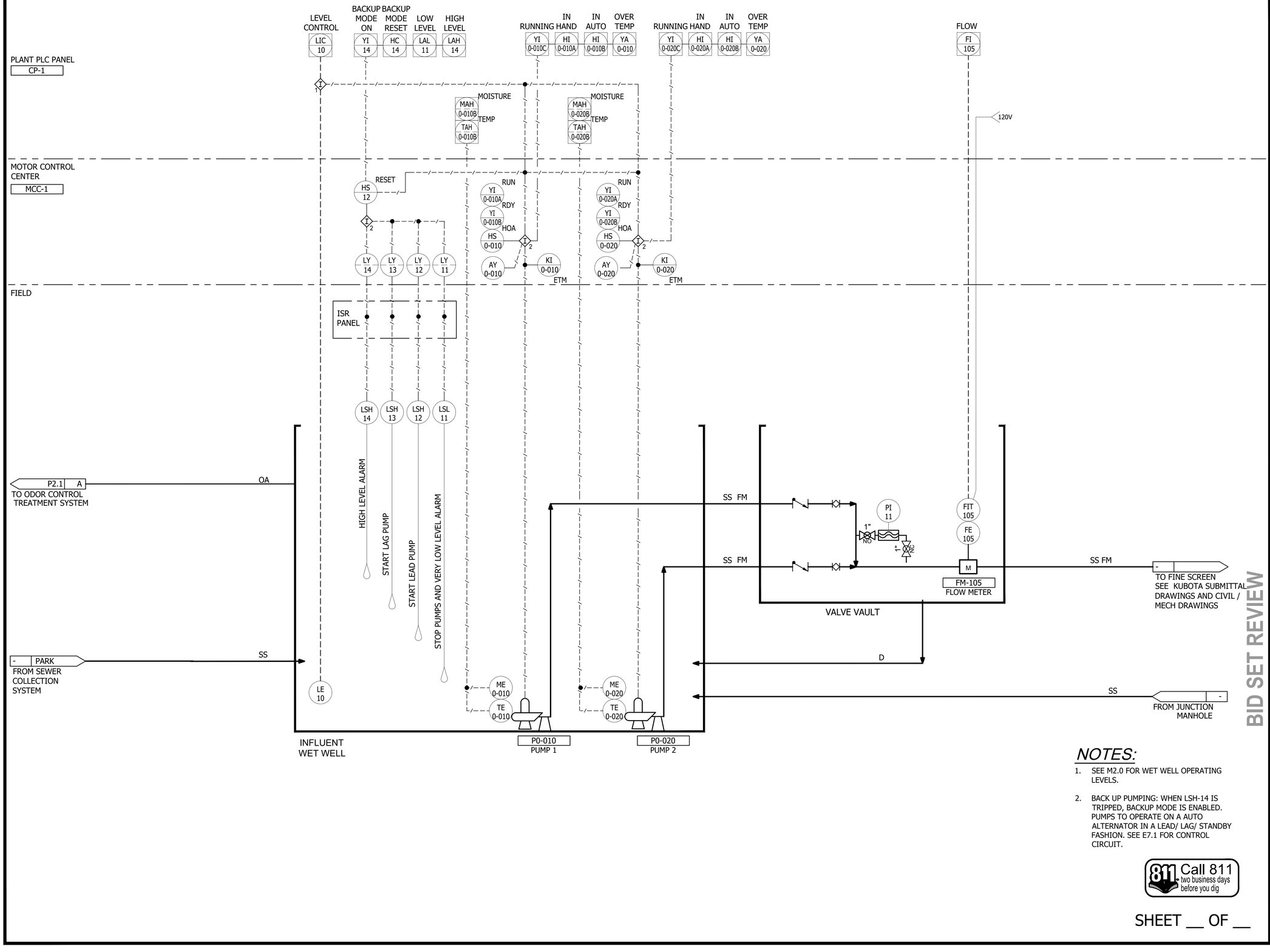
P&ID DIAGRAM LEGEND & ABBREVIATIONS

B-P1.1

SCALE

NO SCALE

PARKS FILE#



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NOTES:

1. SEE M2.0 FOR WET WELL OPERATING LEVELS.
2. BACK UP PUMPING: WHEN LSH-14 IS TRIPPED, BACKUP MODE IS ENABLED. PUMPS TO OPERATE ON A AUTO ALTERNATOR IN A LEAD/ LAG/ STANDBY FASHION. SEE E7.1 FOR CONTROL CIRCUIT.

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MARVIN C. CASANOVA STATE OF WASHINGTON 48989 REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

ALAN E. BUNKER STATE OF WASHINGTON 48055 REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

INFLUENT PUMP STATION P&ID

B-P2.0

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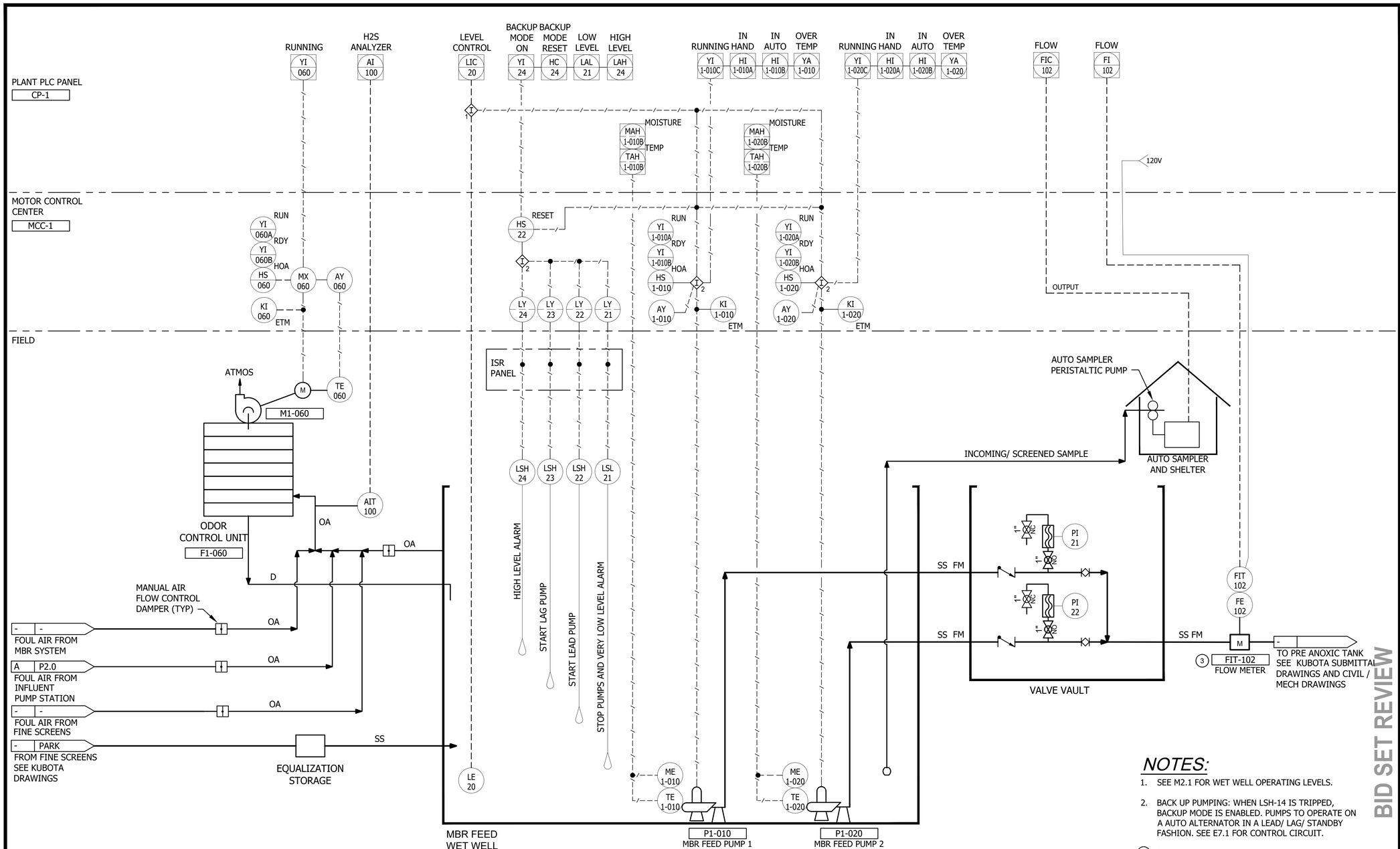

NOTES:

1. SEE M2.1 FOR WET WELL OPERATING LEVELS.
2. BACK UP PUMPING: WHEN LSH-14 IS TRIPPED, BACKUP MODE IS ENABLED. PUMPS TO OPERATE ON A AUTO ALTERNATOR IN A LEAD/ LAG/ STANDBY FASHION. SEE E7.1 FOR CONTROL CIRCUIT.
3. EQUIPMENT AND MOUNTING HARDWARE SUPPLIED BY MANUFACTURER KUBOTA AND INSTALLED BY CONTRACTOR.

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MARVIN C. CASANOVA STATE OF WASHINGTON 48989 REGISTERED PROFESSIONAL ENGINEER

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LORIANN B. BUNKER STATE OF WASHINGTON 46055 REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

MBR FEED PUMP STATION P&ID

B-P2.1

SCALE

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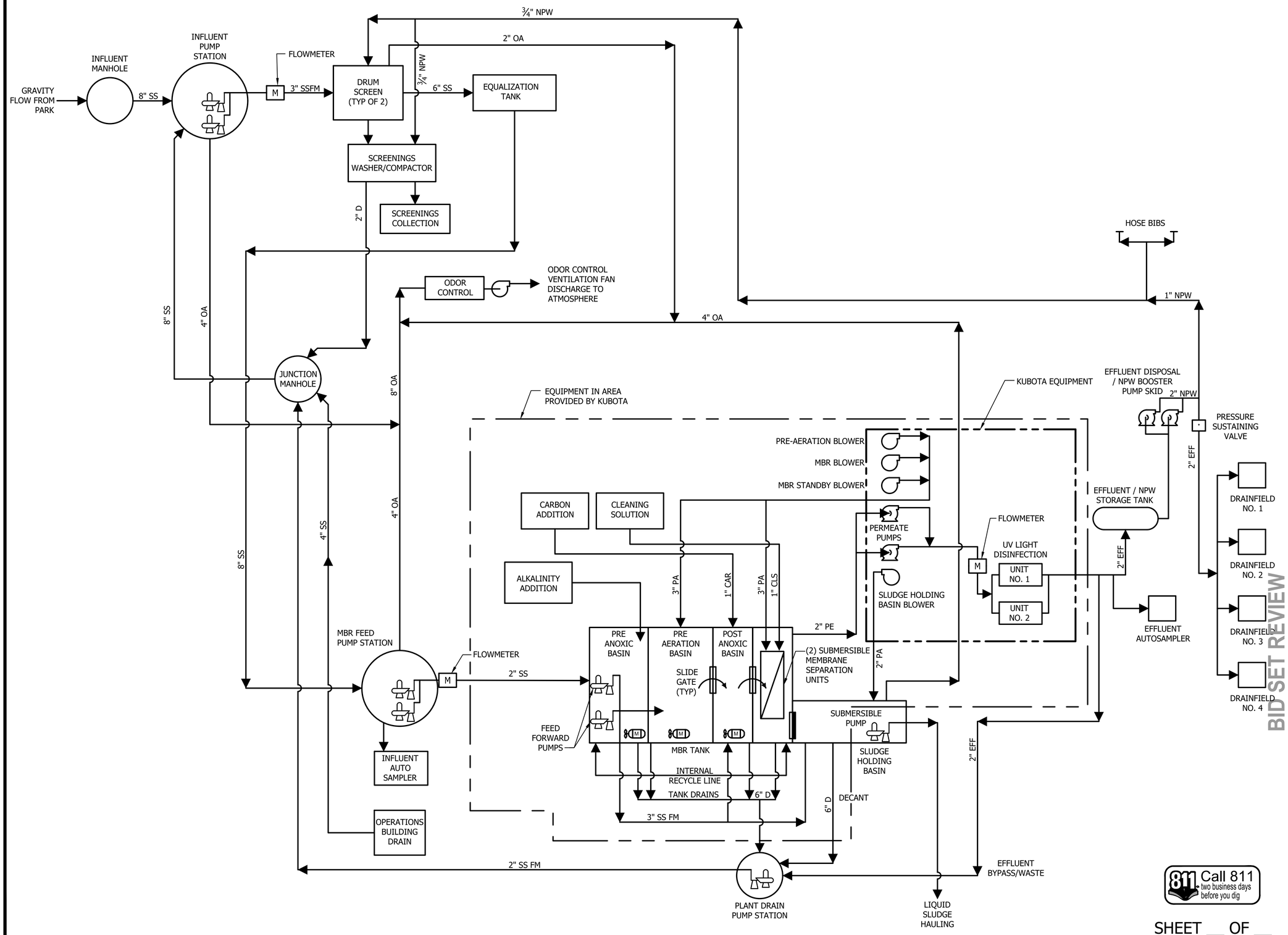

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REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

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PHASE 3A MAINTENANCE BUILDING AND WWTF

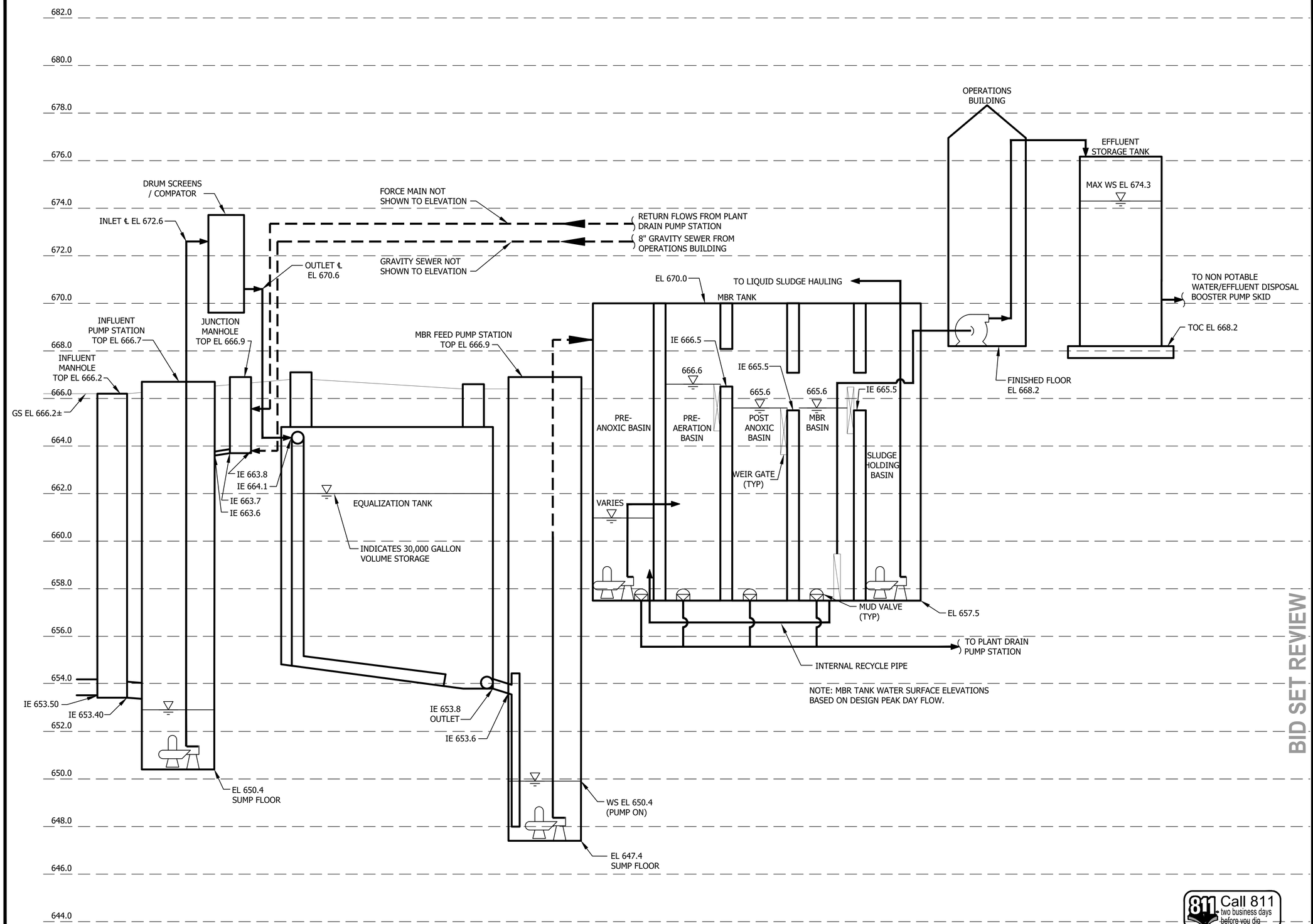
MBR SYSTEM PROCESS FLOW DIAGRAM

B-P3.0

SCALE

NO SCALE

PARKS FILE#



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STATE OF WASHINGTON
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REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

MBR SYSTEM HYDRAULIC PROFILE

B-P4.0

SCALE
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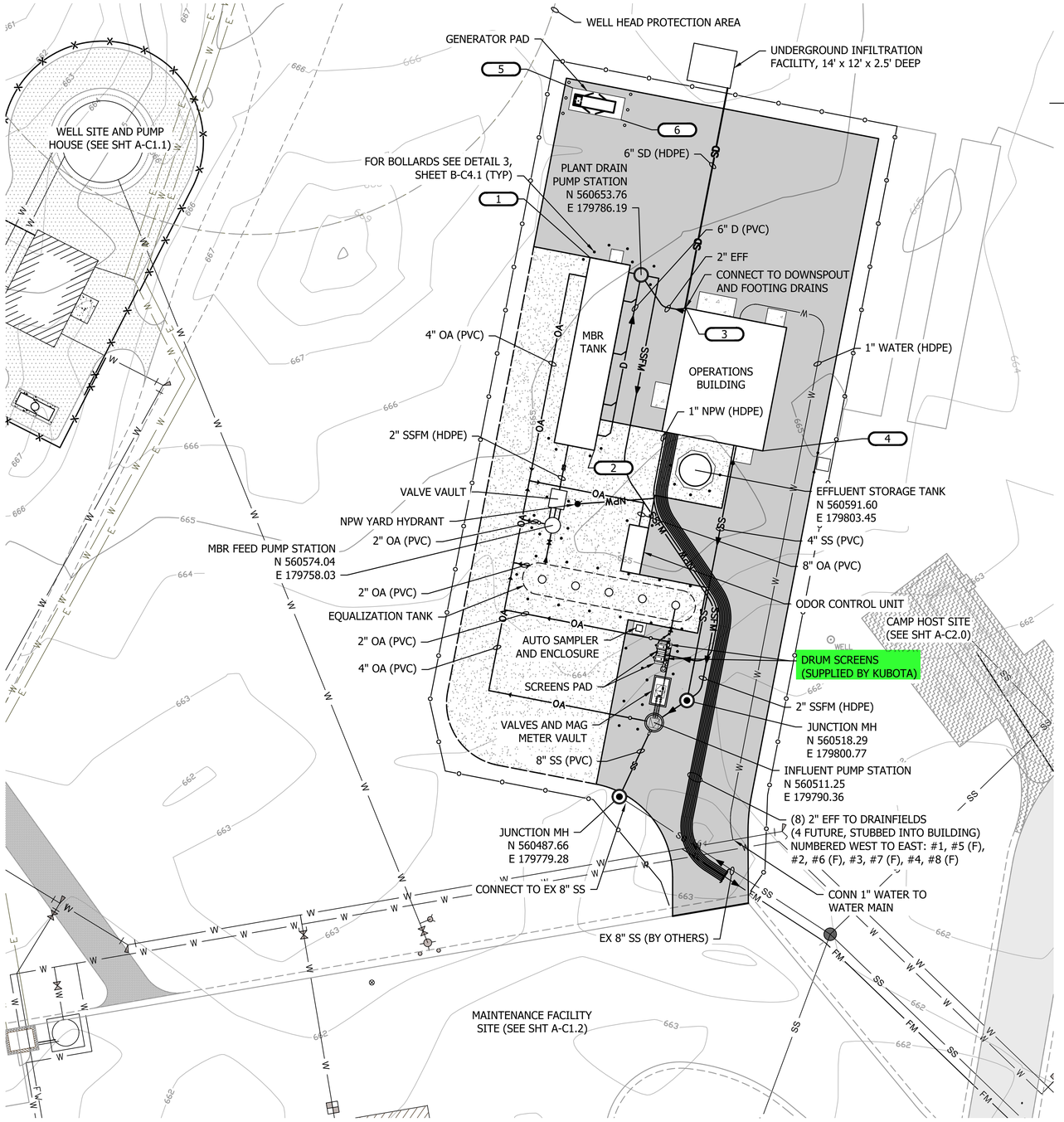

SITE UTILITY PLAN

SCALE 1" = 20'

NOTES:

1. SEE SHEET B-M3.2 FOR ADDITIONAL PIPING DETAIL BETWEEN OPERATIONS BUILDING AND MBR FACILITY.
2. COORDINATE ALL UTILITIES CONNECTING WITH OPERATIONS BUILDING WITH MECHANICAL AND ELECTRICAL SHEETS.
3. SEE SHEET B-S5.0 FOR EQUIPMENT SLAB DETAILS.

COORDINATE TABLE

NUMBER	NORTHING	EASTING	DESCRIPTION
1	560659.28	179769.94	MBR TANK NW CORNER
2	560597.91	179771.30	MBR TANK SE CORNER
3	560643.20	179800.44	OPERATIONS BUILDING NW CORNER
4	560597.72	179824.91	OPERATIONS BUILDING SE CORNER
5	560713.26	179764.41	GENERATOR PAD NW CORNER
6	560703.11	179779.78	GENERATOR PAD SE CORNER

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PRELIMINARY
BRIAN E BUNNELL
STATE OF WASHINGTON
46055
REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

WWTF SITE UTILITY PLAN

B-C2.0

SCALE 20' 0 40'

PARKS FILE#

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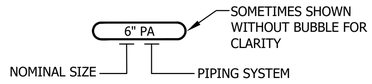
ABBREVIATIONS:

AFF	ABOVE FINISH FLOOR
AL	ALUMINUM
ASSY	ASSEMBLY
ARV	AIR RELEASE VALVE
BF	BUTTERFLY VALVE
BOD	BOTTOM OF DUCT
BR	BRINE SOLUTION
CFM	CUBIC FEET PER MINUTE
CL	CHLORINE, CLASS, CENTER LINE
CLR	CLEAR, CLEARANCE
CLS	CHLORINE SOLUTION (HYPOCHLORITE)
CO	COUNTY, CLEANOUT
COL	COLUMN
CONC	CONCRETE
CONT	CONTINUE, CONTINUOUS
CSBC	CRUSHED SURFACING BASE COURSE
D	DRAIN, DRAINAGE
DP	DIFFERENTIAL PRESSURE
E	EXISTING
EHG	ELECTROLYTIC HYPOCHLORITE GENERATOR
EL	ELEVATION
ELEV	ELEVATION
EPDM	ETHYLENE PROPYLENE DIENE MONOMER
EW	EACH WAY
EX	EXISTING
FC	FLEXIBLE CONNECTION
FD	FLOOR DRAIN
FLG	FLANGE, FLANGED
FRP	FIBERGLASS REINFORCED PLASTIC
GA	GAGE
GALV	GALVANIZED
GV	GATE VALVE
HDG	HOT DIPPED GALVANIZED
HDPE	HIGH DENSITY POLYETHYLENE
HTP	HEAT PUMP
HYD	HYDRAULIC
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
L	LEFT
LI	LEVEL INDICATOR
LS	LEVEL SWITCH
MAX	MAXIMUM
MBR	MEMBRANE BIOLOGICAL REACTOR
MIN	MINIMUM, MINUTE
MJ-R	MECHANICAL JOINT-RESTRAINED
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
NOM	NOMINAL
NPT	NATIONAL PIPE THREAD
OC	ON CENTER
OPP	OPPOSITE
PERF	PERFORATE, PERFORATED
PI	PRESSURE INDICATOR
PT	POINT
PVC	POLYVINYL CHLORIDE
PW	POTABLE WATER
R	RIGHT, RADIUS
RG	RETURN GRILL
ROW	RIGHT OF WAY
S	SLOPE
SCH	SCHEDULE
SED	SEDIMENTATION
SF	SUPPLY FAN
SG	SLUICE GATE, SUPPLY GRILL
SIM	SIMILAR
SKT	SOCKET THREAD
SL	SLIP
SOG	SLAB ON GRADE
STA	STATION
STD	STANDARD
SQ	SQUARE
SR	STATE ROUTE, SUPPLY REGISTER
SST	STAINLESS STEEL
SV	SOLENOID VALVE
SW	SOFTENED WATER
TI	TEMPERATURE INDICATOR
TM	TURBIDITY MONITOR
TOC	TOP OF CONCRETE, TOP OF CURB
TOD	TOP OF DUCT
TOW	TOP OF WALL
TYP	TYPICAL
UH	UNIT HEATER
V	VALVE, VENT, VOLT
VIC	VICTAULIC
VTR	VENT THROUGH ROOF
W/	WITH

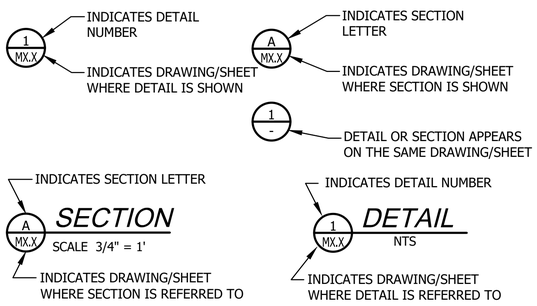
PIPING SYSTEM

SYMBOL	SERVICE
CHF	CHEMICAL FEED
CLS	CHLORINE SOLUTION
D	DRAINAGE
FD	FLOOR DRAIN
FM	FORCE MAIN
NPW	NON-POTABLE WATER
OA	ODOROUS AIR
PA	PROCESS AIR
PE	PERMEATE
SD	STORM SEWER
SS	SANITARY SEWER
SSFM	SANITARY SEWER FORCE MAIN
W	POTABLE WATER
V	VENT

PIPING DESIGNATIONS:



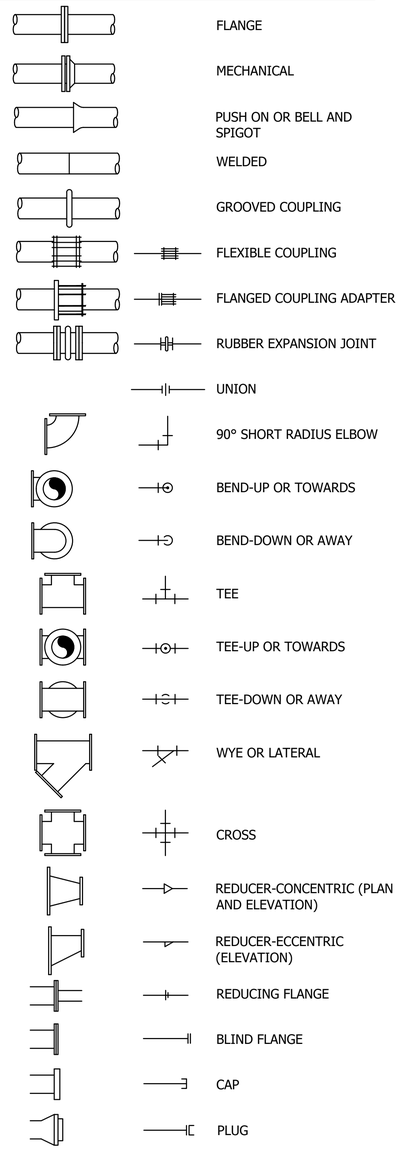
DETAIL AND SECTION DESIGNATION



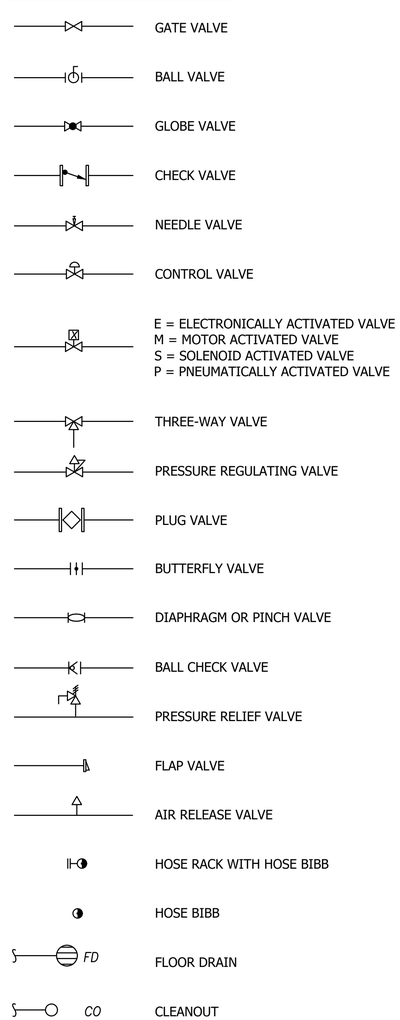
GENERAL NOTES:

1. THIS IS A STANDARD LEGEND, THEREFORE NOT ALL OF THIS INFORMATION MAY BE USED ON THIS PROJECT. CONTACT THE ENGINEER FOR SYMBOLS, LEGENDS AND ABBREVIATIONS NOT LISTED. EACH DISCIPLINE HAS A SPECIFIC LEGEND.

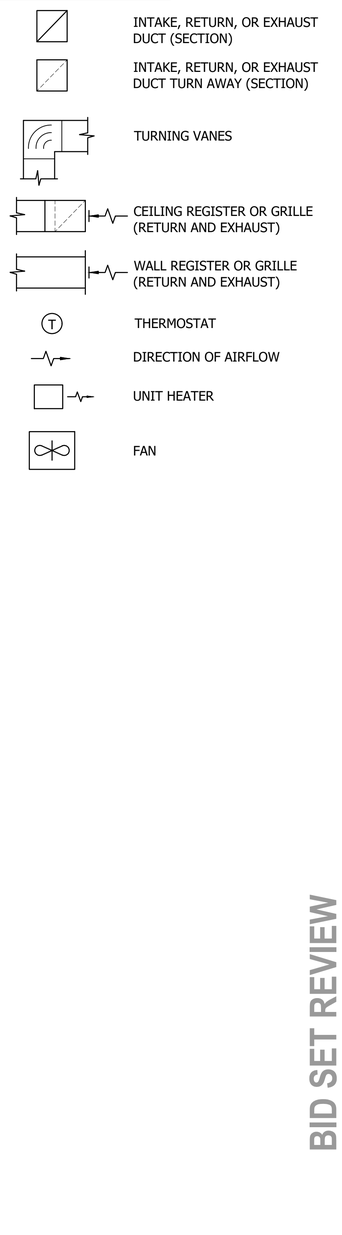
PIPE AND FITTING SYMBOLS:



VALVE SYMBOLS:



HVAC LEGEND:



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PRELIMINARY

BRIAN E BUNNELL
STATE OF WASHINGTON
46055
REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

MECH PIPING SYMBOLS, NOTES AND ABBREVIATIONS

B-M1.0

SCALE

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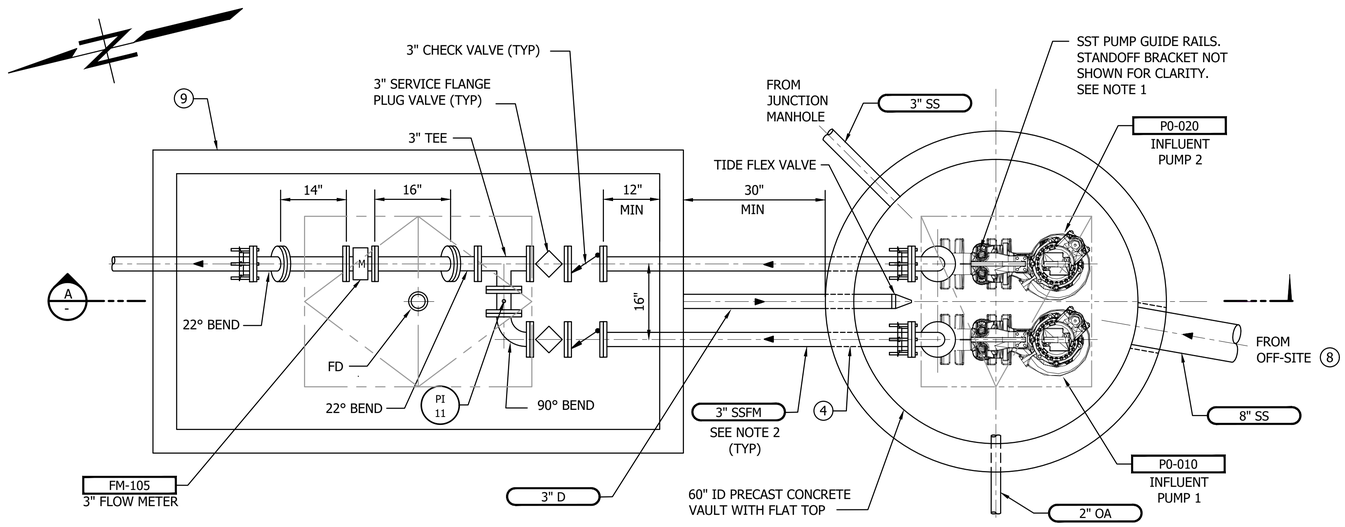
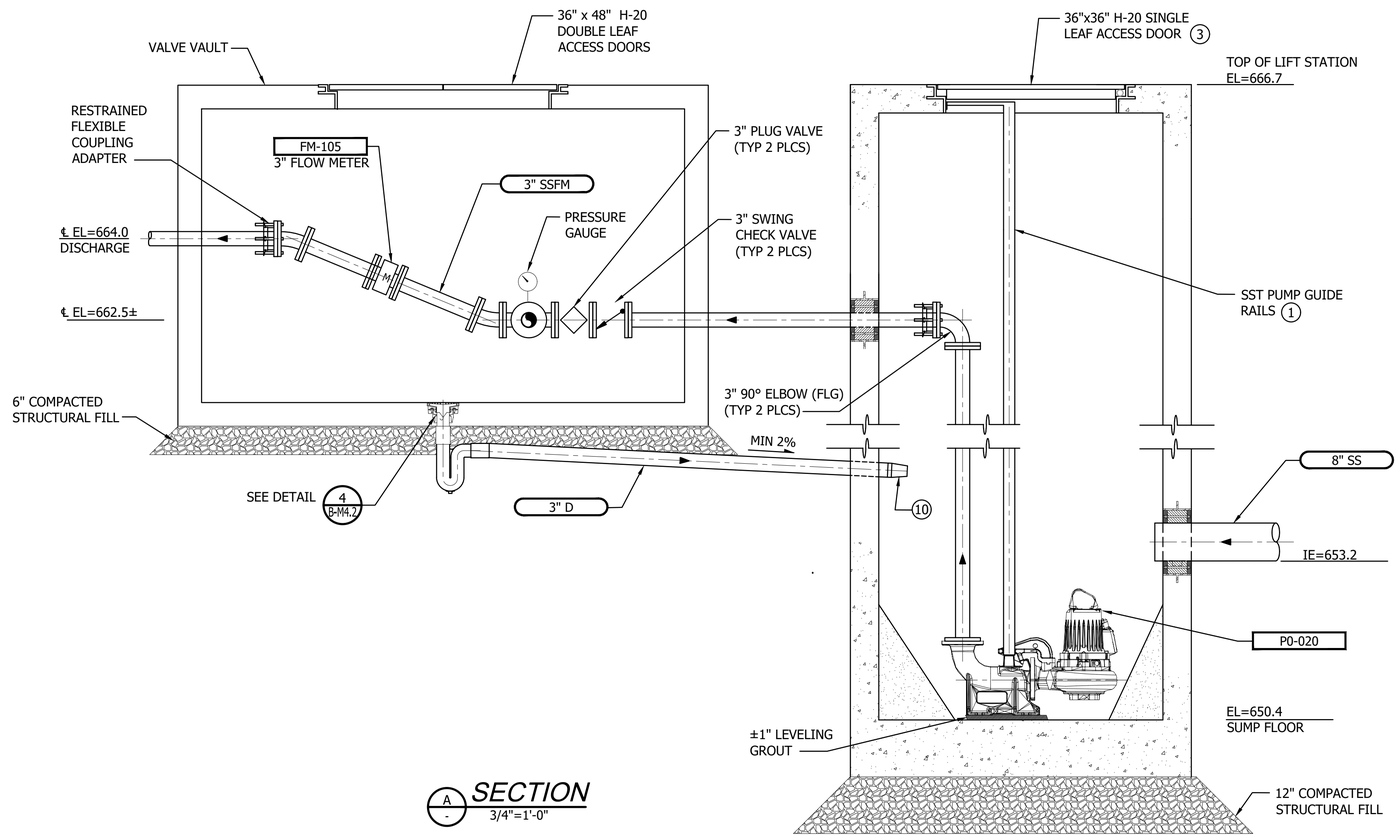


INFLUENT PUMP STATION PLAN

SCALE 3/4" = 1'-0"

NOTES:

1. LOCATE PUMP GUIDES AND DISCHARGE PIPING IN ACCORDANCE WITH PUMP MANUFACTURER MINIMUM CLEARANCES.
2. WATER LEVEL CONTROL FLOATS (QTY 4) AND LEVEL TRANSMITTER TO BE PLACED THE SAME DISTANCE ABOVE SUMP FLOOR AS SHOWN ON M2.1 MBR FEED PUMP STATION.
3. CONTRACTOR SHALL ENSURE PUMPS CLEAR HATCH OPENING WHEN REMOVING PUMPS.
4. CONTRACTOR SHALL CORE DRILL PIPE PENETRATION OPENINGS. SEAL PIPE PENETRATIONS WITH MODULAR SEAL AS SHOWN IN DETAIL 4 ON SHEET M3.5.
5. CONTRACTOR TO VERIFY DIMENSIONS, ELEVATIONS, AND LOCATIONS PRIOR TO CONSTRUCTION.
6. ALL JOINTS AND COUPLINGS SHALL BE RESTRAINED.
7. ALL EXPOSED STEEL AND HARDWARE IN WET WELL SHALL BE 316L STAINLESS STEEL.
8. CONTRACTOR TO FIELD VERIFY CONNECTION REQUIRED TO 8" INFLUENT.
9. VALVE VAULT- OLDCASTLE 4686-LA OR APPROVED EQUAL.
10. TIDE FLEX VALVE AND INVERT MUST BE AT LEAST 6" ABOVE HIGHWATER ALARM. USE TIDE FLEX VALVE SERIES TF-2, TF-35 OR APPROVED EQUAL.



A - SECTION

3/4"=1'-0"

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PRELIMINARY — ALLAN M. ALLES — STATE OF WASHINGTON — 27045 — REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

INFLUENT PUMP STATION PLAN AND SECTION

B-M2.0

SCALE

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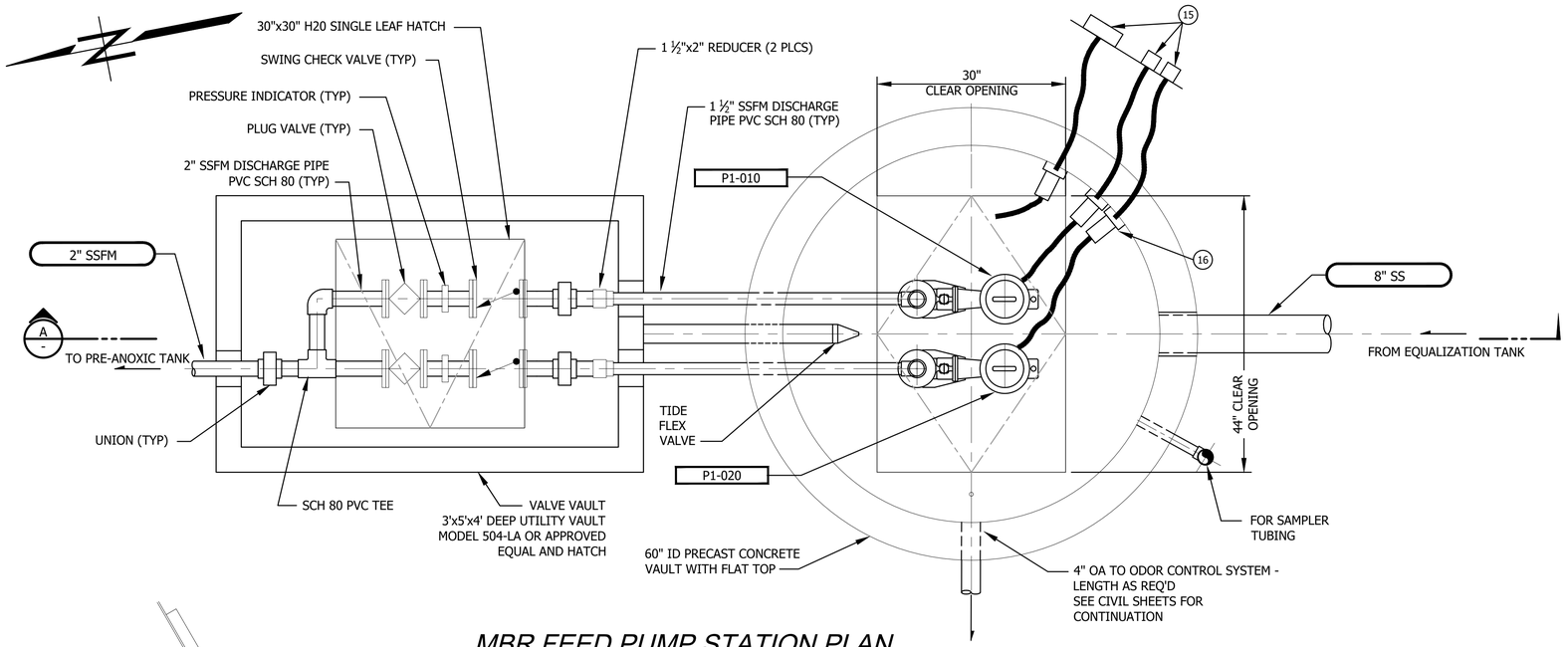
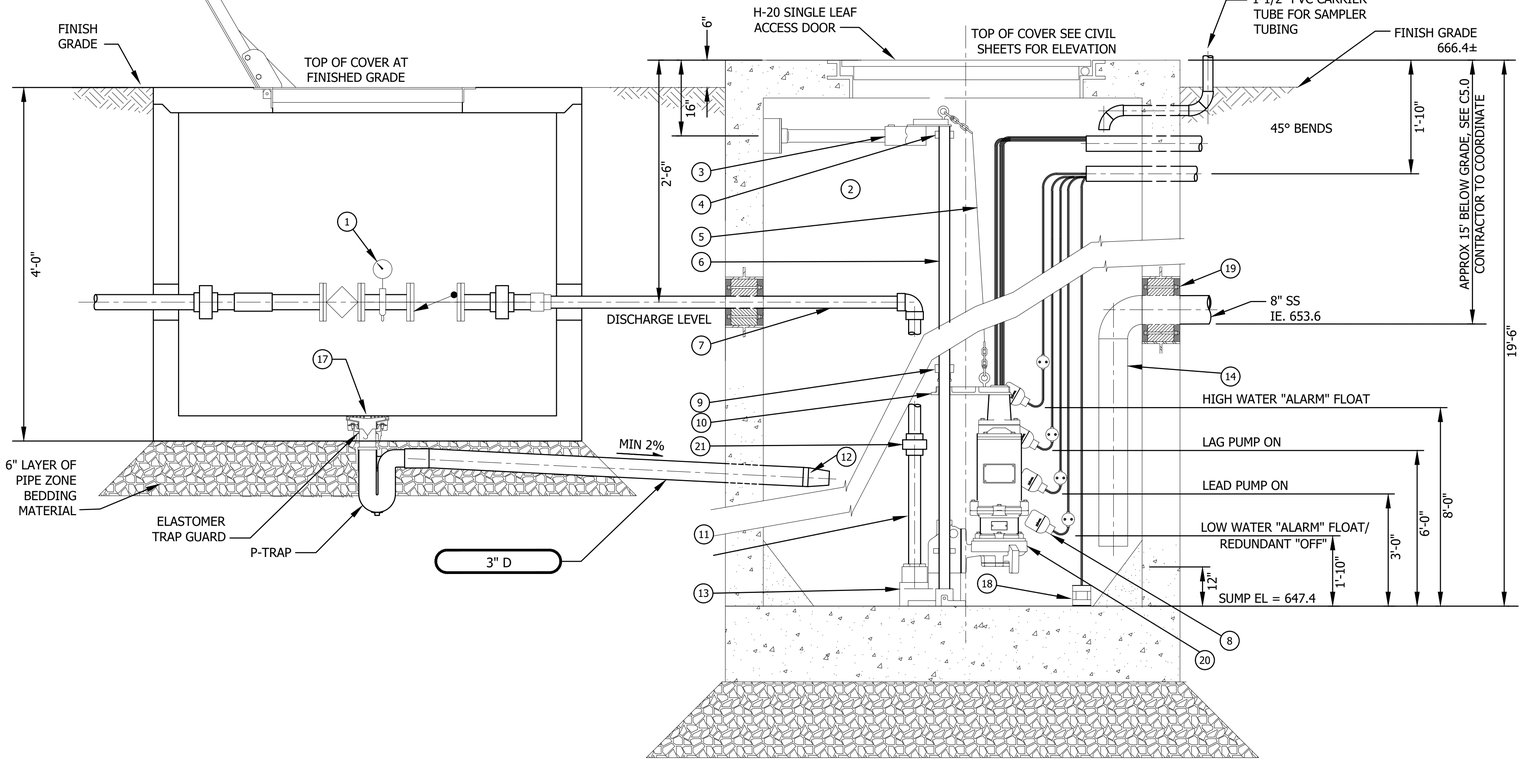


MBR FEED PUMP STATION PLAN

SCALE NO SCALE



A SECTION

NO SCALE

NOTE:

1. SEE SPECIFICATIONS PRIOR TO PACKAGED LIFT STATION INSTALLATION AND FOR RELATED EQUIPMENT.
2. MATCH PIPE DIAMETER FOR PIPE FITTINGS, AND VALVES TO DISCHARGE PIPE DIAMETER OF PUMP STATION
3. EQUIPMENT SHOWN FOR ILLUSTRATIVE PURPOSES. ACTUAL ITEMS MAY VARY IN LOCATION AND/OR APPEARANCE.

MATERIAL LIST:

1. PRESSURE GAUGE
2. USE SST FASTENERS
3. RAIL SUPPORT
4. TOP HOLDDOWN
5. LIFT-OUT CABLE, ¼"
6. GUIDE RAILS (TYP 2 PLCS)
7. DISCHARGE PIPE WITH MODULAR SEAL (TYP)
8. PUMP FLOAT (TYP 4 PLCS) SEE ELECTRICAL SHEETS AND SPECIFICATIONS
9. BOTTOM HOLD-DOWN, SST
10. GUIDE PLATE
11. DISCHARGE PIPE, PVC SCH 80 1½" FOR 2HP PUMP STATION
12. TIDE FLEX VALVE AND INVERT MUST BE AT LEAST 6" ABOVE HIGHWATER ALARM. USE TIDE FLEX VALVE SERIES TF-2, TF-35 OR APPROVED EQUAL
13. DISCHARGE BASE
14. DROP TUBE TO BE INSTALLED ON INLET
15. ELECTRICAL JUNCTION BOX, SEE ELECTRICAL SHEETS
16. CONDUIT FLANGE (TYP 3 PLCS)
17. 4" FLOOR DRAIN
18. LEVEL TRANSMITTER
19. PIPE PENETRATION WITH MODULAR SEAL AS SHOWN IN DETAIL 4 SHEET B-M3.5
20. PUMP
21. 1½" DISASSEMBLY UNION (SOCxSOC)

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ALLAN MAYER STATE OF WASHINGTON 27046 REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

MBR FEED PUMP STATION PLAN AND SECTION

B-M2.1

SCALE

NO SCALE

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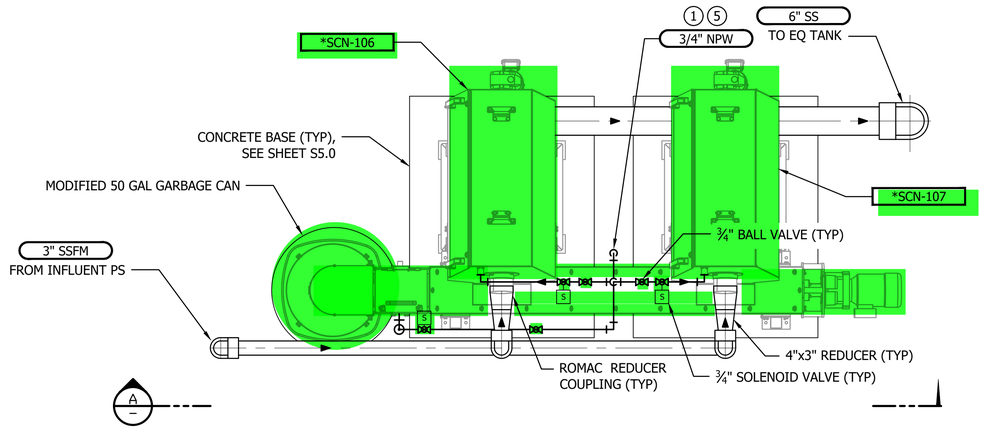
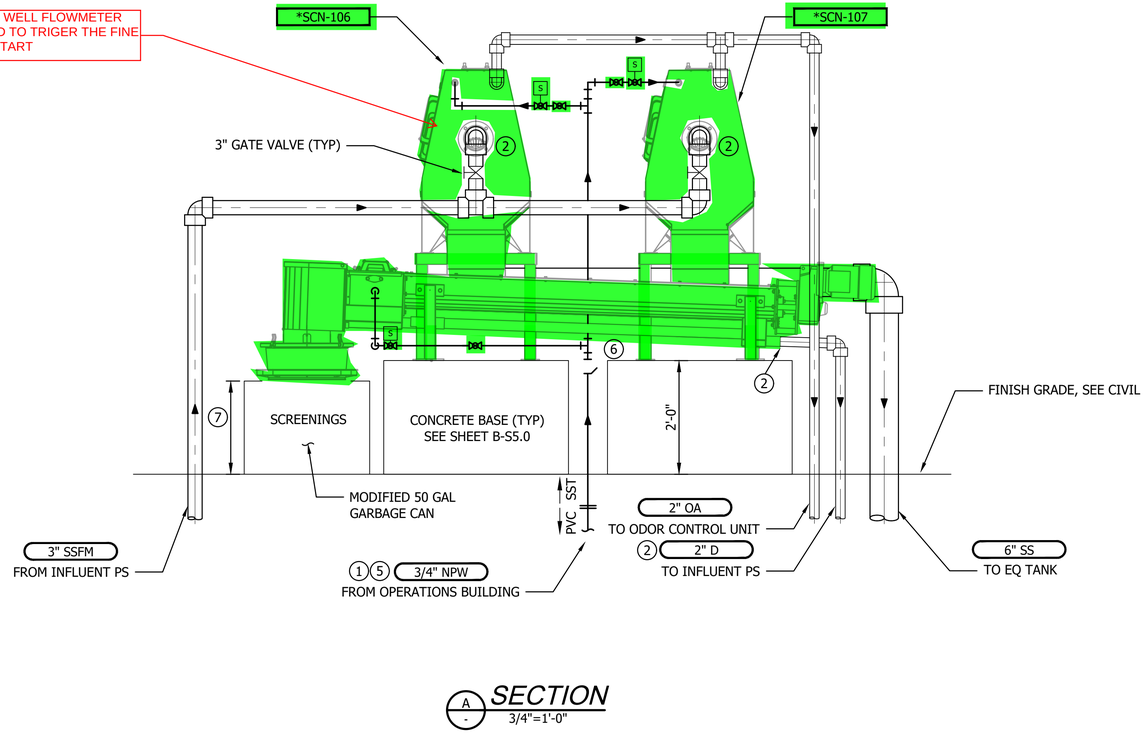


INFLUENT SCREEN PLAN

SCALE 3/4" = 1'-0"



A SECTION

3/4"=1'-0"

NOTES:

1. ALL PIPES TO BE INSULATED AND HEAT TRACED. SEE SPECIFICATION SECTION 404100 FOR DETAILED INFORMATION.
2. CONTRACTOR TO PROVIDE ROMAC TRANSITION COUPLINGS FOR SCREEN'S PLAIN END: 5" INFLUENT, 6" DISCHARGE, AND 2" COMPACTOR DRAIN.
3. * ASTERISKED NOTE INDICATES EQUIPMENT AND MOUNTING HARDWARE SUPPLIED BY MANUFACTURER KUBOTA AND INSTALLED BY CONTRACTOR.
4. CONTRACTOR TO VERIFY DIMENSIONS, ELEVATIONS, AND LOCATIONS PRIOR TO CONSTRUCTION.
5. ALL NPW PIPE ABOVE GRADE TO BE SCHED 40 SST.
6. WYE STRAINER, 50 GRID.
7. CONTRACTOR TO MODIFY TO FIT SITE EQUIPMENT.

BID SET REVIEW

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SHEET __ OF __

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NO.	REVISIONS	INT.	APP.	DATE

ACTION	BY	DATE
DESIGNED	AM	01/03/25
DRAWN	KT	01/03/25
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CHECKED (HDQTS.)		

PRELIMINARY

ALLAN M. ABBS — STATE OF WASHINGTON — 27045 — REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

INFLUENT SCREEN PLAN AND SECTION

B-M2.2

SCALE

AS NOTED

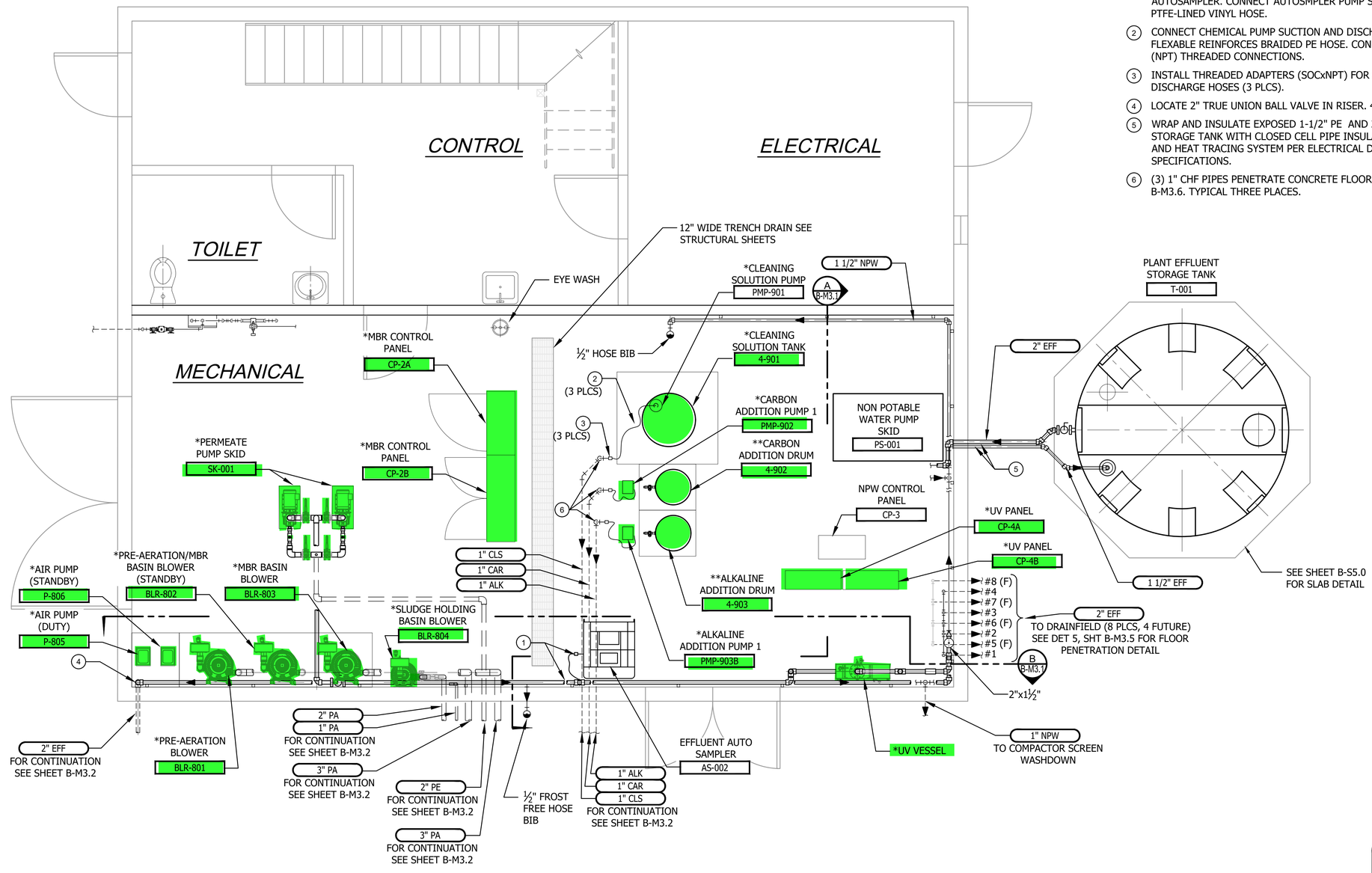
PARKS FILE#

NOTES:

1. * ASTERISKED NOTE INDICATE PIPING, EQUIPMENT AND MOUNTING HARDWARE SUPPLIED BY MANUFACTURER KUBOTA AND INSTALLED BY CONTRACTOR. SEE SPECIFICATION SECTION 017050 FOR DETAILED INFORMATION.
2. FOR PIPING MATERIALS SPECIFICATIONS AND ABBREVIATIONS SEE DIVISION 40 TECHNICAL SPECIFICATIONS.
3. FOR ALL PIPE PENETRATIONS THROUGH FLOOR SEE DETAIL 5 SHEET B-M3.5
4. ** ASTERISKED NOTE INDICATE PIPING, EQUIPMENT AND MOUNTING HARDWARE SUPPLIED BY CHEMICAL SUPPLIER.

KEY NOTES:

1. REDUCE 2" PE PIPE TO ⅜" HOSE CONNECTION, PROVIDE SUCTION HOSE TO AUTOSAMPLER. CONNECT AUTOSMPLER PUMP SUCTION WITH VINYL OR PTFE-LINED VINYL HOSE.
2. CONNECT CHEMICAL PUMP SUCTION AND DISCHARGE PIPES WITH 1" FLEXABLE REINFORCES BRAIDED PE HOSE. CONNECT TO PROCESS PIPE WITH (NPT) THREADED CONNECTIONS.
3. INSTALL THREADED ADAPTERS (SOCxNPT) FOR CONNECTION OF PUMP DISCHARGE HOSES (3 PLCS).
4. LOCATE 2" TRUE UNION BALL VALVE IN RISER. 48" ABOVE FINISH FLOOR.
5. WRAP AND INSULATE EXPOSED 1-1/2" PE AND 2" PE AT PLANT EFFLUENT STORAGE TANK WITH CLOSED CELL PIPE INSULATION, ALUMINUM JACKETING AND HEAT TRACING SYSTEM PER ELECTRICAL DRAWINGS AND SPECIFICATIONS.
6. (3) 1" CHF PIPES PENETRATE CONCRETE FLOOR , SEE DETAIL 18, SHEET B-M3.6. TYPICAL THREE PLACES.



PLAN

SCALE 3/8" = 1'-0"

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PRELIMINARY

BRIAN E BUNNELL STATE OF WASHINGTON 46055 REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

OPERATIONS BUILDING INTERNAL PIPING PLAN

B-M3.0

SCALE

AS NOTED

PARKS FILE#

U:\PSO\Projects\Clients\4763-RW Draft\216-4763-010 NisquallyParkWWOptions\99Svcs\CADD\DWG\PS180624-M3.0.dwg
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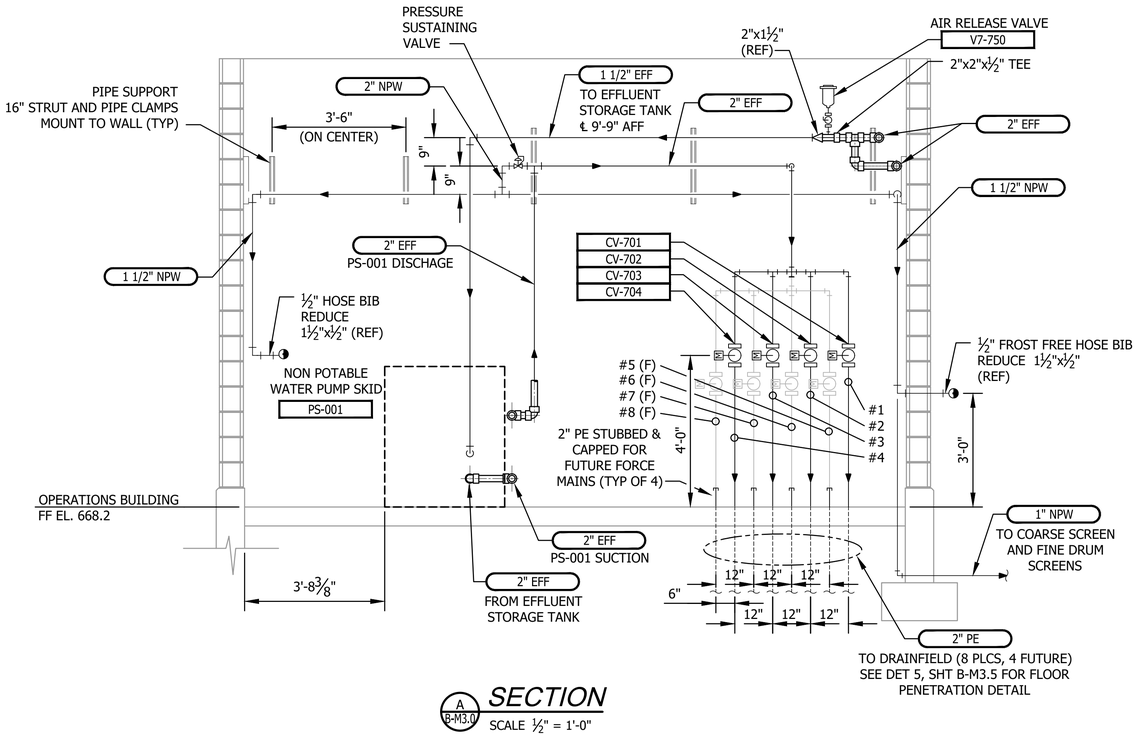


A / B-M3.0 **SECTION**
SCALE ½" = 1'-0"

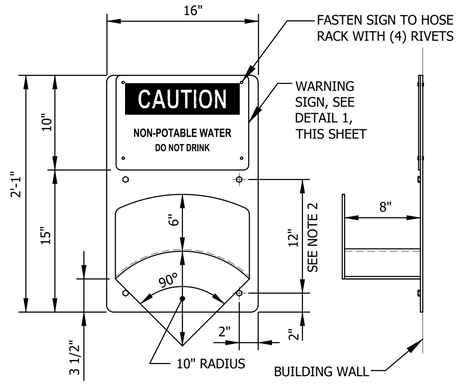
NOTES:

1. GRAPHIC: AS SHOWN WITH BLACK LEGEND ON YELLOW FIELD IN ACCORDANCE WITH ANSI Z535.1 AND ANSI Z535.2.
2. MATERIAL: FADEPROOF GRAPHIC PERMANENTLY EMBEDDED IN 0.10 INCH THICK FIBERGLASS REINFORCED PLASTIC. GUARANTEED NOT TO CHIP, FADE OR PEEL FOR 15 YEARS.
3. ROUNDED CORNERS AND 4 MOUNTING HOLES.

1 / - **DETAIL**
SCALE: NONE

NOTES:

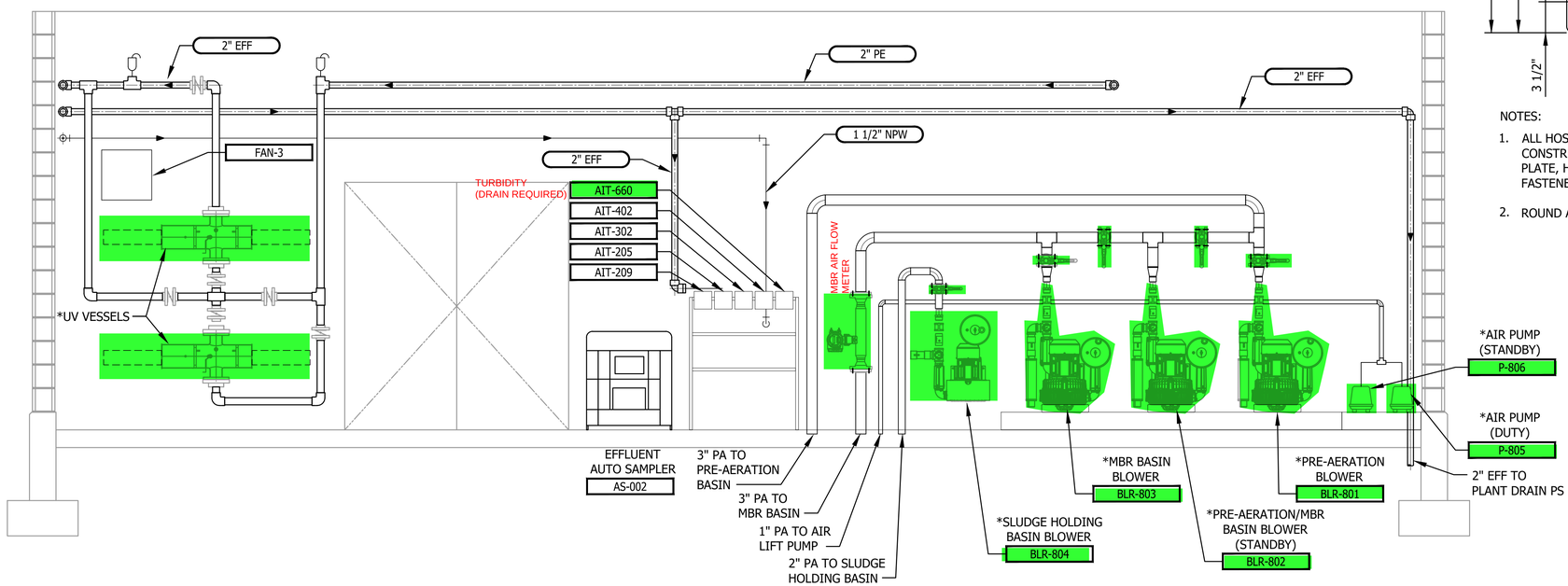
1. * ASTERISKED NOTE INDICATE PIPING, EQUIPMENT AND MOUNTNG HARDWARE SUPPLIED BY MANUFACTURER KUBOTA AND INSTALLED BY CONTRACTOR. SEE SPECIFICATION SECTION 017050 FOR DETAILED INFORMATION.
2. FOR PIPING MATERIALS SPECIFICATIONS AND ABBREVIATIONS SEE DIVISION 40 TECHNICAL SPECIFICATIONS.
3. NON POTABLE WATER PUMP SKID AND EFFLUENT DISPOSAL PUMP SKID SHALL HAVE FLEXIBLE CONNECTIONS TO PROCESS PIPE, CONNECTIONS NOT SHOWN FOR CLARITY.
4. CONTRACTOR SHALL LOCATE UNIONS AS REQUIRED FOR EASY OF ASSEMBLY, NOT SHOWN FOR CLARITY.
5. CONTRACTOR SHALL INSTALL HOSE RACKS AND WARNING SIGNS AT ALL HOSE BIB LOCATIONS. SEE DETAILS 1 AND 2 THIS SHEET.



NOTES:

1. ALL HOSE RACKS AND MOUNTINGS SHALL BE WELDED CONSTRUCTION. MATERIAL SHALL BE MINIMUM 3/16" STEEL PLATE, HOT DIP GALVANIZED AFTER FABRICATION. ALL FASTENERS SHALL BE TYPE 316 STAINLESS STEEL.
2. ROUND ALL CORNERS (3/4" RADIUS).

2 / - **DETAIL**
SCALE: NONE



B / B-M3.0 **SECTION**
SCALE ½" = 1'-0"

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SHEET __ OF __

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		DATE
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		INT.
		REVISIONS
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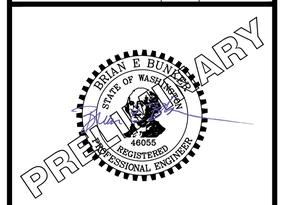


REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF OPERATIONS BUILDING INTERNAL PIPING SECTION AND DETAILS

B-M3.1

SCALE

AS NOTED

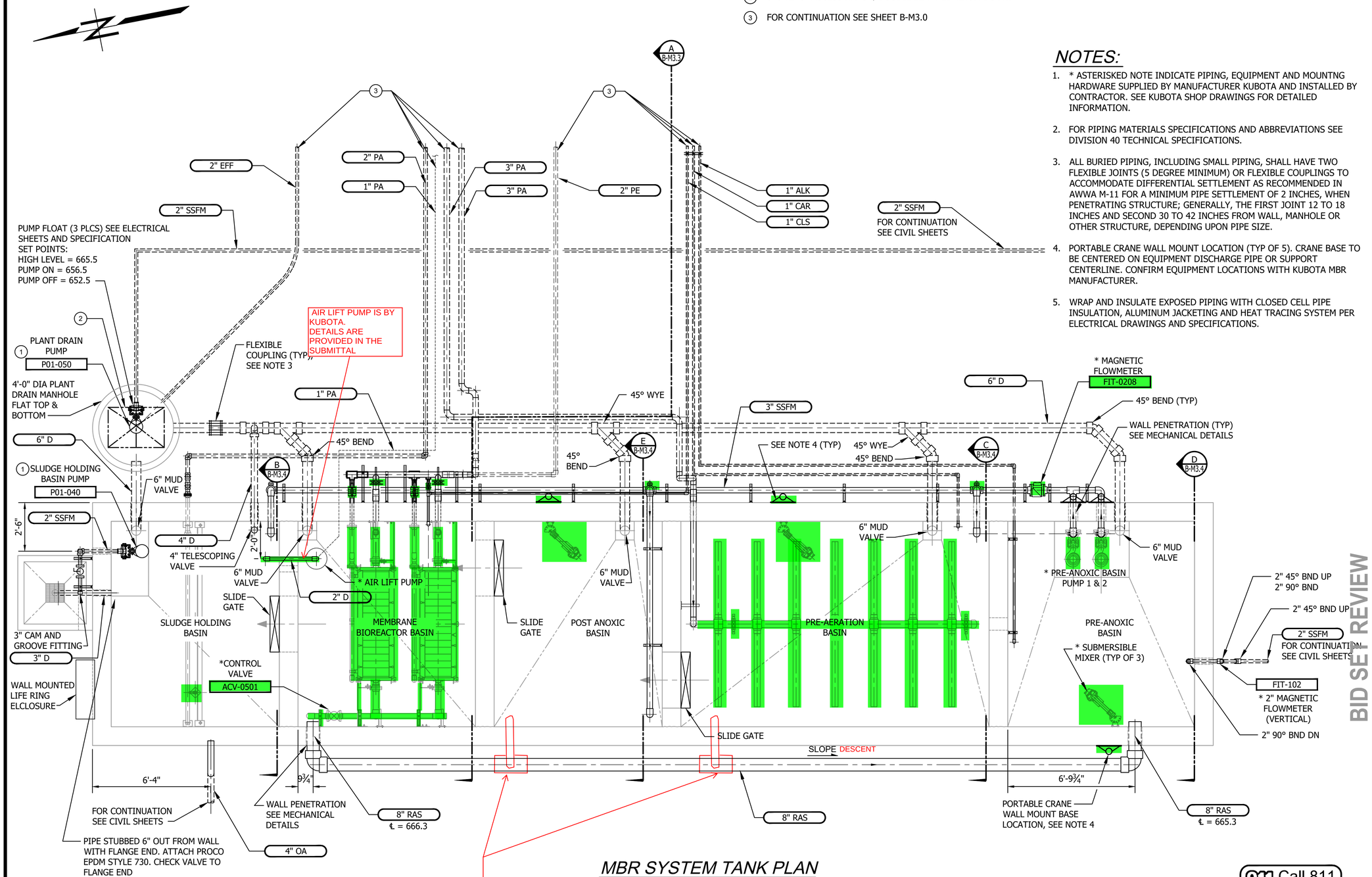
PARKS FILE#

CONSTRUCTION NOTES:

1. RAIL PUMP AND BASE ELBOW WITH INTEGRATED CHECK VALVE.
2. 3'-0"x2'-6" ACCESS HATCH, DOUBLE LEAF ALUMINUM DOORS
3. FOR CONTINUATION SEE SHEET B-M3.0

NOTES:

1. * ASTERISKED NOTE INDICATE PIPING, EQUIPMENT AND MOUNTNG HARDWARE SUPPLIED BY MANUFACTURER KUBOTA AND INSTALLED BY CONTRACTOR. SEE KUBOTA SHOP DRAWINGS FOR DETAILED INFORMATION.
2. FOR PIPING MATERIALS SPECIFICATIONS AND ABBREVIATIONS SEE DIVISION 40 TECHNICAL SPECIFICATIONS.
3. ALL BURIED PIPING, INCLUDING SMALL PIPING, SHALL HAVE TWO FLEXIBLE JOINTS (5 DEGREE MINIMUM) OR FLEXIBLE COUPLINGS TO ACCOMMODATE DIFFERENTIAL SETTLEMENT AS RECOMMENDED IN AWWA M-11 FOR A MINIMUM PIPE SETTLEMENT OF 2 INCHES, WHEN PENETRATING STRUCTURE; GENERALLY, THE FIRST JOINT 12 TO 18 INCHES AND SECOND 30 TO 42 INCHES FROM WALL, MANHOLE OR OTHER STRUCTURE, DEPENDING UPON PIPE SIZE.
4. PORTABLE CRANE WALL MOUNT LOCATION (TYP OF 5). CRANE BASE TO BE CENTERED ON EQUIPMENT DISCHARGE PIPE OR SUPPORT CENTERLINE. CONFIRM EQUIPMENT LOCATIONS WITH KUBOTA MBR MANUFACTURER.
5. WRAP AND INSULATE EXPOSED PIPING WITH CLOSED CELL PIPE INSULATION, ALUMINUM JACKETING AND HEAT TRACING SYSTEM PER ELECTRICAL DRAWINGS AND SPECIFICATIONS.



MBR SYSTEM TANK PLAN

SCALE ⅜"=1'-0"

BID SET REVIEW

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PRELIMINARY

BRIAN E BUNDY STATE OF WASHINGTON 46055 REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

MBR SYSTEM TANK PLAN

B-M3.2

SCALE

AS NOTED

PARKS FILE#

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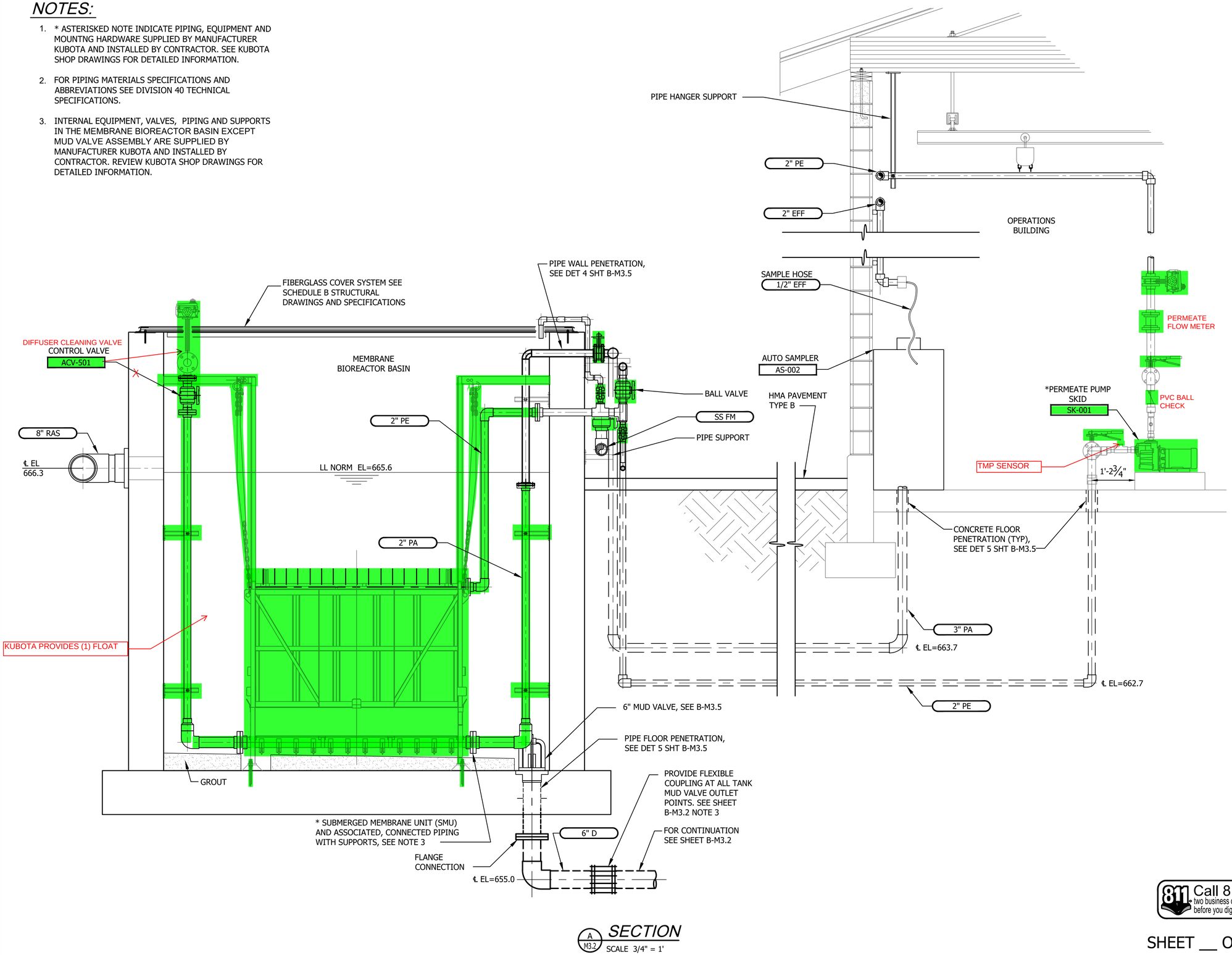
Jan-06-25 10:26am

NOTES:

1. * ASTERISKED NOTE INDICATE PIPING, EQUIPMENT AND MOUNTNG HARDWARE SUPPLIED BY MANUFACTURER KUBOTA AND INSTALLED BY CONTRACTOR. SEE KUBOTA SHOP DRAWINGS FOR DETAILED INFORMATION.
2. FOR PIPING MATERIALS SPECIFICATIONS AND ABBREVIATIONS SEE DIVISION 40 TECHNICAL SPECIFICATIONS.
3. INTERNAL EQUIPMENT, VALVES, PIPING AND SUPPORTS IN THE MEMBRANE BIOREACTOR BASIN EXCEPT MUD VALVE ASSEMBLY ARE SUPPLIED BY MANUFACTURER KUBOTA AND INSTALLED BY CONTRACTOR. REVIEW KUBOTA SHOP DRAWINGS FOR DETAILED INFORMATION.



A / M3.2 *SECTION*
SCALE 3/4" = 1'

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BRIAN E BUNNELL STATE OF WASHINGTON 46055 REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY
REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

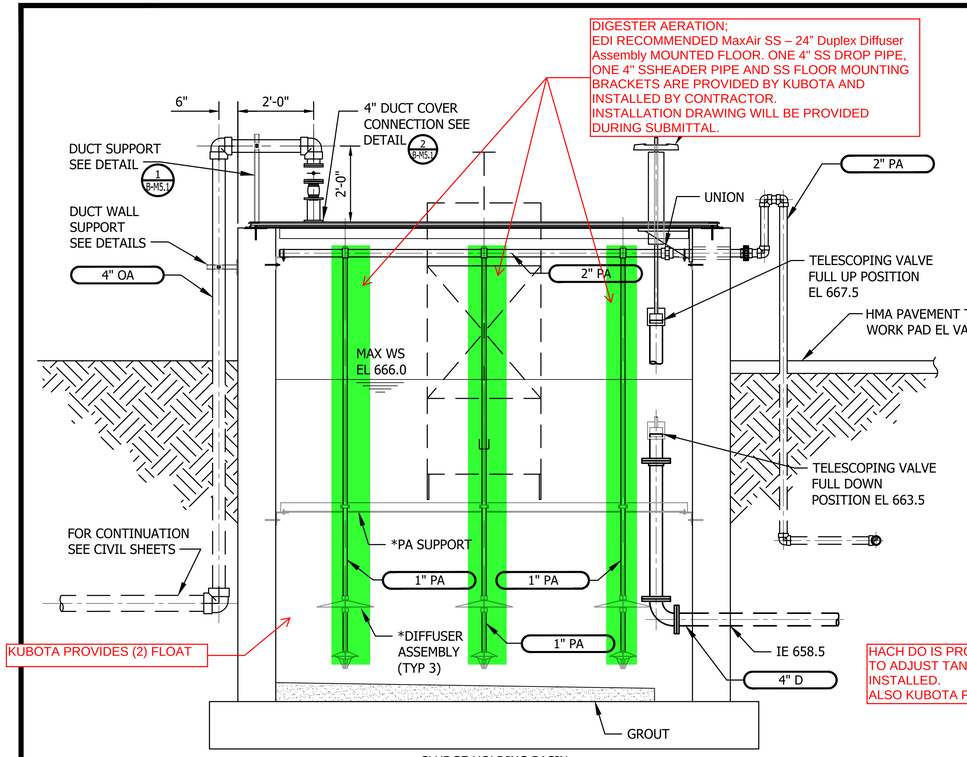
PHASE 3A MAINTENANCE BUILDING AND WWTF

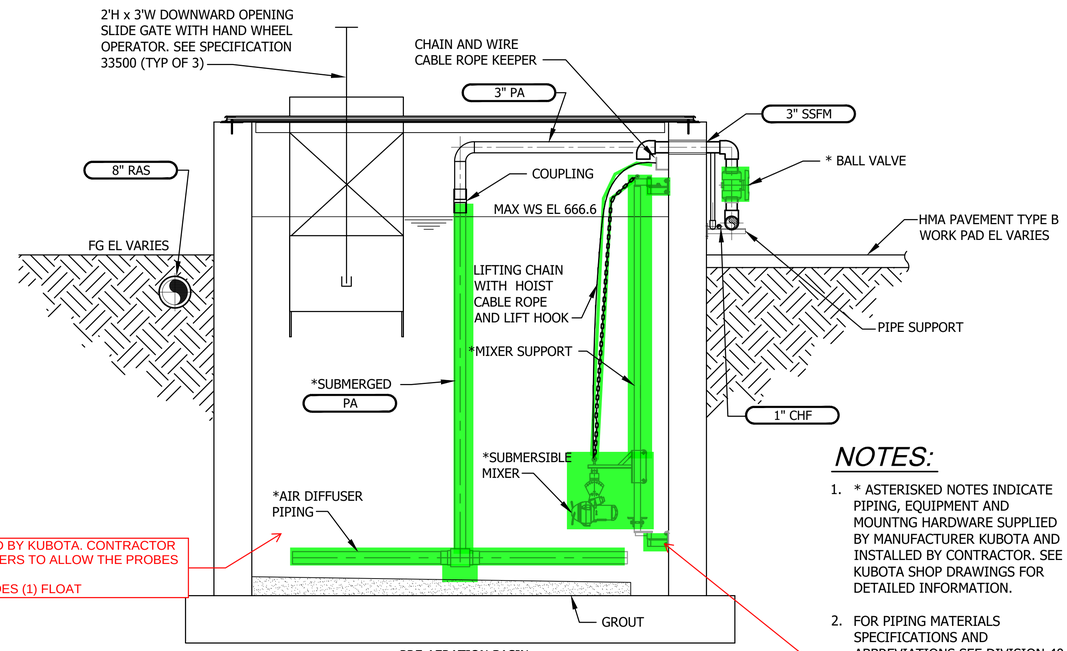
MBR TANK INTERNAL PIPING SECTION

B-M3.3

SCALE
AS NOTED

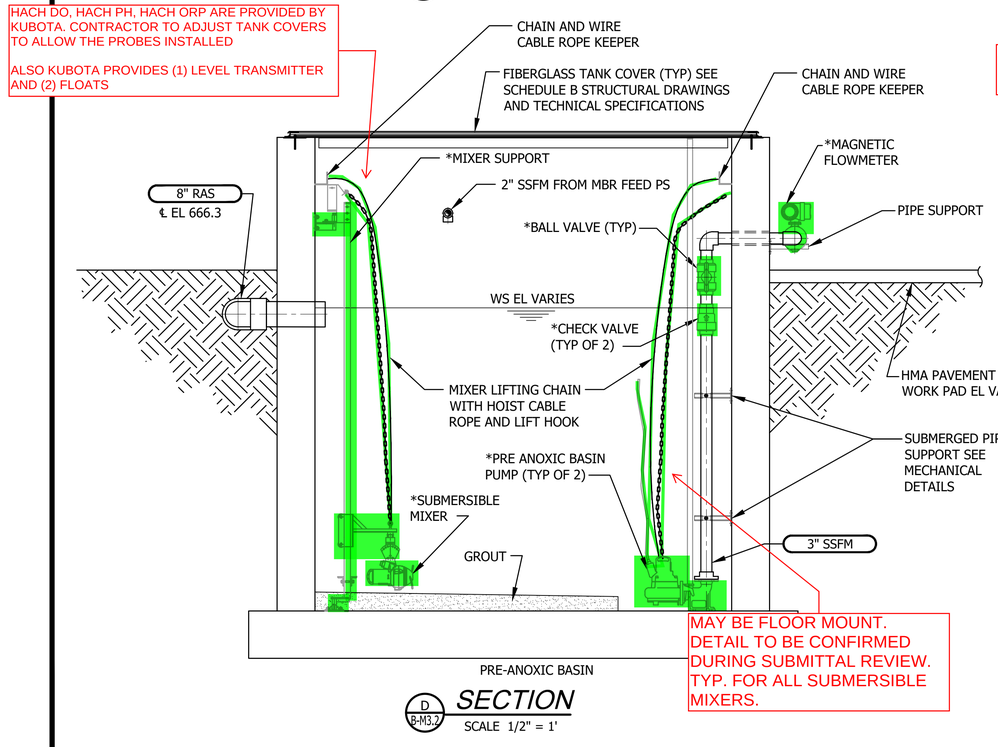
PARKS FILE#

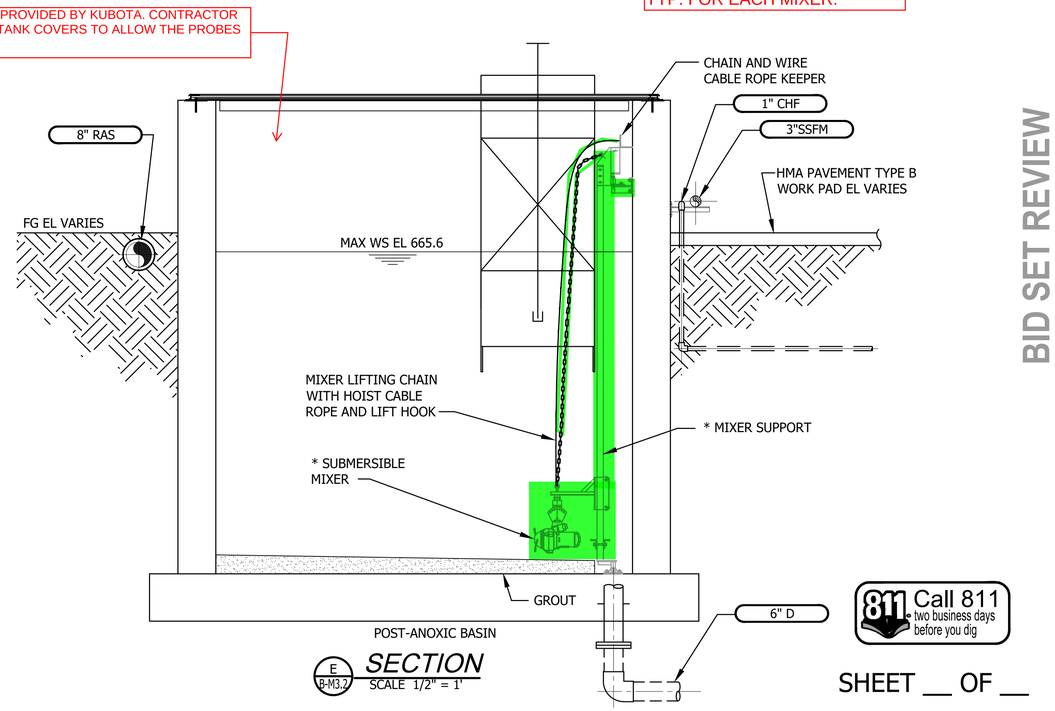




NOTES:

1. * ASTERISKED NOTES INDICATE PIPING, EQUIPMENT AND MOUNTNG HARDWARE SUPPLIED BY MANUFACTURER KUBOTA AND INSTALLED BY CONTRACTOR. SEE KUBOTA SHOP DRAWINGS FOR DETAILED INFORMATION.
2. FOR PIPING MATERIALS SPECIFICATIONS AND ABBREVIATIONS SEE DIVISION 40 TECHNICAL SPECIFICATIONS.





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PRELIMINARY
BRIAN E BUNNELL
STATE OF WASHINGTON
46055
REGISTERED PROFESSIONAL ENGINEER
REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

MBR SYSTEM PIPING SECTIONS

B-M3.4

SCALE
AS NOTED

PARKS FILE#

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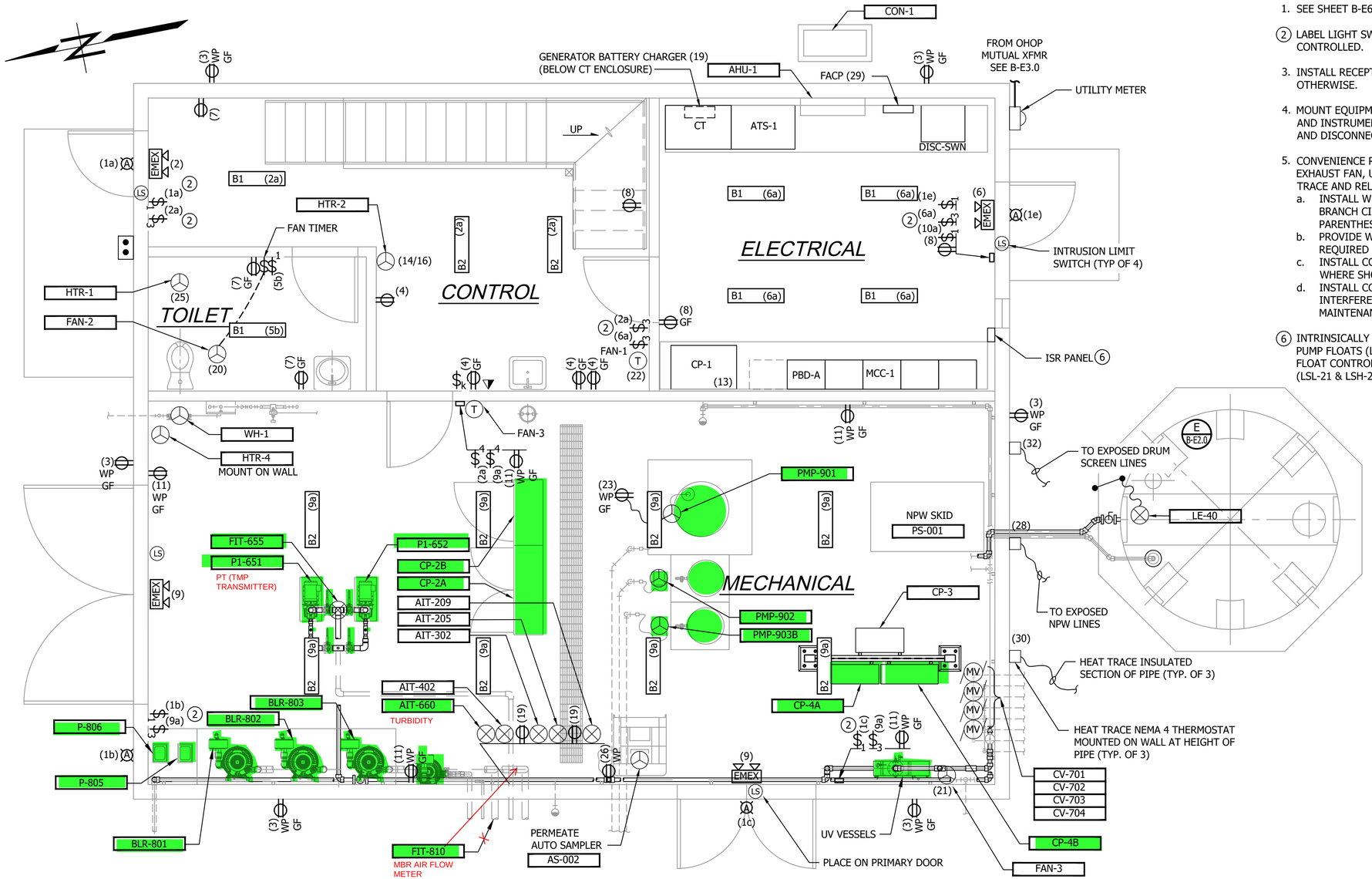
SHEET __ OF __



ELECTRICAL PLAN

SCALE: ⅜"=1'-0"

NOTES:

1. SEE SHEET B-E6.1 FOR LIGHTING SCHEDULE.
2. (2) LABEL LIGHT SWITCH TO IDENTIFY WHICH LIGHTS ARE CONTROLLED.
3. INSTALL RECEPTACLES 24" A.F.F. UNLESS NOTED OTHERWISE.
4. MOUNT EQUIPMENT USING STAINLESS STEEL STRUT: PANELS AND INSTRUMENTS @ 66" A.F.G. TO TOP, TERMINAL BOXES AND DISCONNECT SWITCHES @ 48" A.F.G. TO TOP.
5. CONVENIENCE RECEPTACLES, LIGHTING FIXTURES, WALL EXHAUST FAN, UNIT HEATERS. MOTORIZED DAMPER, HEAT TRACE AND RELATED SWITCHES:
   a. INSTALL WHERE SHOWN AND CONNECT TO 120V BRANCH CIRCUITS AND/OR SWITCHLEGS INDICATED IN PARENTHESES.
   b. PROVIDE WIRES, CONDUITS, ETC (NOT SHOWN) AS REQUIRED FOR PROPER OPERATION OF EQUIPMENT.
   c. INSTALL CONDUITS CONCEALED IN WALLS EXCEPT WHERE SHOWN OTHERWISE.
   d. INSTALL CONDUITS AND BOXES SO AS NOT TO INTERFERE WITH INSTALLATION. OPERATION AND MAINTENANCE OF OTHER EQUIPMENT.

(6) INTRINSICALLY SAFE BARRIERS (RELAYS) FOR PLANT DRAIN PUMP FLOATS (LSL-31 & LSH-32), INFLUENT PUMP BACKUP FLOAT CONTROL (LSL-11 & LSH-14) & MBR FEED FLOATS (LSL-21 & LSH-24).

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PRELIMINARY
MARVIN C. CASANOVA
STATE OF WASHINGTON
48989
REGISTERED
PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

BUILDING ELECTRICAL PLAN

B-E4.0

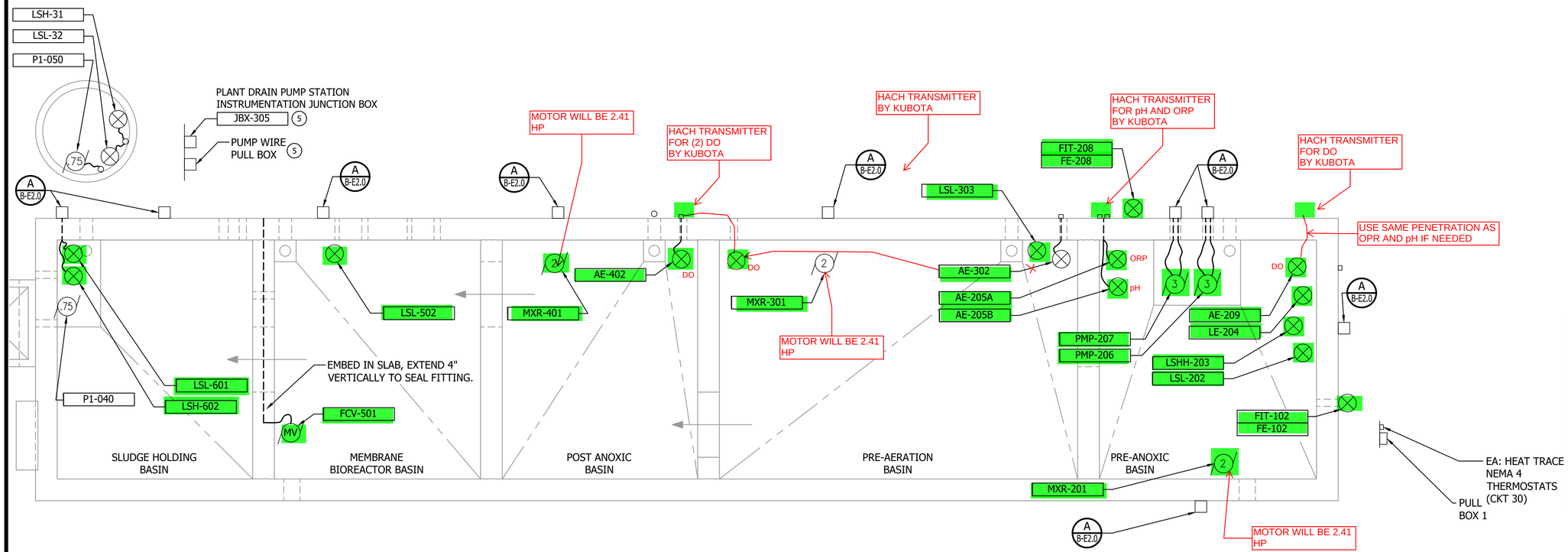
SCALE

AS NOTED

PARKS FILE#

NOTES:

1. ENTER ENCLOSURES THROUGH BOTTOM.
2. PROVIDE STRAIN RELIEF FOR ALL CABLES WITHIN BASINS USING STAINLESS STEEL KLELLUMS CORD GRIPS. MOUNT WHERE ACCESSIBLE TO OPERATOR PER (A / B-E2.0).
3. COIL AND CABLE TIE EXCESS INSTRUMENT CABLES WITHIN BASINS.
4. INSTRUMENT LOCATIONS SHOWN ARE APPROXIMATE. VERIFY EXACT LOCATIONS BEFORE ROUTING CABLE AND CONDUIT.
5. PROVIDE NEMA 7 (XP) JUNCTION BOX WITH STAINLESS STEEL HINGES, CONTAINING SCREW COMPRESSION TERMINALS FOR CONNECTION OF PUMP/INSTRUMENT CABLE LEADS TO WIRES RUNNING TO MCC-1 & CP-1. SEE DETAIL THIS SHEET FOR MOUNTING.
6. REFER TO SHEET B-E6.2 FOR CABLE AND CONDUIT SCHEDULE.



MBR TANK ELECTRICAL PLAN

SCALE: 3/8"=1'-0"

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MARVIN C. CASANOVA
STATE OF WASHINGTON
48989
REGISTERED PROFESSIONAL ENGINEER

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WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

MBR TANK ELECTRICAL PLAN

B-E5.0

SCALE

AS NOTED

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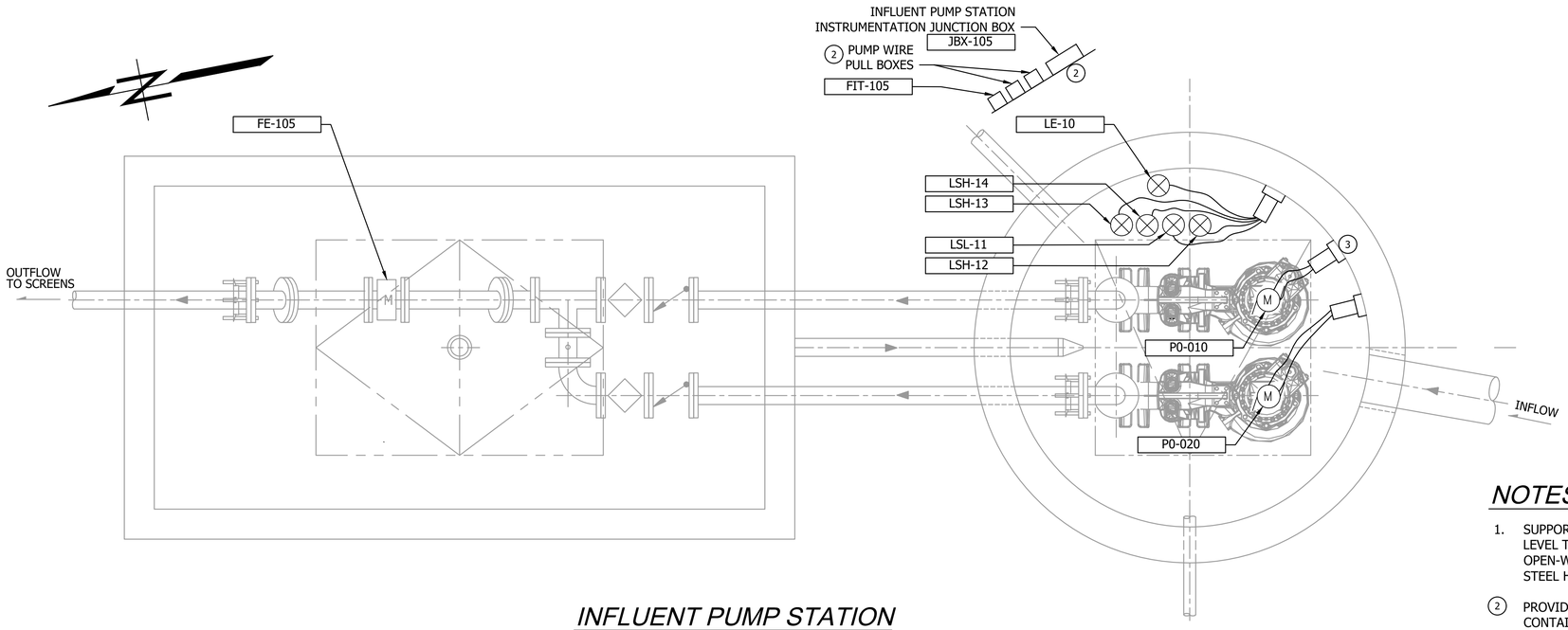
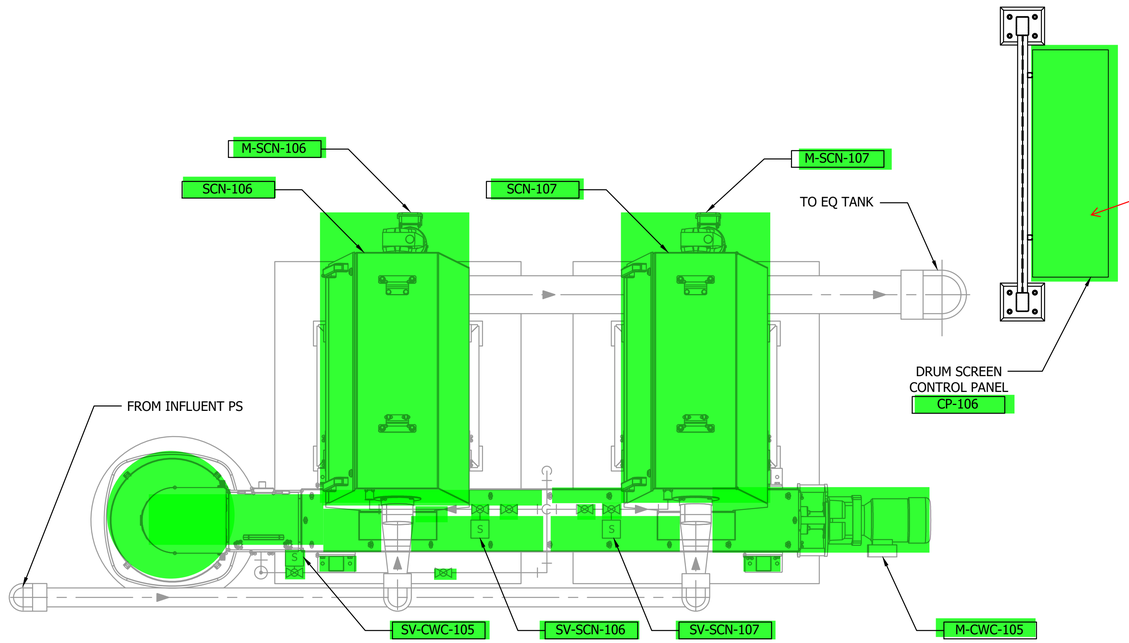


INFLUENT PUMP STATION ELECTRICAL PLAN

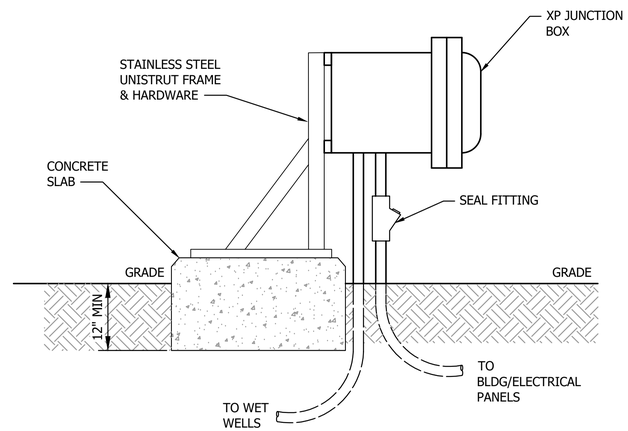
SCALE: 1"=1'-0"



FIT105 (INFLUENT WET WELL FLOWMETER INFORMATION) IS USED TO TRIGER THE FINE SCREEN SYSTEM TO START

INFLUENT SCREEN PLAN

SCALE: 1"=1'-0"



MOUNTING DETAIL

A / -

NO SCALE

NOTES:

1. SUPPORT ALL PUMP CABLES, FLOAT SWITCH CABLES, AND SUBMERSIBLE LEVEL TRANSDUCER CABLES IN WET WELL W STAINLESS STEEL OPEN-WEAVE GRIPS (KELLUMS, OR EQUAL) ATTACHED TO STAINLESS STEEL HOOKS FASTENED TO ACCESS HATCH FRAME.
2. PROVIDE NEMA 7 (XP) JUNCTION BOX WITH STAINLESS STEEL HINGES, CONTAINING SCREW COMPRESSION TERMINALS FOR CONNECTION OF PUMP/INSTRUMENT CABLE LEADS TO WIRES RUNNING TO MCC-1 & CP-1. SEE DETAIL THIS SHEET FOR MOUNTING.
3. PROVIDE INSULATING BUSHING ON WET WELL END OF EACH CONDUIT.
4. REFER TO SHEET B-E6.2 FOR CABLE AND CONDUIT SCHEDULE.

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PRELIMINARY

MARVIN C. CASANOVA
STATE OF WASHINGTON
48989
REGISTERED PROFESSIONAL ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

INFLUENT PUMP AND SCREEN ELECTRICAL PLAN

B-E5.1

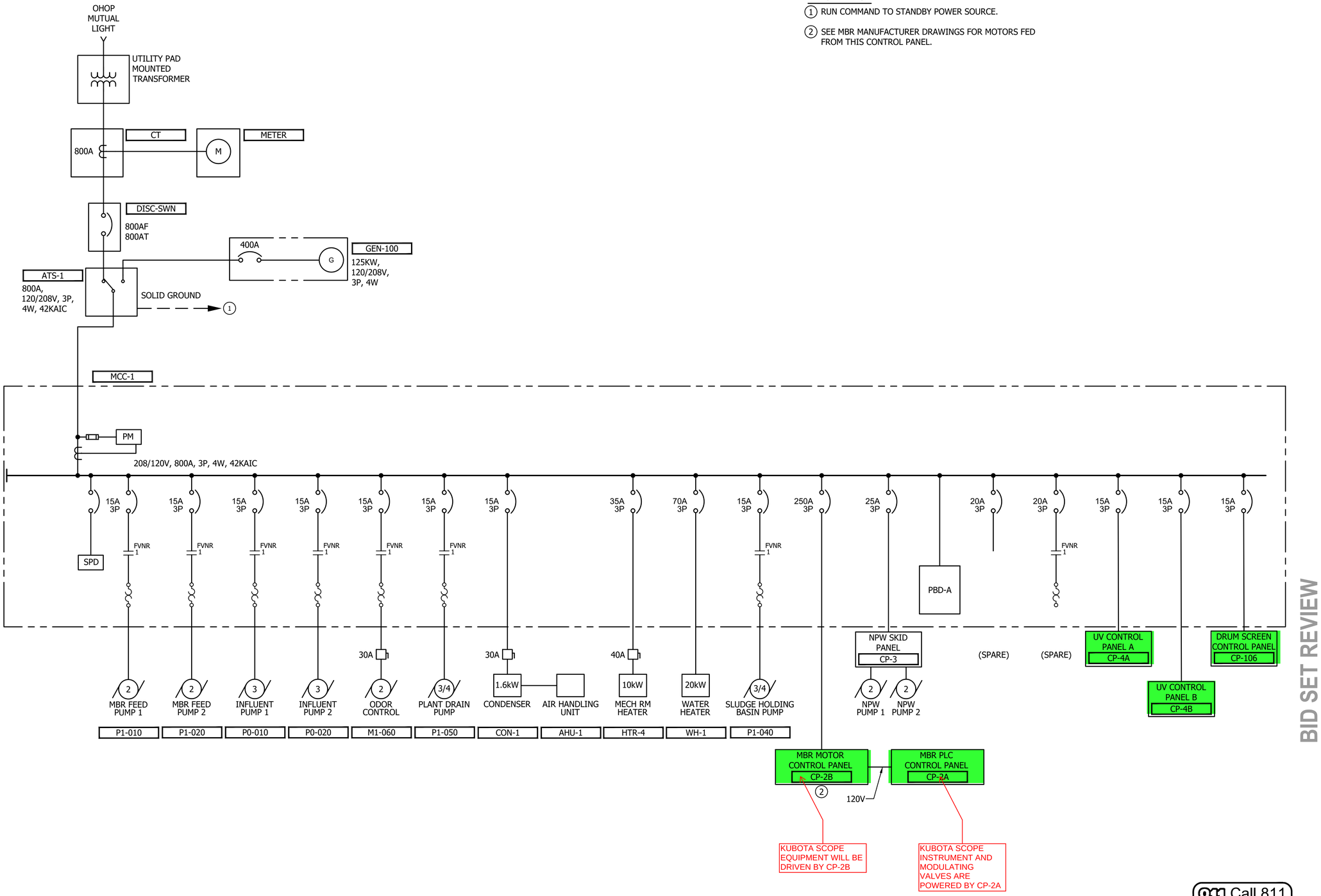
SCALE

AS NOTED

PARKS FILE#

NOTES:

1. RUN COMMAND TO STANDBY POWER SOURCE.
2. SEE MBR MANUFACTURER DRAWINGS FOR MOTORS FED FROM THIS CONTROL PANEL.



MCC-1 ONE-LINE DIAGRAM

BID SET REVIEW

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MARVIN C. CASANOVA — STATE OF WASHINGTON — 48989 — REGISTERED PROFESSIONAL ENGINEER — PRELIMINARY

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

ELECTRICAL ONE-LINE DIAGRAM

B-E6.0

SCALE

NO SCALE

PARKS FILE#

CONDUIT AND CABLE SCHEDULE

v2.0

NUMBER	CONDUIT QUAN & SIZE	CONDUIT TYPE	WIRE FILL	WIRE TYPE	FROM	TO	VIA	REMARKS
C-101	(1)1"	PVC/GRS	(10)#14	THWN	CP-1	GEN-100		(2) SPARE
C-102	(1)1"	GRS	(10)#14	THWN	CP-1	ATS-1		
C-103	(1)4"	GRS	(82)#14	THWN	CP-1	MCC-1		(8) SPARE
C-104	(1)1"	PVC/GRS	(2)#10	THWN	ATS-1	GEN-100		START SIGNAL
C-105	(1)1"	PVC/GRS	(8)#14, (1)#14G	THWN	MCC-1	JBX-105	ISR PANEL	FLOAT SIGNALS
C-105A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	JBX-105	LSL-11, LSH-12, LSH-13, LSH-14		
C-106	(1)1"	PVC/GRS	(8)#14, (1)#14G	THWN	MCC-1	JBX-205	ISR PANEL	FLOAT SIGNALS
C-106A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	JBX-205	LSL-21, LSH-22, LSH-23, LSH-24		
C-107	(1)1"	PVC/GRS	(4)#14, (1)#14G	THWN	MCC-1	JBX-305	ISR PANEL	FLOAT SIGNALS
C-107A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	JBX-305	LSH-31, LSL-32		
C-200	(1)1"	PVC/GRS	(4)#14, (1)#14G	THWN	MCC-1	JBX-105		SEAL & TEMPERATURE
C-200A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	JBX-105	P0-010		
C-201	(1)1"	PVC/GRS	(4)#14, (1)#14G	THWN	MCC-1	JBX-105		SEAL & TEMPERATURE
C-201A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	JBX-105	P0-020		
C-202	(1)1"	PVC/GRS	(4)#14, (1)#14G	THWN	MCC-1	JBX-205		SEAL & TEMPERATURE
C-202A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	JBX-205	P1-010		
C-203	(1)1"	PVC/GRS	(4)#14, (1)#14G	THWN	MCC-1	JBX-205		SEAL & TEMPERATURE
C-203A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	JBX-205	P1-020		
C-204	(1)1"	PVC/GRS	(4)#14, (1)#14G	THWN	MCC-1	JBX-305		SEAL & TEMPERATURE
C-204A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	JBX-305	P1-050		
C-208	(1)1"	PVC/GRS	(4)#14	THWN	MCC-1	P1-040	JUNCTION BOX	SLUDGE PUMP CONTROL
C-210	(1)1"	GRS	(10)#14	THWN	CP-1	CP-3		NPW PUMP CONTROL
C-211	(1)1"	GRS	(12)#14, (1)#14G	THWN	CP-1	CV-701		(4) SPARE
C-212	(1)1"	GRS	(12)#14, (1)#14G	THWN	CP-1	CV-702		(4) SPARE
C-213	(1)1"	GRS	(12)#14, (1)#14G	THWN	CP-1	CV-703		(4) SPARE
C-214	(1)1"	GRS	(12)#14, (1)#14G	THWN	CP-1	CV-704		(4) SPARE
C-215	(1)3/4"	GRS	(2)#14, (1)#14G	THWN	CP-1	INTRUSION SW., CTRL N.		
C-216	(1)3/4"	GRS	(2)#14, (1)#14G	THWN	CP-1	INTRUSION SW., CTRL E.		
C-217	(1)3/4"	GRS	(2)#14, (1)#14G	THWN	CP-1	INTRUSION SW., ELEC.		
C-218	(1)3/4"	GRS	(2)#14, (1)#14G	THWN	CP-1	INTRUSION SW. MECH. W.		
C-219	(1)3/4"	GRS	(2)#14, (1)#14G	THWN	CP-1	INTRUSION SW. MECH. N.		
C-220	(1)3/4"	GRS	(3)#14	THWN	CP-1	BLDG. SECURITY SW.		
C-501	(1)1"	PVC/GRS	(4)#14, (1)#14G		CP-2A	LSL-601, LSH-602	JUNCTION BOX	FLOATS, SLUDGE HOLDING BASIN
C-502	(1)1"	PVC/GRS	(4)#14, (1)#14G		CP-2A	LSL-502	JUNCTION BOX	FLOAT, MBR BASIN
C-503	(1)1"	PVC/GRS	(8)#14, (1)#14G		CP-2A	FCV-501		VALVE, MBR BASIN
C-504	(1)1"	PVC/GRS	(4)#14, (1)#14G		CP-2A	LSHH-203, LSL-202	JUNCTION BOX	FLOATS, PRE-ANOXIC BASIN
C-505	(1)1"	PVC/GRS	(4)#14, (1)#14G		CP-2A	PMP-902, PMP-903B		FAIL SIGNALS
C-506	(1)1"	PVC/GRS	(2)#14, (1)#14G		CP-2A	LSL-303		FLOAT, PRE-AERATION BASIN
C-507	(1)1"	PVC/GRS	(8)#14, (1)#14G		CP-2A	FCV-657		VALVE, PERMEATE FLOW
C-512	(1)1"	PVC/GRS	(4)#14, (1)#14G		CP-2B	MXR-201	JUNCTION BOX	MIXER TEMP, MOISTURE
C-513	(1)1"	PVC/GRS	(4)#14, (1)#14G		CP-2B	MXR-401	JUNCTION BOX	MIXER TEMP, MOISTURE
C-514	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	CP-2B	PMP-206		SEAL & TEMPERATURE
C-515	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	CP-2B	PMP-207		SEAL & TEMPERATURE
C-516	(1)1"	PVC/GRS	(4)#14, (1)#14G		CP-2B	MXR-301	JUNCTION BOX	MIXER TEMP, MOISTURE
S-100	(1)1"	PVC/GRS	FIBER OPTIC CABLE, 6 STRAND	FO	CP-1	MAINTENANCE BUILDING	3'X3' HH01	
S-105	(1)1"	PVC/GRS	(2)#16	TSP	CP-1	FIT-105		INFLUENT FLOW TRANSMITTER
S-105A	(1)1"	GRS	MANUFACTURER'S CABLE	MANUF. CABLE	FE-105	FIT-105		
S-200	(1)1"	PVC/GRS	(2)#16	TSP	CP-1	JBX-105		INFLUENT WELL LEVEL TRANSMITTER
S-200A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	LE-10	JBX-105		
S-201	(1)1"	PVC/GRS	(2)#16	TSP	CP-1	JBX-205		MBR FEED WELL LEVEL TRANSMITTER
S-201A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	LE-20	JBX-205		
S-210	(1)1"	GRS	(2)CAT5e	CAT5e	CP-1	CP-2A		(1) SPARE
S-401	(1)1"	PVC/GRS	(2)#16	TSP	CP-1	AIT-100		H2S ANALYZER
S-402	(1)1"	PVC/GRS	(2)#16	TSP	CP-1	LE-40		NPW TANK LEVEL
S-403	(1)1"	GRS	(2)#16	TSP	CP-1	AS-002		FLOW SIGNAL TO EFFLUENT SAMPLER
S-404	(1)1"	PVC/GRS	(2)#16	TSP	CP-1	SMP-2230		FLOW SIGNAL TO INFLUENT SAMPLER
S-506	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	AE-302	AIT-302		PRE-AERATION DO ANALYZER
S-507	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	AE-205A, AE-205B	AIT-205		ORP/PH ANALYZER
S-508	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	AE-209	AIT-209		DO/TEMP ANALYZER
S-509	(1)1"	GRS	(10)#16	TSP	CP-2A	AIT-302, AIT-205, AIT-209, AIT-402		MBR ANALYZERS
S-510	(1)1"	PVC/GRS	(2)#16	TSP	CP-2A	FIT-208		FEED FORWARD FLOW
S-511	(1)1"	PVC/GRS	(2)#16	TSP	CP-2A	LE-204		PRE-ANOXIC BASIN LEVEL
S-512	(1)1"	PVC/GRS	(2)#16	TSP	CP-2A	FIT-102		MBR FEED FLOW
S-513	(1)1"	PVC/GRS	(2)#16	TSP	CP-2A	PT-600		PERMEATE SUCTION PRESSURE
S-514	(1)1"	PVC/GRS	(1)CAT5e	CAT5E	CP-2A	CP-106		DRUM SCREEN CONTROL PANEL
S-515	(1)1"	GRS	(1)CAT5e	CAT5E	CP-2A	CP-4A		UV CONTROL PANEL
S-516	(1)1"	GRS	(1)CAT5e	CAT5E	CP-2A	CP-4B		UV CONTROL PANEL
S-517	(1)1"	GRS	MANUFACTURER'S CABLE	MANUF. CABLE	CP-4A	UV VESSEL A		
S-518	(1)1"	GRS	MANUFACTURER'S CABLE	MANUF. CABLE	CP-4B	UV VESSEL B		
S-519	(1)1"	GRS	(4)#16	TSP	CP-2A	PMP-902, PMP-903		FLOW CONTROL
S-520	(1)1"	GRS	(2)#16	TSP	CP-2A	FIT-655		PERMEATE FLOW
S-521	(1)1"	GRS	(2)#16	TSP	CP-2A	AIT-660		TURBIDITY ANALYZER
S-522	(1)1"	GRS	(2)#16	TSP	CP-2A	FIT-810		MBR BASIN AIR FLOW

CONDUIT AND CABLE SCHEDULE

v2.0

NUMBER	CONDUIT QUAN & SIZE	CONDUIT TYPE	WIRE FILL	WIRE TYPE	FROM	TO	VIA	REMARKS
P-100	(2)4"	PVC/GRS	(3)600KCMIL, (1)#1/0G	XHHW	UTILITY XFMR.	ATS-1	DISC-SWN	
P-101	(1)4"	PVC/GRS	(3)600KCMIL, (1)#1/0G	XHHW	GEN-100	ATS-1		(1) SPARE
P-102	(2)4"	GRS	(3)600KCMIL, (1)#1/0G	XHHW	ATS-1	MCC-1		
P-200	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	MCC-1	PUMP WIRE PULL BOX		MBR FEED PUMP 1, (1) SPARE
P-200A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	P1-010	PUMP WIRE PULL BOX		
P-201	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	MCC-1	PUMP WIRE PULL BOX		MBR FEED PUMP 2, (1) SPARE
P-201A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	P1-020	PUMP WIRE PULL BOX		
P-202	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	MCC-1	PUMP WIRE PULL BOX		INFLUENT PUMP 1, (1) SPARE
P-202A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	P0-010	PUMP WIRE PULL BOX		
P-203	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	MCC-1	PUMP WIRE PULL BOX		INFLUENT PUMP 2, (1) SPARE
P-203A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	P0-020	PUMP WIRE PULL BOX		
P-204	(1)1"	PVC/GRS	(3)#12, (4)#14, (1)#12G	XHHW	MCC-1	PUMP WIRE PULL BOX		PLANT DRAIN PUMP, TEMP, SEAL
P-204A	(1)1"	PVC/GRS	MANUFACTURER'S CABLE	MANUF. CABLE	P1-050	PUMP WIRE PULL BOX		
P-206	(1)1"	GRS	(3)#10, (1)#10G	XHHW	MCC-1	HTR-4		MECHANICAL ROOM HEATER
P-208	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	MCC-1	P1-040	JUNCTION BOX	SLUDGE HOLDING BASIN PUMP
P-209	(1)4"	GRS	(3)#4/0, (1)#4G	XHHW	MCC-1	CP-2B		KUBOTA MOTOR CONTROL PANEL
P-210	(1)1"	GRS	(3)#12, (1)#12G	XHHW	MCC-1	CP-3		NPW SKID PANEL
P-213	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	MCC-1	CP-106		DRUM SCREEN CONTROL PANEL
P-214	(1)1"	GRS	(3)#6, (1)#6G	XHHW	MCC-1	WH-1		DOMESTIC WATER HEATER
P-215	(1)1"	GRS	(3)#12, (1)#12G	XHHW	MCC-1	CP-4A		UV CONTROL PANEL
P-216	(1)1"	GRS	(3)#12, (1)#12G	XHHW	MCC-1	CP-4B		UV CONTROL PANEL
P-217	(1)1"	PVC/GRS	(3)#12, (4)#14, (1)#12G	XHHW	MCC-1	M1-060		ODOR CONTROL BLOWER, AUX. TEMP
P-300	(1)1"	GRS	(2)#12, (1)#12G	XHHW	PBD-A	CP-1		
P-301	(1)1"	GRS	(2)#12, (1)#12G	XHHW	PBD-A	HTR-1		
P-302	(1)1"	GRS	(2)#12, (1)#12G	XHHW	PBD-A	FACP-1		FIRE ALARM CONTROL PANEL
P-303	(1)1"	GRS	(2)#12, (1)#12G	XHHW	PBD-A	FAN-3		
P-304	(1)1"	GRS	(2)#12, (1)#12G	XHHW	PBD-A	FAN-2		
P-305	(1)1"	GRS	(2)#12, (1)#12G	XHHW	PBD-A	FAN-1		
P-306	(1)1"	PVC/GRS	(2)#12, (1)#12G	XHHW	PBD-A	SMP-2230		INFLUENT SAMPLER
P-307	(1)1"	GRS	(2)#12, (1)#12G	XHHW	PBD-A	AS-002		PERMEATE SAMPLER
P-308	(1)1"	PVC/GRS	(2)#12, (1)#12G	XHHW	PBD-A	HT-MBR		MBR HEAT TRACE
P-309	(1)1"	PVC/GRS	(2)#12, (1)#12G	XHHW	PBD-A	HT-NPW		NPW HEAT TRACE
P-310	(1)1"	GRS	(2)#12, (1)#12G	XHHW	PBD-A	CP-2A		
P-311	(1)1"	PVC/GRS	(2)#12, (1)#12G	XHHW	PBD-A	HT-DS		DRUM SCREEN HEAT TRACE
P-312	(1)1"	GRS	(3)#10, (1)#10G	XHHW	PBD-A	HTR-3		ELECTRICAL ROOM HEATER
P-313	(1)1"	GRS	(3)#10, (1)#10G	XHHW	PBD-A	HTR-2		CONTROL ROOM HEATER
P-314	(1)1"	GRS	(4)#10, (1)#10G	XHHW	PBD-A	POLE LIGHTS AND RECEPTACLES		SEE E3.0 FOR ROUTING
P-401	(1)1"	PVC/GRS	(2)#12, (1)#12G	XHHW	CP-1	AIT-100		H2S ANALYZER
P-402	(1)1"	PVC/GRS	(2)#12, (1)#12G	XHHW	CP-1	FIT-105		INFLUENT FLOW TRANSMITTER
P-501	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	AIT-205		ORP/PH ANALYZER
P-502	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	AIT-209		DO/TEMP ANALYZER
P-503	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-2B	FCV-501		BIOREACTOR CONTROL VALVE
P-504	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	AIT-302		PRE-AERATION DO ANALYZER
P-505	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	AIT-402		POST-ANOXIC DO ANALYZER
P-506	(1)1"	GRS	(3)#12, (1)#12G	XHHW	CP-2B	FCV-657		PERMEATE FLOW CONTROL VALVE
P-507	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	AIT-660		TURBIDITY
P-508	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	FIT-810		MBR BASIN AIR FLOW
P-510	(1)1"	PVC/GRS	(1)3C-#12+G	VFD	CP-2B	PMP-207		FEEDFORWARD PUMP
P-511	(1)1"	PVC/GRS	(1)3C-#12+G	VFD	CP-2B	PMP-206		FEEDFORWARD PUMP
P-512	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-2B	SCN-106		DRUM SCREEN
P-513	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-2B	SCN-107		DRUM SCREEN
P-514	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-2B	CWC-105	30A DISC., PULL BOX 1	COMPACTOR
P-515	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-2B	MXR-201		PRE-ANOXIC MIXER
P-516	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-2B	MXR-401		POST-ANOXIC MIXER
P-517	(1)1"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-2B	MXR-301		PRE-AERATION MIXER
P-518	(1)1"	GRS	(6)#12, (2)#12G	XHHW	CP-2B	PMP-902, PMP-903		CARBON, ALKALINE PUMPS
P-519	(1)1"	GRS	(2)3C-#12+G	VFD	CP-2B	P1-651		PERMEATE PUMP 1
P-520	(1)1"	GRS	(2)3C-#12+G	VFD	CP-2B	P1-652		PERMEATE PUMP 2
P-521	(1)1"	PVC/GRS	(2)#12, (1)#12G	XHHW	CP-2B	FIT-102		MBR FEED FLOW
P-522	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	FIT-655		PERMEATE FLOW
P-523	(1)1"	PVC/GRS	(2)#12, (1)#12G	XHHW	CP-2B	FIT-208		FEEDFORWARD FLOW
P-524	(1)1"	GRS	(2)3C-#10+G	VFD	CP-2B	BLR-801		PA BLOWER
P-525	(1)1"	GRS	(2)3C-#10+G	VFD	CP-2B	BLR-802		MBR+PA STANDBY BLOWER
P-526	(1)1"	GRS	(2)3C-#10+G	VFD	CP-2B	BLR-803		MBR BLOWER
P-527	(1)1"	GRS	(3)#12, (1)#12G	XHHW	CP-2B	BLR-804		SHT BLOWER
P-528	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	P-805		AIR PUMP 1
P-529	(1)1"	GRS	(2)#12, (1)#12G	XHHW	CP-2B	P-806		AIR PUMP 2
P-601	(1)3/4"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-106	M-SCN-106		DRUM SCREEN 1 MOTOR
P-602	(1)3/4"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-106	M-SCN-107		DRUM SCREEN 2 MOTOR
P-603	(1)3/4"	PVC/GRS	(2)#12, (1)#12G	XHHW	CP-106	SV-SCN-106		DRUM SCREEN 1 SOLENOID
P-604	(1)3/4"	PVC/GRS	(2)#12, (1)#12G	XHHW	CP-106	SV-SCN-107		DRUM SCREEN 2 SOLENOID
P-605	(1)3/4"	PVC/GRS	(2)#12, (1)#12G	XHHW	CP-106	SV-CWC-105		COMPACTOR SOLENOID
P-606	(1)3/4"	PVC/GRS	(3)#12, (1)#12G	XHHW	CP-106	M-CWC-105		COMPACTOR MOTOR

BID SET REVIEW

NOTES:

1. CONDUIT AND CONDUCTORS FOR OPERATIONS BUILDING EXTERIOR AND INTERIOR LIGHTING AND RECEPTACLES NOT SHOWN IN SCHEDULE.
2. SEE SHEET B-E6.1 FOR PANELBOARD SCHEDULE AND SHEET B-E4.0 FOR LIGHTING AND RECEPTACLE PLAN. PROVIDE MINIMUM ¾" GRS WITH #12 CONDUCTORS AT QUANTITIES TO PROVIDE WORKING SYSTEM AS DRAWN. PROVIDE EQUIPMENT GROUNDING CONDUCTOR AND DEDICATED NEUTRAL CONDUCTORS.

811 Call 811 two business days before you dig

SHEET __ OF __

FIT105 (INFLUENT WET WELL FLOWMETER INFORMATION) IS USED TO TRIGER THE FINE SCREEN SYSTEM TO START

CAD NO.

	DATE
	APP.
	INT.
	REVISIONS
	NO.

ACTION	BY	DATE
DESIGNED	MC	01/03/25
DRAWN	DP	01/03/25
CHECKED (FIELD)		
CHECKED (HDQTS.)		

PRELIMINARY

MARVIN C. CASANOVA
STATE OF WASHINGTON
48989
REGISTERED ENGINEER

REGISTERED STAMP

WASHINGTON STATE PARKS AND RECREATION COMMISSION

NISQUALLY STATE PARK

PHASE 3A MAINTENANCE BUILDING AND WWTF

ELECTRICAL CONDUIT AND CABLE SCHEDULE

B-E6.2

SCALE

NO SCALE

PARKS FILE#

U:\PSO\Projects\Clients\4763--RW Dron\216--4763--010 NisquallyParkWWOptions\995vcs\CADD\DWG\PS18062A-E6.2.dwg
Jan--06--25 9:50am

J-1 IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER,COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE			CONTROL	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR(PRIMARY ELEMENT)		
F	FLOW RATE	RATIO(FRACTION)			
G	USER'S CHOICE		GLASS,VIEWIG DEVIDE		
H	HAND				HIGH
I	CURRENT(ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME,TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE	MOMENTARY			MIDDLE,INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE,RESTRICTION		
P	PRESSURE,VACUUM		POINT(TEST) CONNECTION		
Q	QUANTITY	INTEGRATE,TOTALIZE			
R	RADIATION		RECORD		
S	SPEED,FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION,MECANICAL ANALYSIS			VALVE,DAMPER,OR LOUVER	
W	WEIGHT,FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT,STATE,PRESENCE	Y AXIS		RELAY,COMPUTE,CONVERT	
Z	POSITION,DIMENSION	Z AXIS		DRIVER,ACTUATOR, UNCLASSIFIED,FINAL CONTROL ELEMENT	

GENERAL INSTRUMENT OR FUNCTION SYMBOLS	FIELD MOUNTED	PRIMARY LOCATION ACCESSIBLE TO OPERATOR	AUXILIARY LOCATION ACCESSIBLE TO OPERATOR	NORMALLY INACCESSIBLE OR BEHIND THE PANEL
DISCRETE INSTRUMENT	◯	⊖	⊖	⊖
SHARED DISPLAY SHARED CONTROL	▢	▢	▢	▢
COMPUTER FUNCTION	⬡	⬡	⬡	⬡
PROGRAMMABLE LOGIC CONTROL	⊠	⊠	⊠	⊠
PLC INPUT/OUTPUT	ANALOG INPUT ▲ TAG	ANALOG OUTPUT ▼ TAG	DISCRETE INPUT △ TAG	DISCRETE OUTPUT ▽ TAG

INSTRUMENT SYMBOL IDENTIFIERS

J-1: IDENTIFICATION LETTERS (SEE TABLE ABOVE)
J-2: LOOP NUMBER
J-3: DEVICE SEQUENCE LETTER
J-4: INSTRUMENT MODIFIER

J-4 INSTRUMENT MODIFIER

1/2	SELECT 1 OR 2 POSITION
A/M	Remote-MANUAL SETTING
AMSS	Remote-MANUAL-START-STOP FUNCTION
DO	DISSOLVED OXYGEN
ESTOP	EMERGENCY STOP
FAIL	FAILURE CONDITION
HOR	HAND-OFF-REMOTE
I/I	CURRENT TO CURRENT CONVERTER
I/P	CURRENT TO PNEUMATIC CONVERTER
LEL	LOWER EXPLOSIVE LIMIT
LOR	LOCAL-OFF-REMOTE
LOS	LOCK-OUT-STOP
LR	LOCAL-REMOTE
OC	OPEN-CLOSE
OCR	OPEN-CLOSE-REMOTE
OIL	LUBRICATING OR COOLING OIL
ON	ON CONDITION
OPEN	OPEN CONDITION OR COMMAND
OSC	OPEN-STOP-CLOSE
RDY	READY CONDITION
RESET	RESET FAILURE
RUN	MAINTAINED RUN COMMAND
SP	SET POINT
SS	START-STOP
WND	MOTOR WINDING
BCN	BEACON
V/P	VOLTAGE TO PNEUMATIC CONVERTER
V/I	VOLTAGE TO CURRENT CONVERTER

LINES

——►	MAIN PROCESS FLOW (WITH TYPICAL DIRECTION OF SHOWN)
———	MAIN (EXISTING)
———	SECONDARY PROCESS FLOW
———	SECONDARY (EXISTING)
———	INSTRUMENT SUPPLY PROCESS TAPS,NON PROCESS FLOW
-//- -//-	PNEUMATIC SIGNAL
—— ——	ANALOG ELECTRIC SIGNAL
—— . ——	DISCRETE ELECTRIC SIGNAL
—×— ×—	CAPILLARY TUBE OR FILLED SYSTEM
∿∿∿∿∿	ELECTROMAGNETIC OF SONIC SIGNAL (UNGUDED)
—o—o—	SOFTWARE OR DATA LINK
—•—•—	MECHANICAL
—L—L—	HYDRAULIC
120V	POWER SUPPLY
SA	SERVICE AIR AUPPLY

FLOW PRIMARY ELEMENTS

	ORIFICE PLATE
	SINGLE PORT PITOT TUBE OR PITOT-VENTURI TUBE
	AVERAGING PITOT TUBE
T	THERMAL MASS FLOWMETER
M	MAGNETIC FLOWMETER
	TURBINE OR PROPELLER-TYPE PRIMARY ELEMENT
	ROTOMETER
	POSITIVE DISPLACEMENT TYPE FLOW TOTALIZING INDICATOR
	VORTEX SENSOR
	TARGET TYPE SENSOR
	VENTURI TUBE
	SONIC FLOWMETER
D	DENDITY METER

VALVES

	GATE VALVES (2-WAY AND 3-WAY)
	GLOBAL VALVE (3-WAY AND 2-WAY)
	PLUG VALVE
	ECCENTRIC PLUG VALVE
	CHECK VALVE AND BALL CHECK VALVE
	DIAPHRAGM VALVE (PINCH VALVE)
	BUTTERFLY VALVE
	BALL VALVE (2-WAY AND 3-WAY)
	NEEDLE VALVE
	INSTERLOCK
	PRESSURE REDUCING REGULATING VALVE. SELF-CONTAINED
	BACK PRESSURE REGULATING VALVE. SELF-CONTAINED
S	SOLENOID VALVE
	PRESSURE SURGE DISCHARGE
	CONTROL VALVE
	TELESCOPING VALVE
NC	NORMALLY CLOSED
NUM	NORMALLY NUMBER

VALVE OPERATORS

	DIAPHRAGM
	DIAPHRAGM,PRESSURE BALANCED
	HAND
M	MOTOR
	CYLINDER OPERATOR
S	SOLENOID

[C] SUPPLIED BY CONTRACTOR
[K] SUPPLIED BY KUBOTA

ALL PIPES ARE BY CONTRACTOR UNLESS OTHERWISE SPECIFIED

General Notes

For Earth, For Life
Kubota

KUBOTA Water and Environment U.S.A. Corporation
19910 N Creek Pkwy, Suite 100
Bothell, WA 98011

REFERENCE ONLY
FOR ENGINEERING
DESIGN WORK

No.	Revision/Issue	Date
4	FOR BID BY S. KUBO	4.11 2025
3	70% BY A. CLINGMAN S. KUBO	11.3 2022
2	70% BY A. CLINGMAN S. KUBO	6.6 2022
1	70% BY A. CLINGMAN S. KUBO	5.26 2022
0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name
P&ID Symbol

Project Name and Address
NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area
Stamp
Drawing Number
Symbol 1/2
Author
A. CLINGMAN/S. KUBO

INSTRUMENT & MECHANICAL EQUIPMENT SYMBOLS & MISCELLANEOUS

	CENTRIFUGAL BLOWER		INJECTOR		WELDED CAP
	INTAKE SCREEN/FILTER		FILTER OR SEPARATOR		BLIND FLANGE
	HVAC FAN	T	DRIP TRAP	P	PURGE
	FLOW STRAIGHTENING VANE		CAP OR PLUG		DIAPHRAGM
	FLEXIBLE COUPLING		HOSE CONNECTION		THERMOMETER WELL
	INLET SILENCER/FILTER		RUPTURE DISK, PRESSURE	M	MOTOR
	ROTARY LOBE PUMP		RUPTURE DISK,VACUUM		HEATING COIL
	SUBMERSIBLE PUMP		ANNULAR SEAL		DRAIN
	SUBMERSIBLE PUMP with GUIDE RAIL		CENTRIFICAL PUMP		DRAIN
	INTERLOCK,RELAY, OR OTHER FUNCTION DESCRIBED IN DRAWINGS OR SPECIFICATIONS		METERING PUMP		SLUICE GATE
	FLEXIBLE METAL HOSE		PROGRESSIVE CAVITY PUMP		FLAG GATE
	HOSE		UNION		SLIDE GATE
	INTERFACE MARKER NEW/EXISTIING		Y STRANER		FLANGE
M	MIXER		STATIC MIXER		REDUCER
	ULTRASONIC TRANSMITTER		CENTRIFUGAL BLOWER		ROTARY BLOWER

ABBREVIATIONS

AFD	ADJUSTABLE FRECUENCY DRIVE
AS	AIR SUPPLY
CMPTR	COMPUTER
CS	CONSTANT SPEED
DWV	DRAIN,WASTE, & VENT
ES	ELECTRICAL SUPPLY
FC	FAIL CLOSED
FO	FAIL OPEN
FP	FIELD PANEL
GND	GROUND
HMI	HUMAN-MACHINE INTERFACE
I/O	INPUT/OUTPUT
LCP	LOCAL CONTROL PANEL
MCC	MOTOR CONTROL CENTER
MUX	TELEMETRY MULTIPLEXING
NaOH	SODIUM HYDROXIDE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OF	OVERFLOW
PLC	PROGRAMMABLE LOGIC CONTROLLER
PT	PRESSURE TAG
SP	SUMP PUMP
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUTABLE POWER SUPPLY
V	VENT ABOVE ELEVATION
VS	VARIABLE SPEED
VSD	VARIABLE SPEED DRIVE(VFD)

FLOW STREAM DESIGNATION

XX" aaa

XX = LINE SIZE
aaa = FLOW STREAM ABBREVIATION AS DEFINED ON 00-G-04 GENERAL LEGEND

SHEET CONNECTION SYMBOLS

X | YY-a-ZZ — CONNECTION TO PROCESS WITH IN THIS CONTRACT

X = SEQUENCE
YY-a-ZZ = DWG. NO.

CONNECTION TO PROCESS NOT IN THIS CONTRACT

EQUIPMENT TAGS

aaa - xxxx

aaa = EQUIPMENT TAG PREFIX
SEE 00-M-01 FOR DEFINTIONS

xxxx = TAG NO.

UNIT PROCESS

No	Unit Process
01	PUMP STATION AREA
02	HEAD WORKS AREA
03	EQUALIZATION AREA
04	DE-OX AREA
05	ANEAROBIC AREA
06	1ST ANOXIC AREA
07	SWING AREA
08	PRE-AERATION AREA
09	2ND ANOXIC AREA
10	SMU AREA
11	RAS AREA
12	IR AREA
13	PERMEATE SYSTEM
14	AIR SCOUR SYSTEM
15	PRE-AERATION SYSTEM
16	CIP SYSTEM
17	WAS SYSTEM
18	UV SYSTEM
19	-
20	OTHER
99	PLC/SCADA

C SUPPLIED BY CONTRACTOR

K SUPPLIED BY KUBOTA

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General Notes

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1	70% BY A. CLINGMAN S. KUBO	5.26 2022
0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name
P&ID Symbol

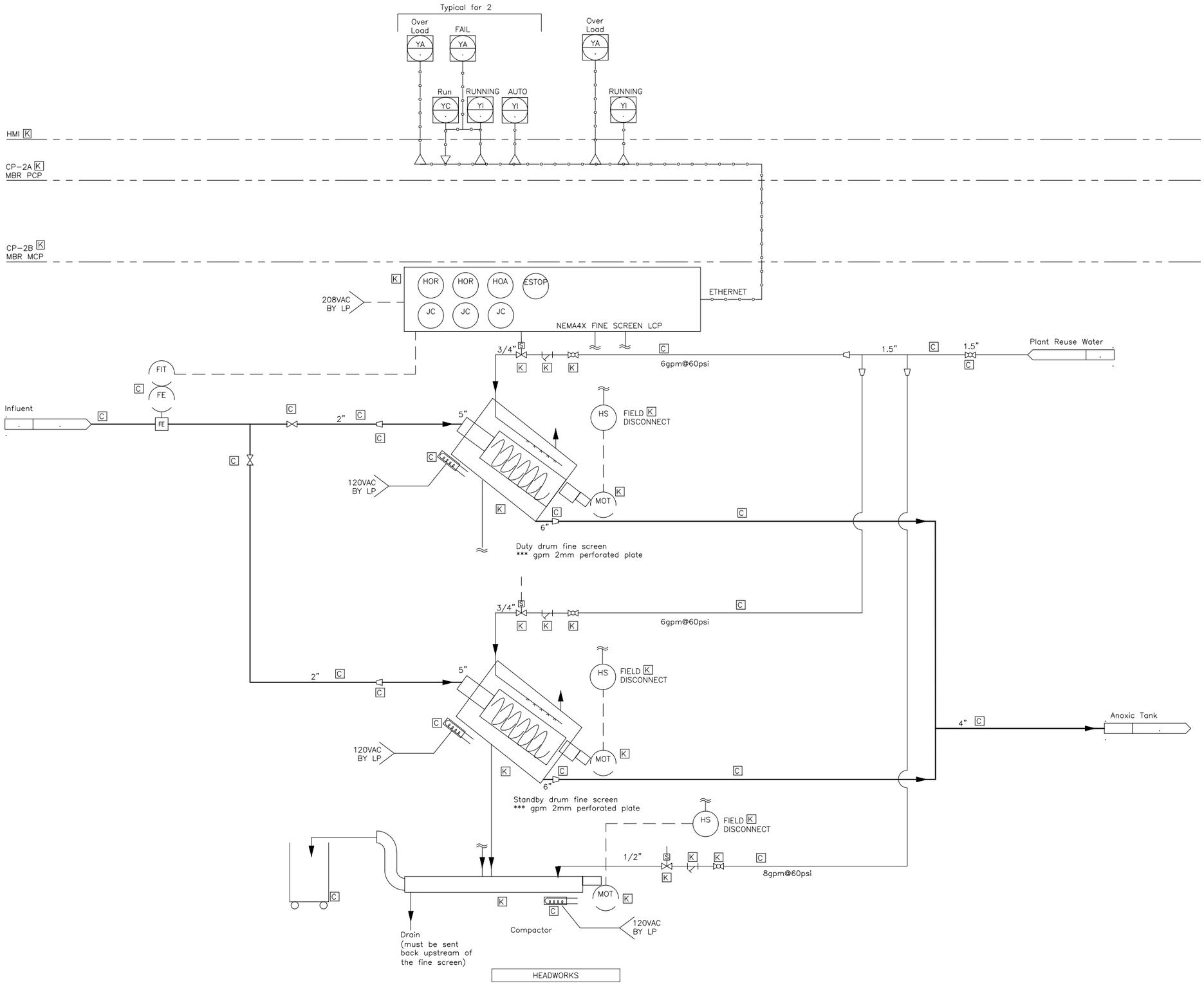
Project Name and Address
NISQUALLY STATE PARK NEW FULL SERVICE PARK - PAHSE 3

Area

Stamp

Drawing Number
Symbol 2/2

Author
A. CLINGMAN/S. KUBO



HEADWORKS

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Drawing Name

HEADWORKS

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

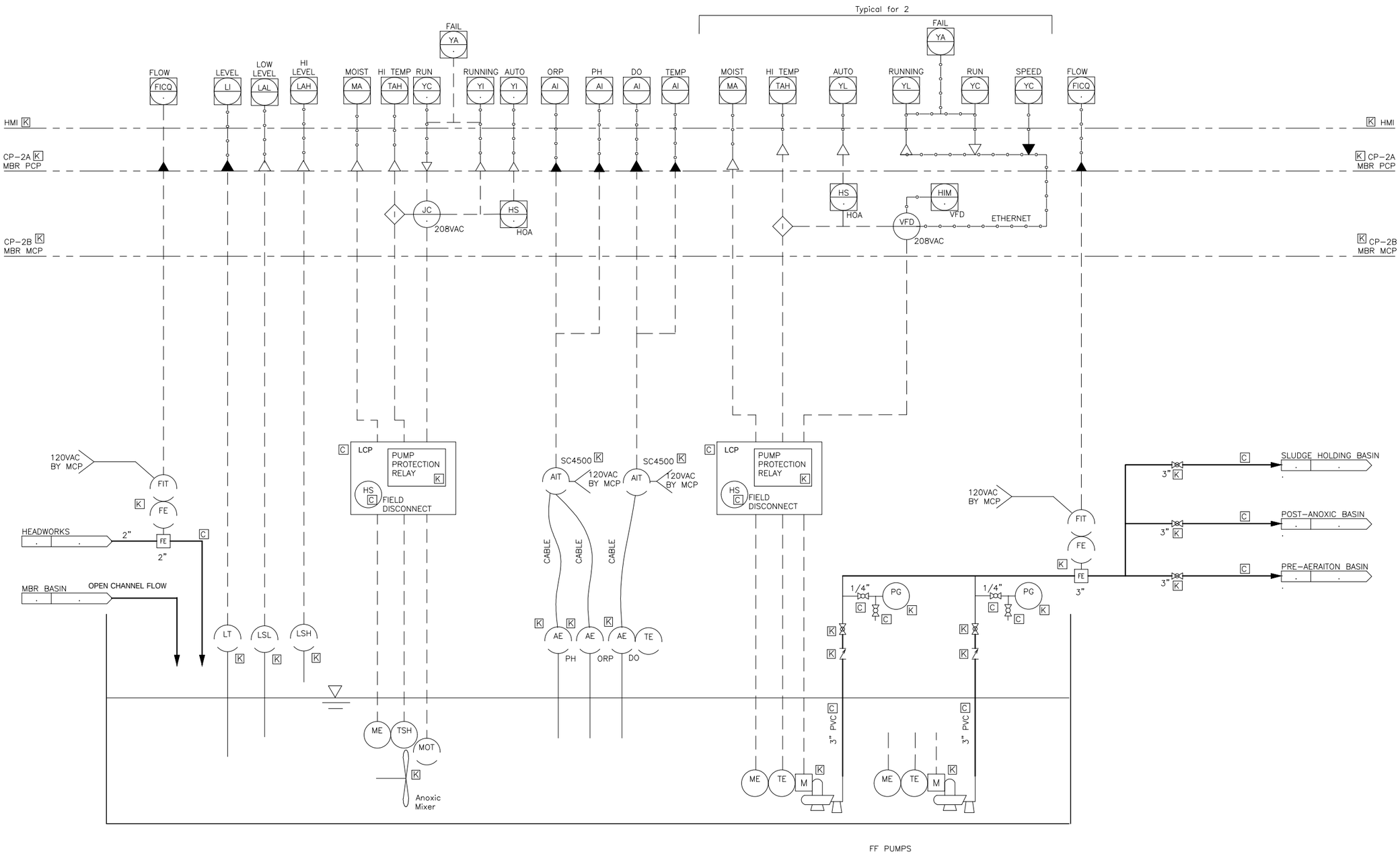
Stamp

Drawing Number

P&ID 1/11

Author

A. CLINGMAN/S. KUBO



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Drawing Name

PRE-ANOXIC BASIN

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK - PAHSE 3

Area

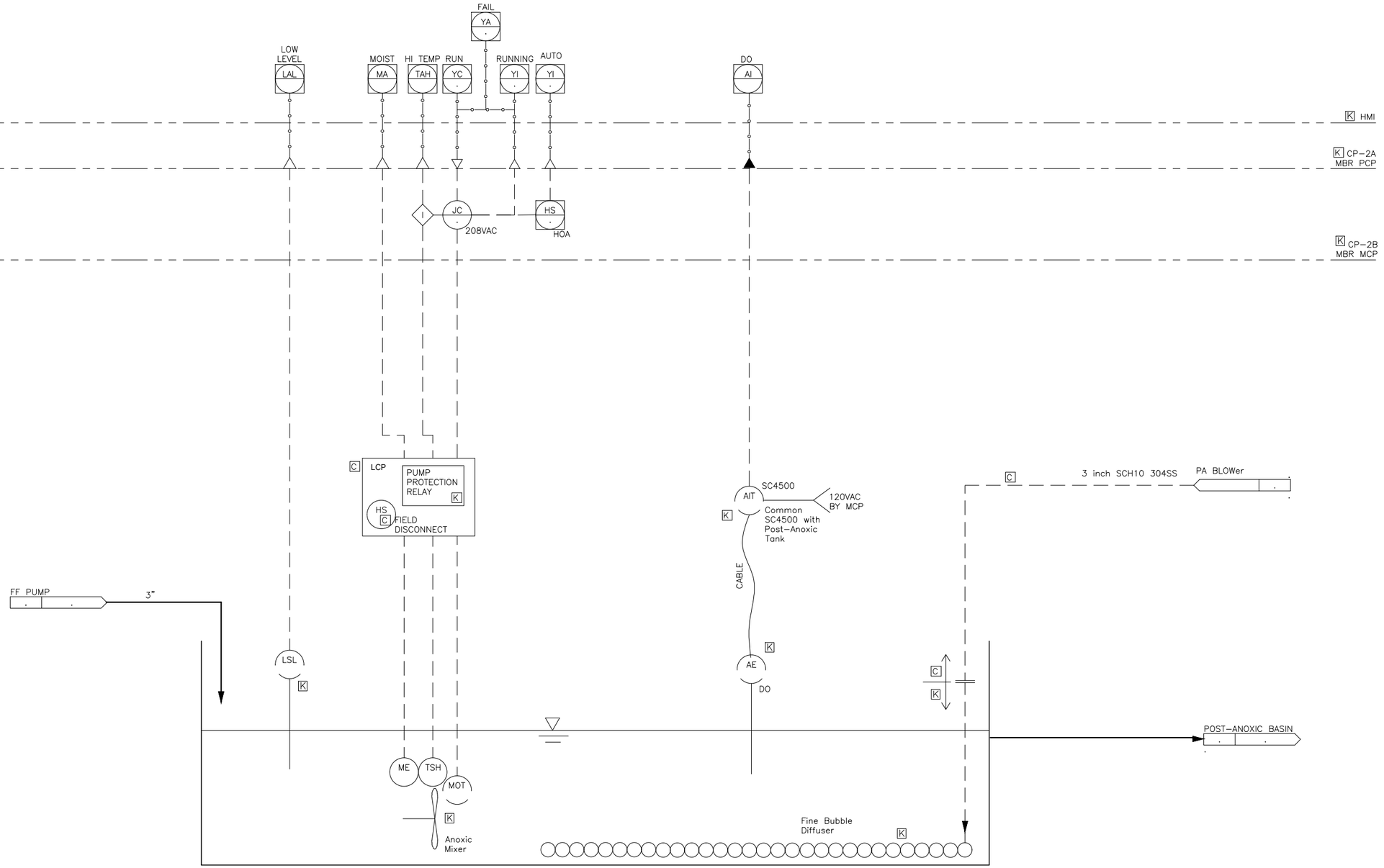
Stamp

Drawing Number

P&ID 2/11

Author

A. CLINGMAN/S. KUBO



PRE-AERATION BASIN

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0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name

PRE-AERATION BASIN

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK - PAHSE 3

Area

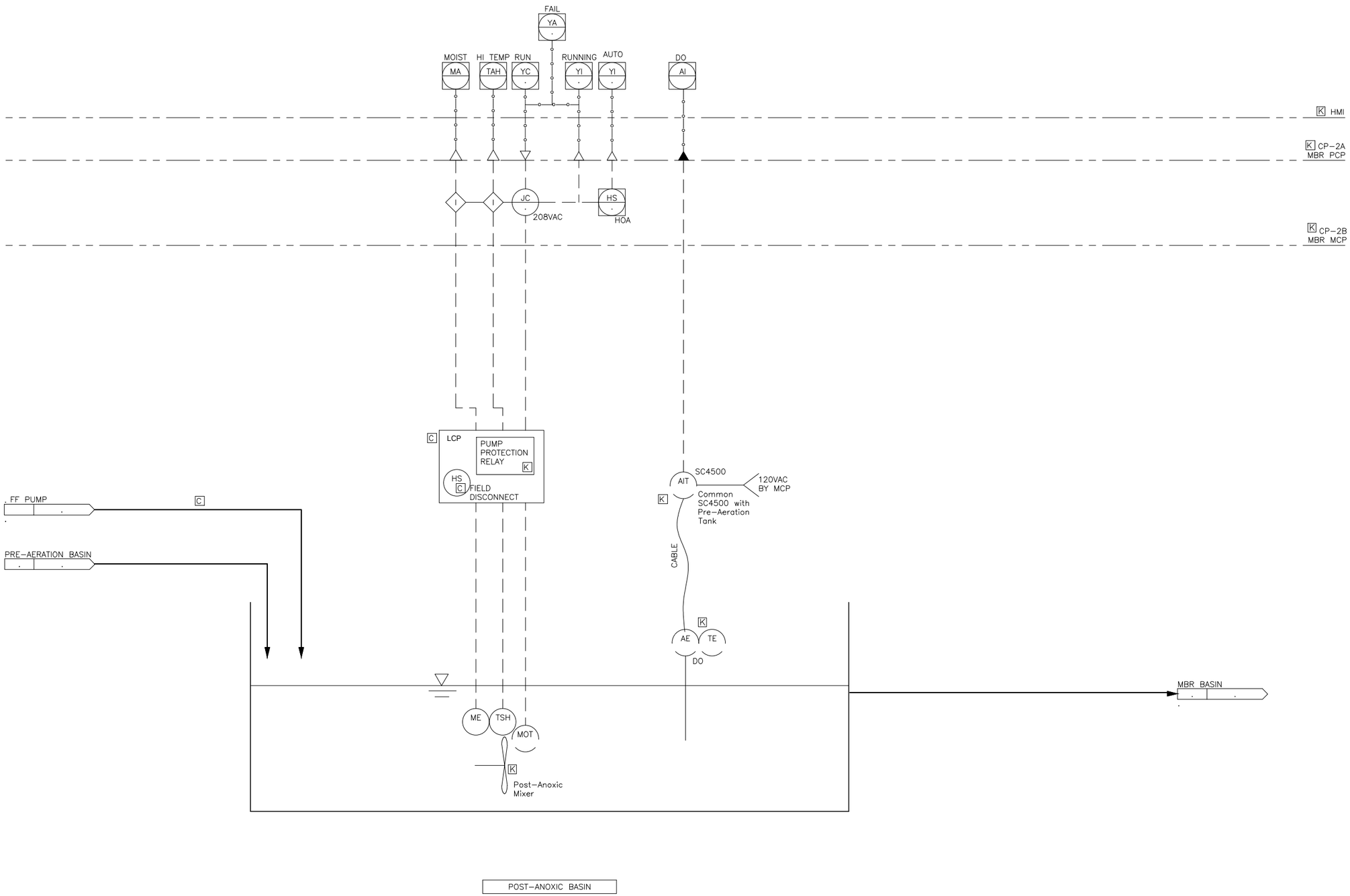
Stamp

Drawing Number

P&ID 3/11

Author

A. CLINGMAN/S. KUBO



POST-ANOXIC BASIN

[C] SUPPLIED BY CONTRACTOR

[K] SUPPLIED BY KUBOTA

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Drawing Name

POST-ANOXIC BASIN

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK - PAHSE 3

Area

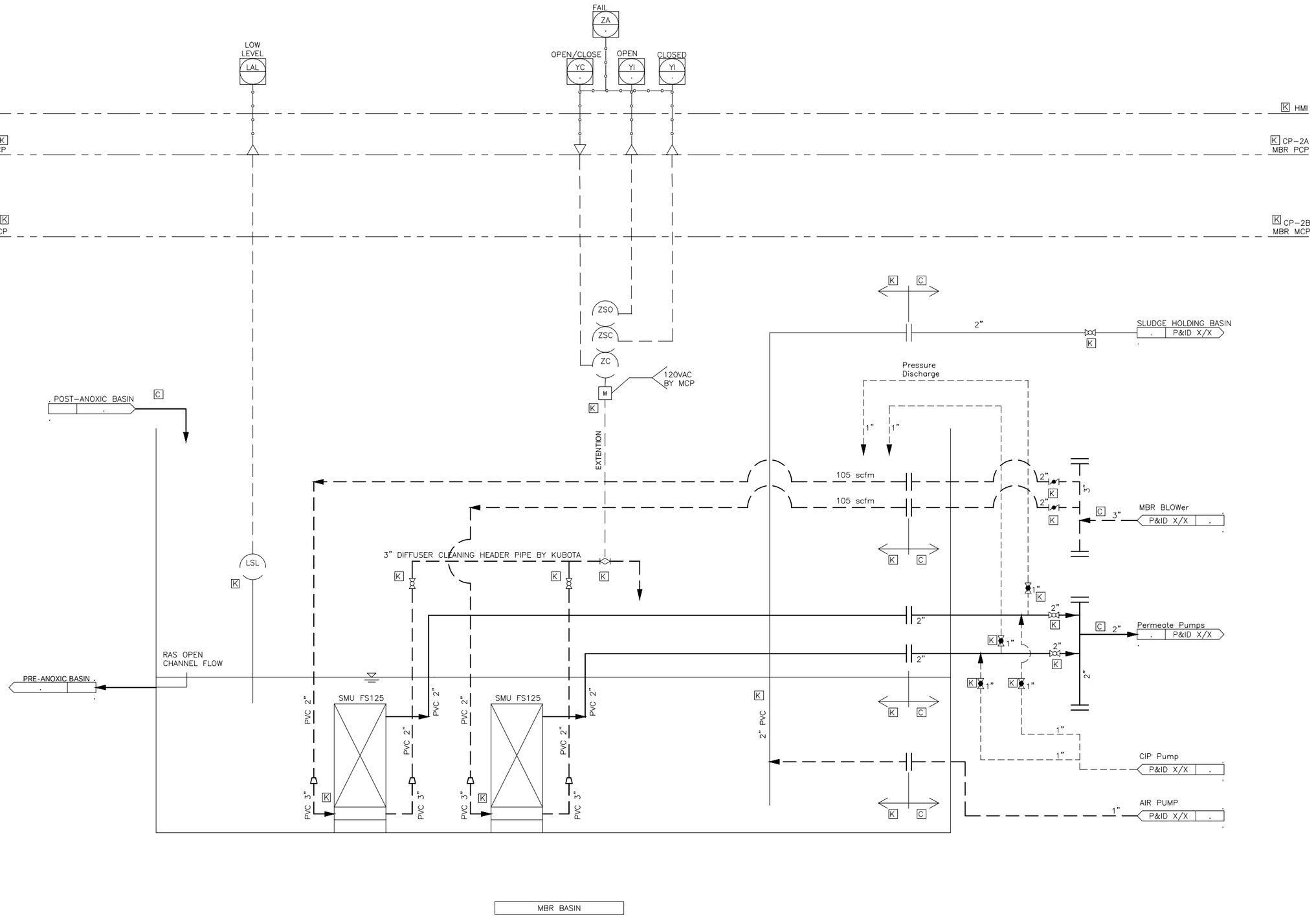
Stamp

Drawing Number

P&ID 4/11

Author

A. CLINGMAN/S. KUBO



MBR BASIN

C SUPPLIED BY CONTRACTOR

K SUPPLIED BY KUBOTA

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General Notes

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2	70% BY A. CLINGMAN S. KUBO	6.6 2022
1	70% BY A. CLINGMAN S. KUBO	5.26 2022
0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name

MBR BASIN

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

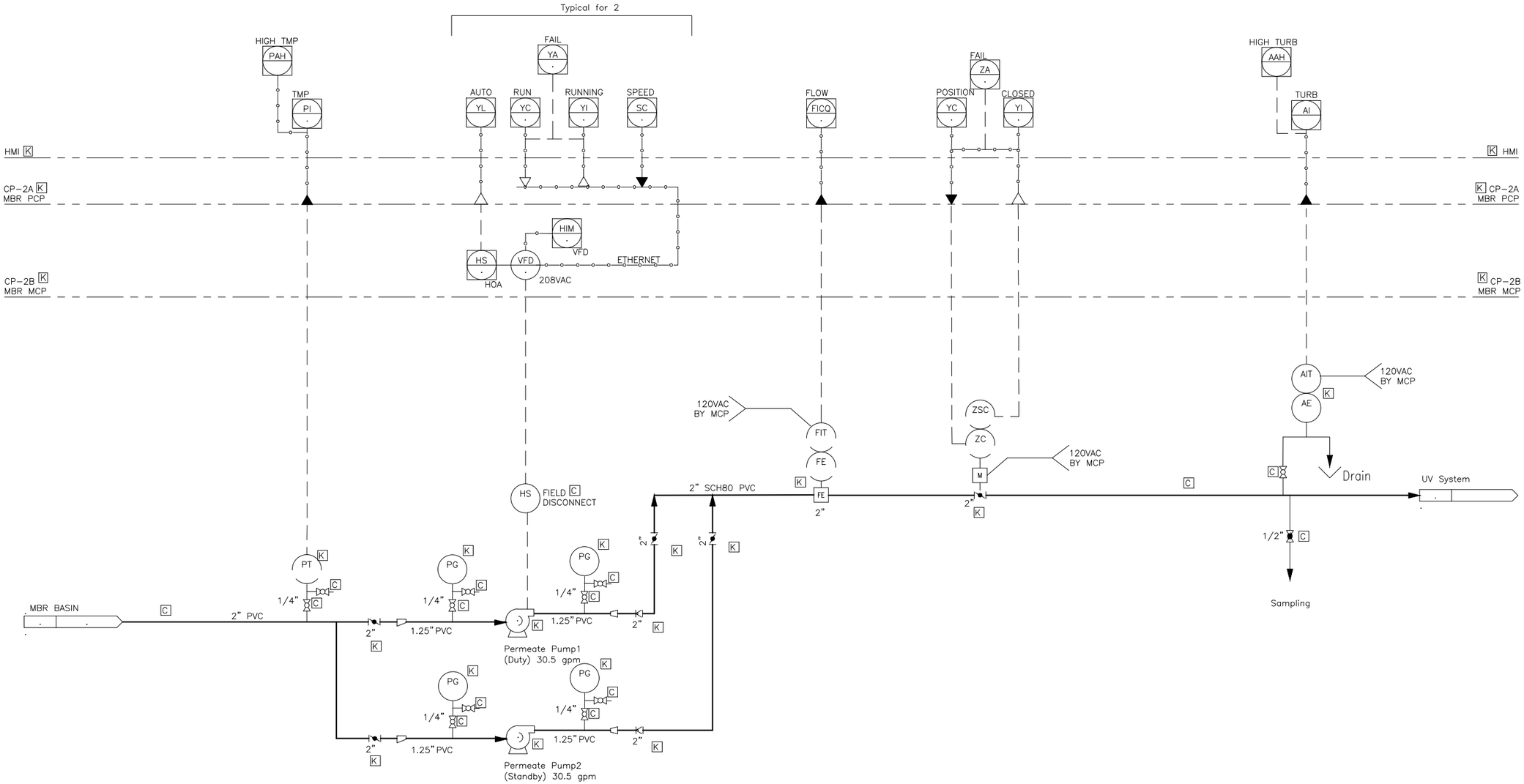
Stamp

Drawing Number

P&ID 5/11

Author

A. CLINGMAN/S. KUBO



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K SUPPLIED BY KUBOTA

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0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name

PERMEATE COLLECTION SYSTEM

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

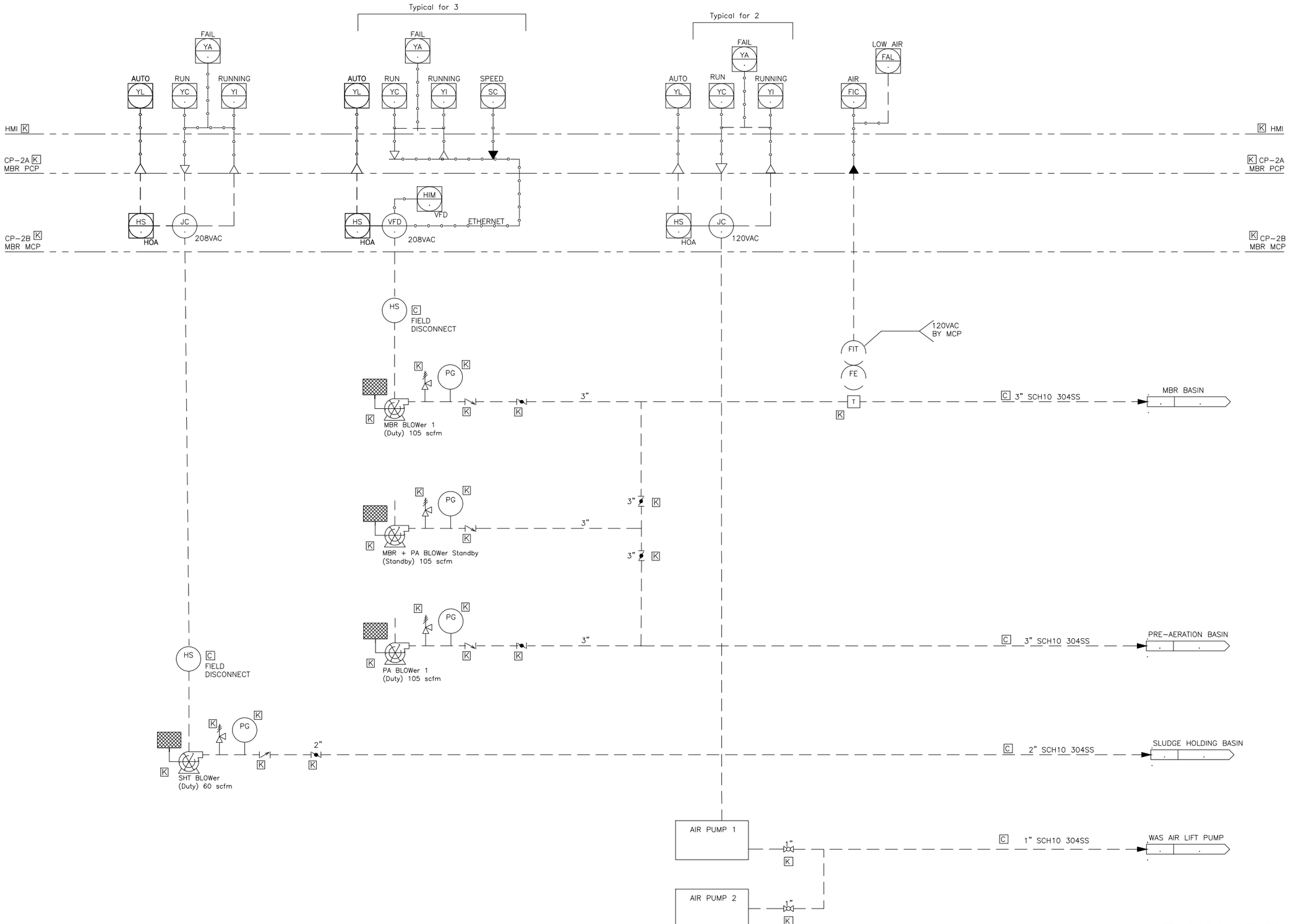
Stamp

Drawing Number

P&ID 6/11

Author

A. CLINGMAN/S. KUBO



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0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name

BLOWER SYSTEM

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

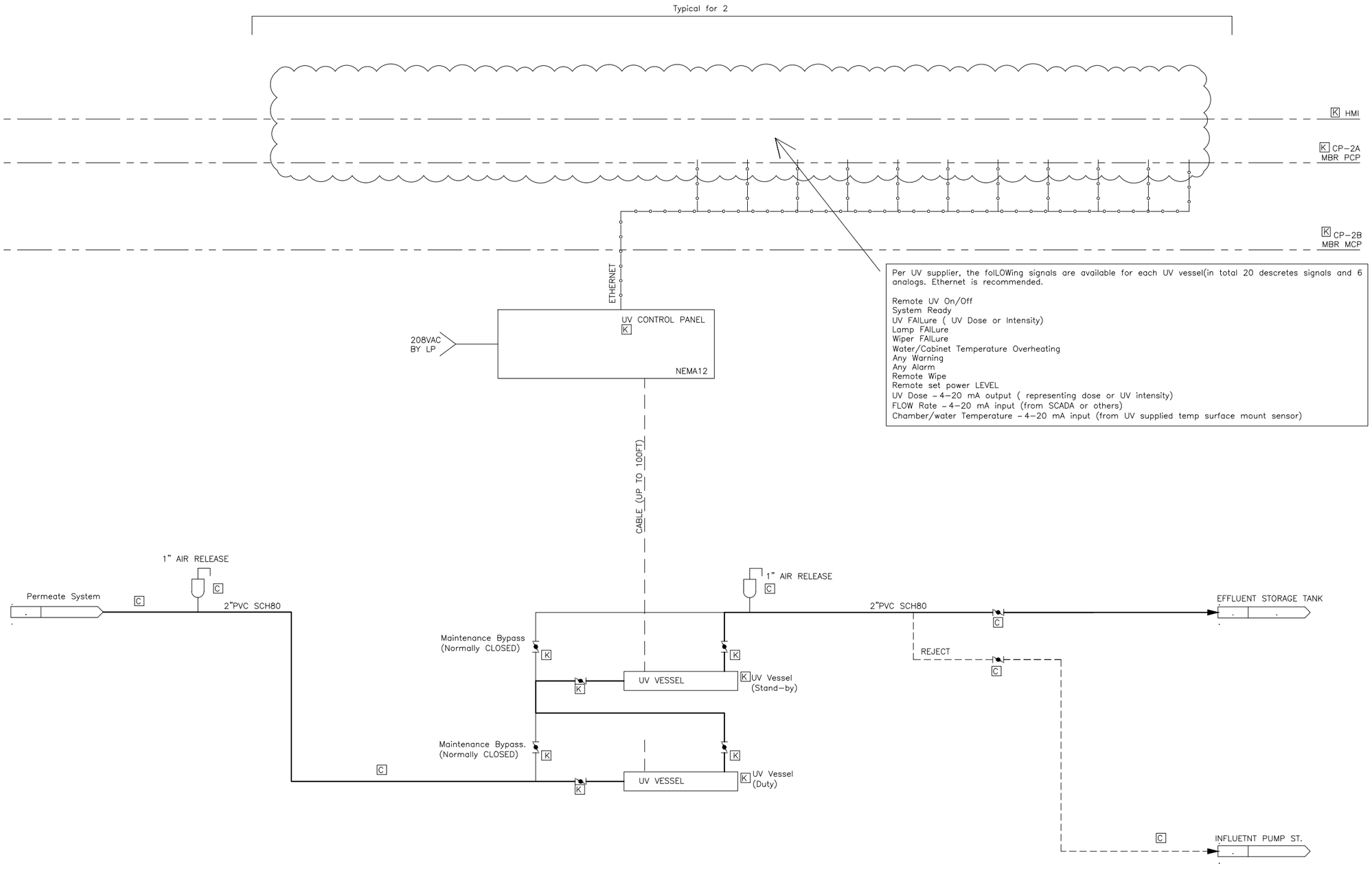
Stamp

Drawing Number

P&ID 7/11

Author

A. CLINGMAN/S. KUBO



General Notes

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0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name

UV SYSTEM

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

Stamp

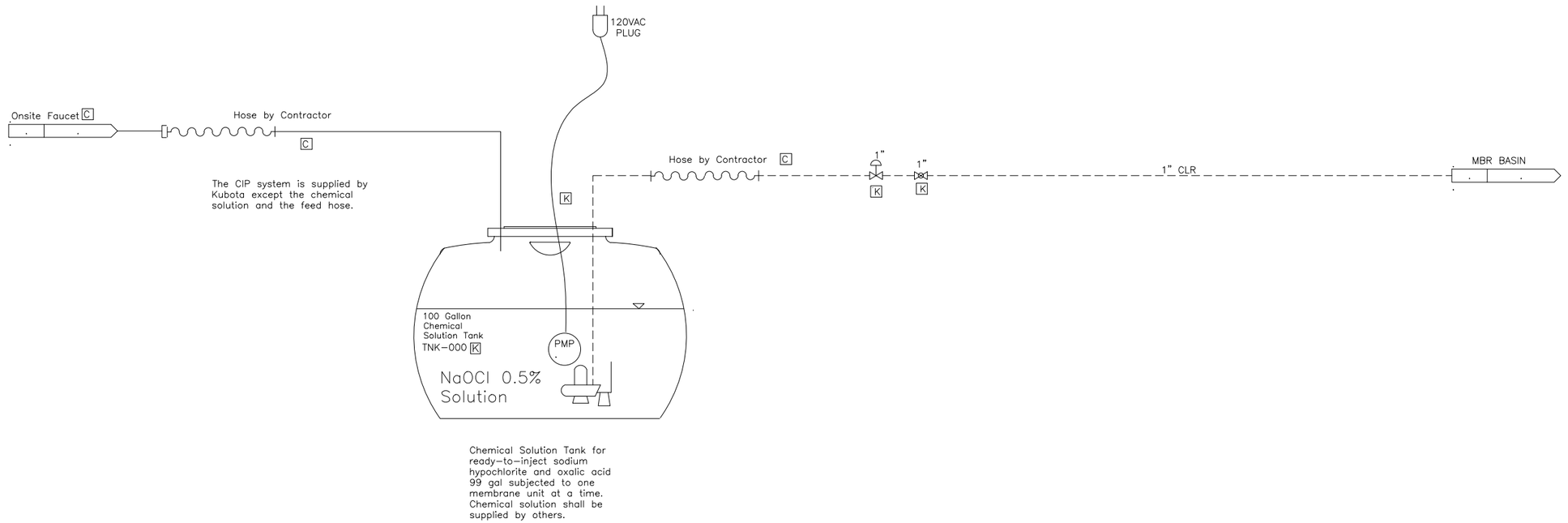
Drawing Number
P&ID 8/11

Author
A. CLINGMAN/S. KUBO

HMI [K] — [K] HMI

CP-2A [K] MBR PCP — [K] CP-2A MBR PCP

CP-2B [K] MBR MCP — [K] CP-2B MBR PCP



CIP System

[C] SUPPLIED BY CONTRACTOR

[K] SUPPLIED BY KUBOTA

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0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name

CIP

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

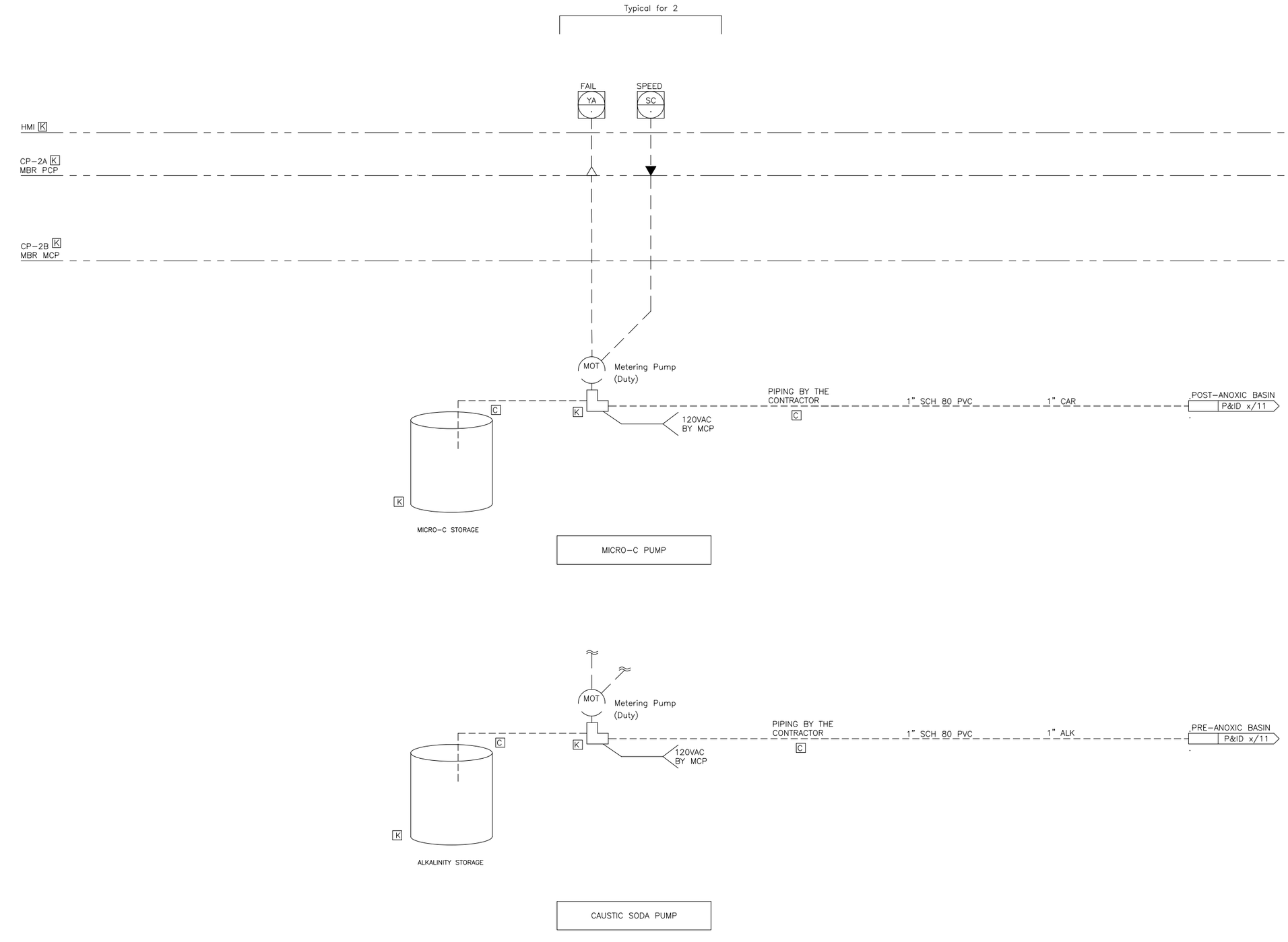
Stamp

Drawing Number

P&ID 9/11

Author

A. CLINGMAN/S. KUBO



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0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name

CHEMICAL DOSING

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

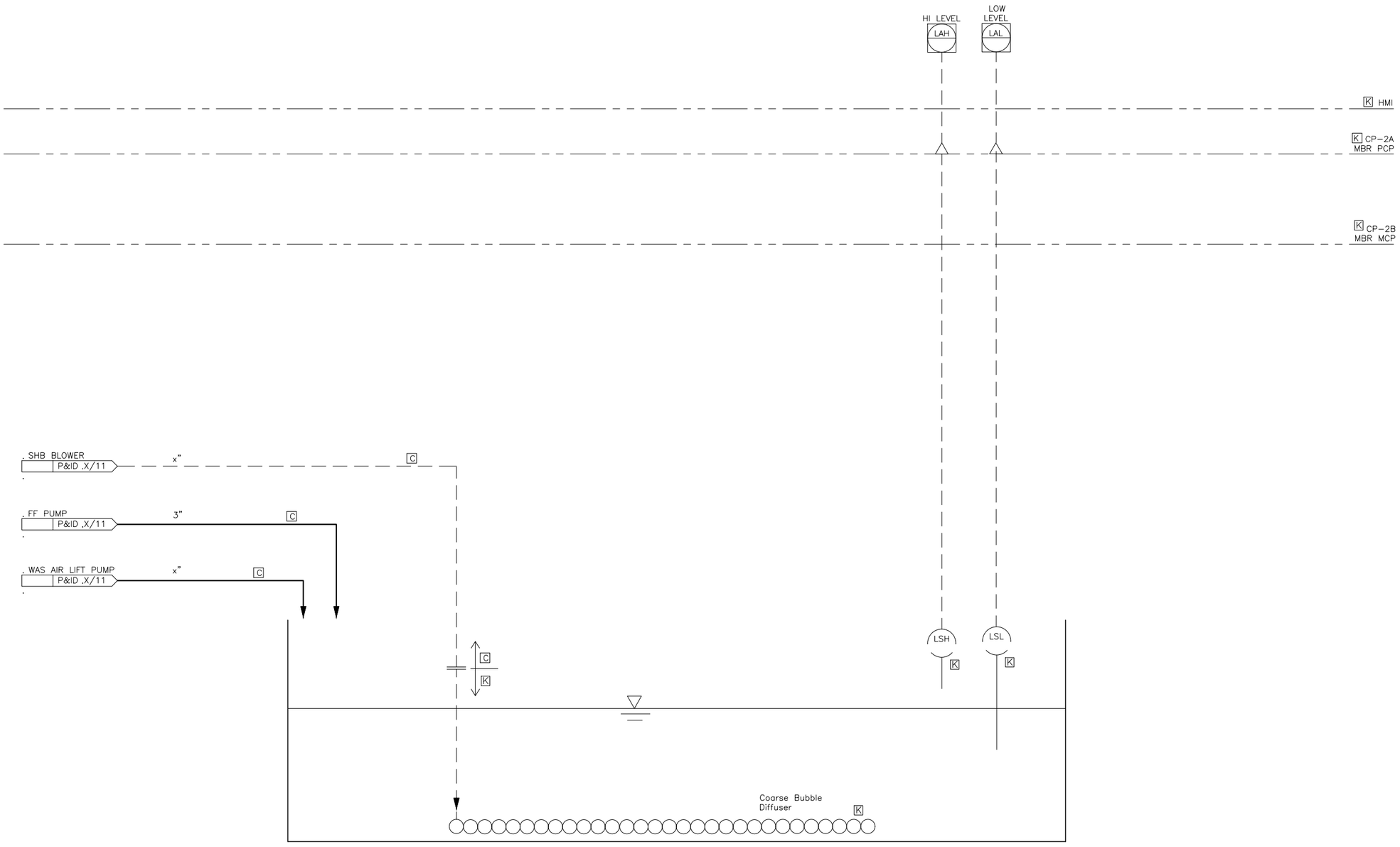
Stamp

Drawing Number

P&ID 10/11

Author

A. CLINGMAN/S. KUBO



SLUDGE HOLDING TANK

C SUPPLIED BY CONTRACTOR

K SUPPLIED BY KUBOTA

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Drawing Name

SLUDGE HOLDING TANK

Project Name and Address

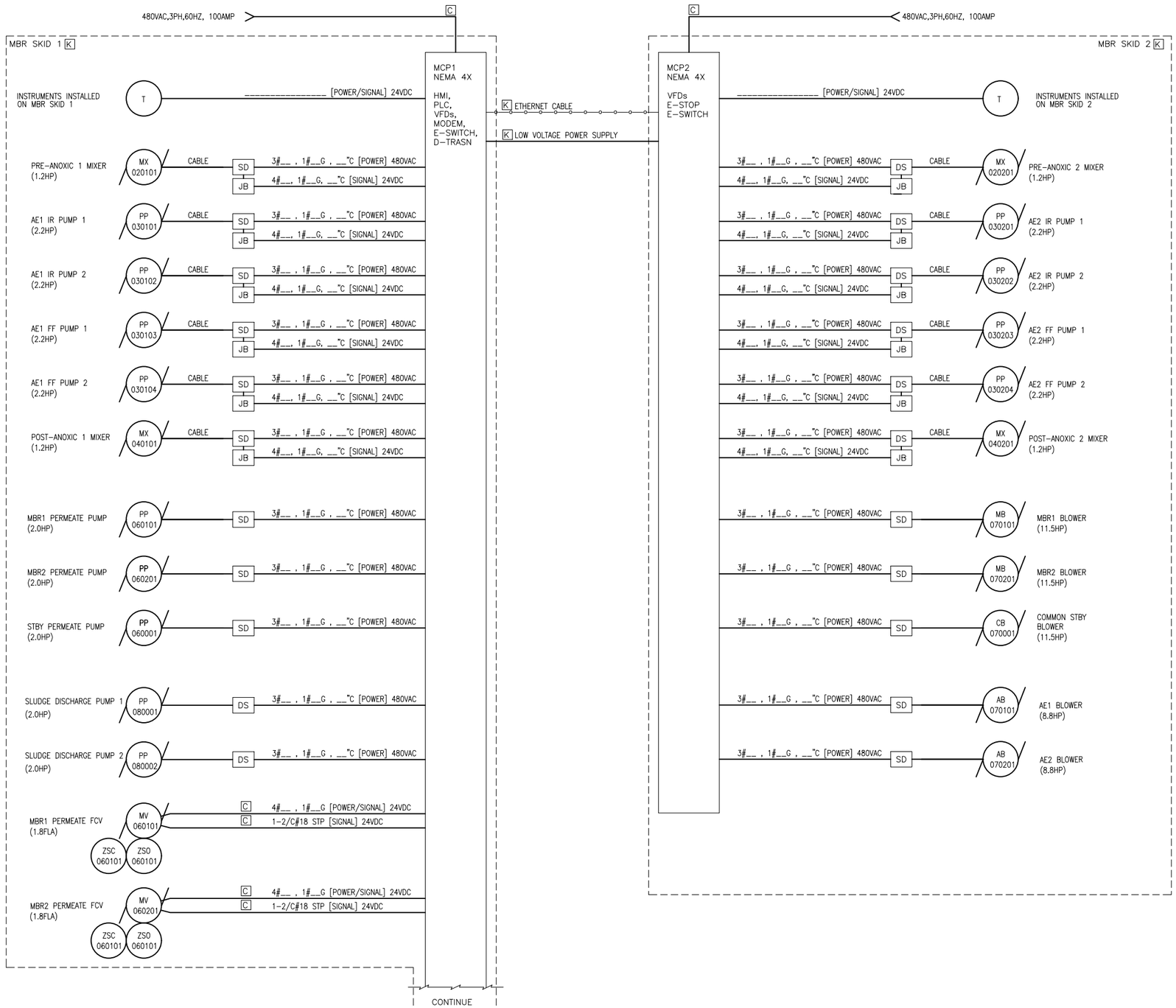
NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

Stamp

Drawing Number
P&ID 11/11

Author
A. CLINGMAN/S. KUBO



NOTE
1. THIS IS NOT FOR CONSTRUCTION.
2. WIRE SCHEDULE SHALL BE DETERMINED BY OTHERS.
3. GROUND WIRES CAN BE CONSOLIDATED IF APPLICABLE.
4. CONDUITS CAN BE CONSOLIDATED IF APPLICABLE.
5. C IS BY CONTRACTOR. K IS BY PROVIDED BY KUBOTA
6. ALL VFDs IN KUBOTA CONTROL PANEL ARE CONNECTED TO ETHERNET SWITCH VIA ETHERNET CABLES

General Notes

For Earth, For Life
Kubota

KUBOTA Membrane USA Cooporation
11807 North Creek Parkway S. Suite B109
Bothell, WA 98011 USA
Tel; +1 425 898 2853

REFERENCE ONLY
FOR ENGINEERING
DESIGN WORK

No.	Revision/Issue	Date
4	SUBMITTAL TO CONTRACTOR SHINGO KUBO	2.2 2021
3	CONTRACTOR BID FINAL SHINGO KUBO	5.25 2020
2	SHINGO KUBO (90%)	9.11 2019
1	SHINGO KUBO	8.29 2019
0	SHINGO KUBO (ORIGINAL)	7.12 2019

Drawing Name
RISER DIAGRAM
MBR PACKAGE PLANT

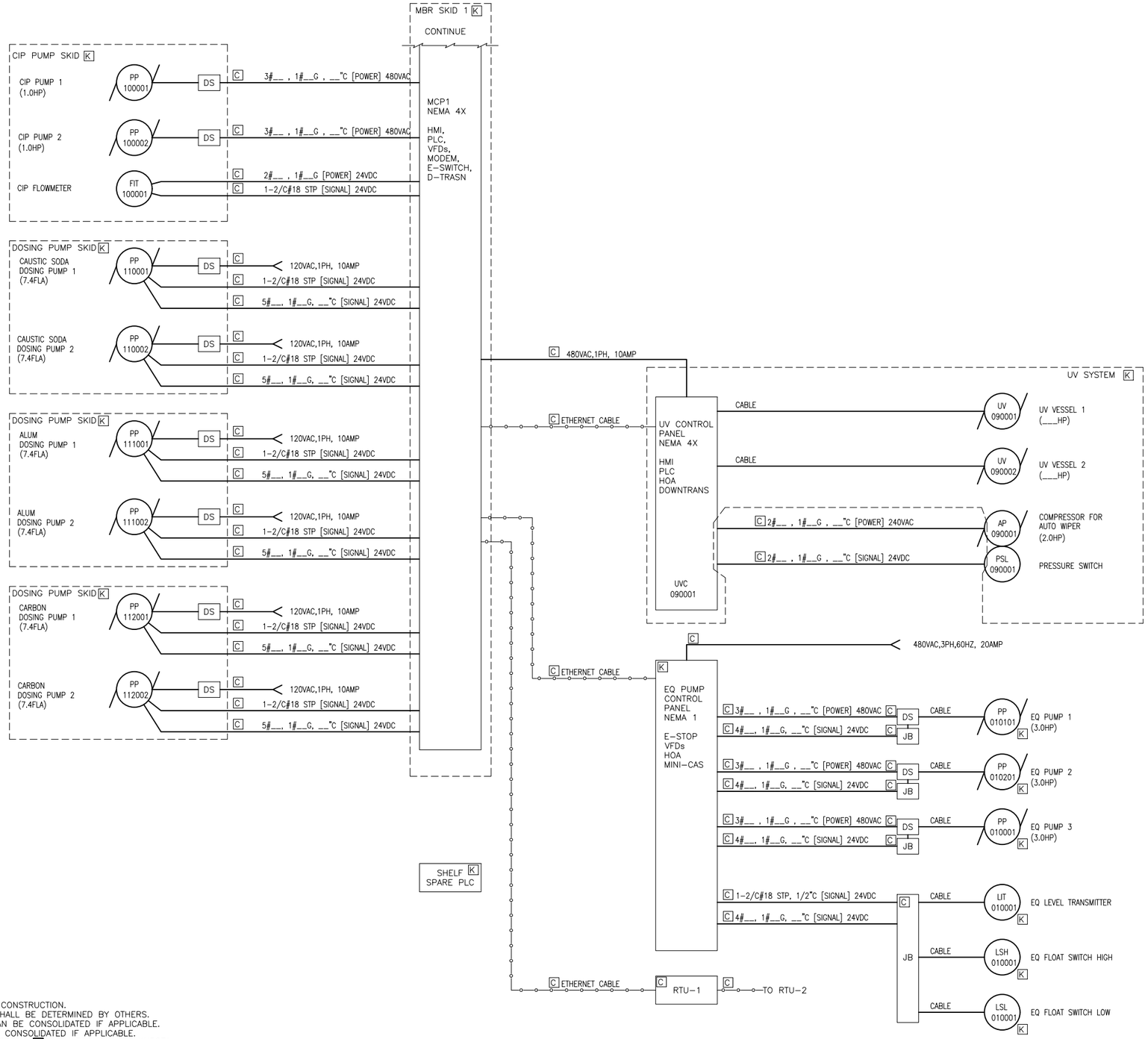
Project Name and Address
WOODSTOCK JOB CORPS CENTER WASTEWATER TREATMENT PLANT

Area

Stamp

Drawing Number
RSD 1/2

Author
SHINGO.K



NOTE
1. THIS IS NOT FOR CONSTRUCTION.
2. WIRE SCHEDULE SHALL BE DETERMINED BY OTHERS.
3. GROUND WIRES CAN BE CONSOLIDATED IF APPLICABLE.
4. CONDUITS CAN BE CONSOLIDATED IF APPLICABLE.
5. C IS BY CONTRACTOR. K IS BY PROVIDED BY KUBOTA
6. ALL VFDs IN KUBOTA CONTROL PANEL ARE CONNECTED TO ETHERNET SWITCH VIA ETHERNET CABLES

General Notes

For Earth, For Life
Kubota

KUBOTA Membrane USA Cooporation
11807 North Creek Parkway S. Suite B109
Bothell, WA 98011 USA
Tel; +1 425 898 2853

REFERENCE ONLY
FOR ENGINEERING
DESIGN WORK

No.	Revision/Issue	Date
4	SUBMITTAL TO CONTRACTOR SHINGO KUBO	2.2 2021
3	CONTRACTOR BID FINAL SHINGO KUBO	5.25 2020
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Drawing Name
RISER DIAGRAM
MBR PACKAGE PLANT

Project Name and Address
WOODSTOCK JOB CORPS CENTER WASTEWATER TREATMENT PLANT

Area

Stamp

Drawing Number
RSD 2/2

Author
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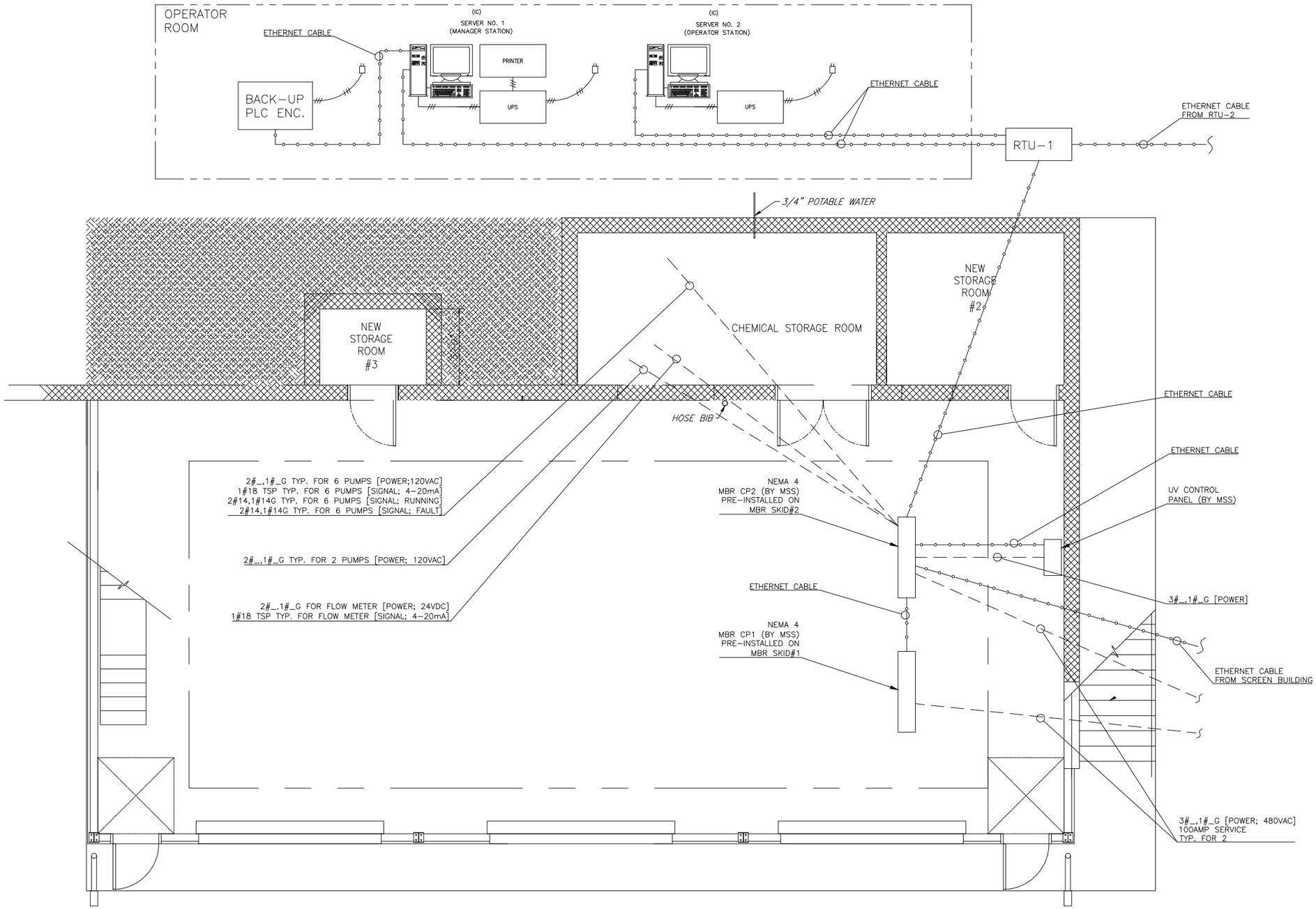

NOTE
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2. GROUND WIRES CAN BE CONSOLIDATED

General Notes

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Bothell, WA 98011 USA
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REFERENCE ONLY
FOR ENGINEERING
DESIGN WORK

No.	Revision/Issue	Date
1	60% SUBMITTAL (SHINGO.K)	4.22 2019

Drawing Name
NETWORK DIAGRAM

WASTEWATER TREATMENT BUILDING

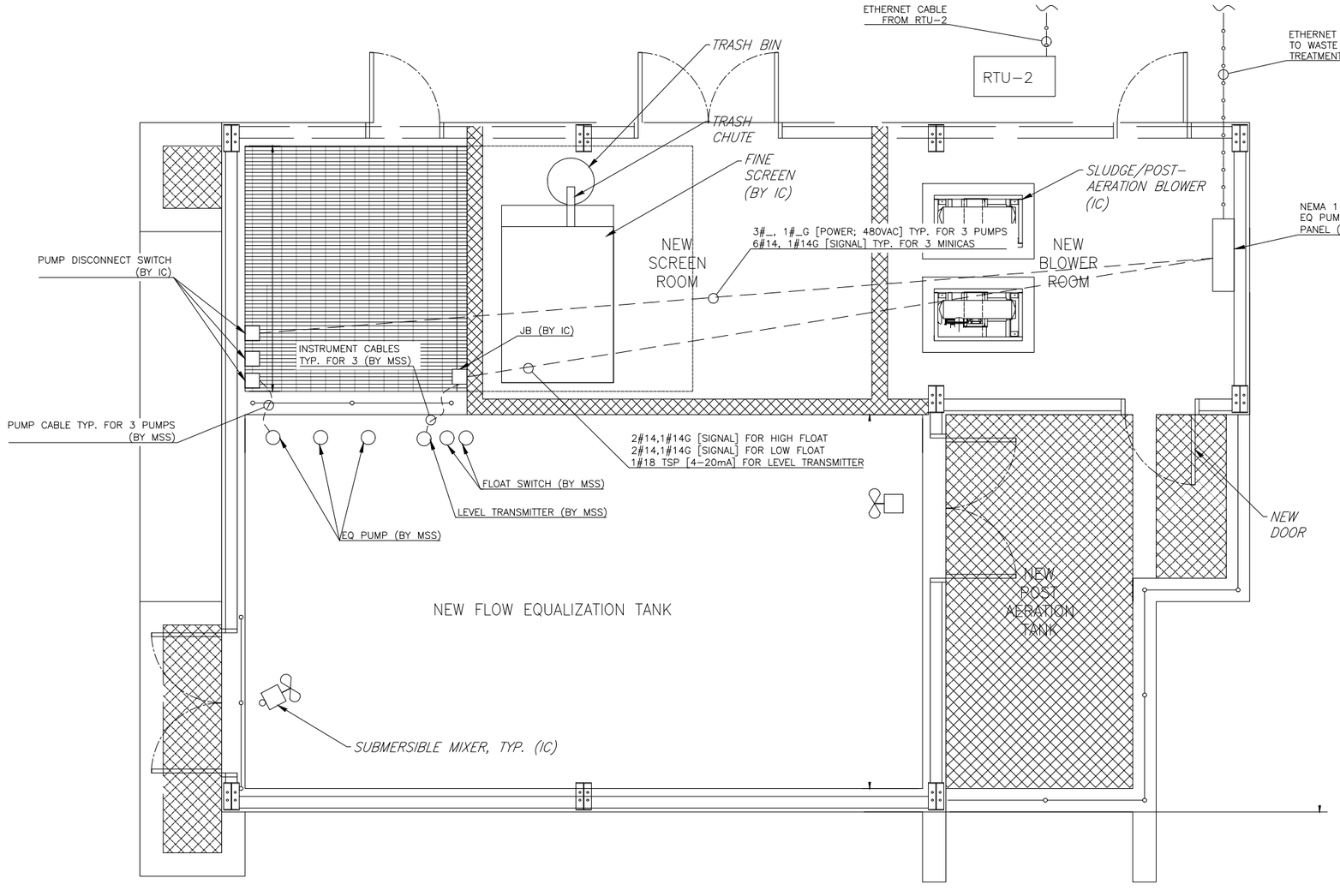
Project Name and Address
WOODSTOCK JOB CORPS CENTER WASTEWATER TREATMENT PLANT

Area

Stamp

Drawing Number
NTWK 1/2

Author
SHINGO.K



NOTE
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2. GROUND WIRES CAN BE CONSOLIDATED

General Notes

For Earth, For Life
Kubota

KUBOTA Membrane USA Cooporation
11807 North Creek Parkway S. Suite
B109
Bothell, WA 98011 USA
Tel; +1 425 898 2853

REFERENCE ONLY
FOR ENGINEERING
DESIGN WORK

No.	Revision/Issue	Date
1	60% SUBMITTAL (SHINGO.K)	4.22 2019

Drawing Name
NETWORK DIAGRAM
SCREEN BUILDING

Project Name and Address
WOODSTOCK JOB CORPS CENTER WASTEWATER TREATMENT PLANT

Area

Stamp

Drawing Number
NTWK 2/2

Author
SHINGO.K

General Notes

For Earth, For Life
Kubota

KUBOTA Water and Environment U.S.A. Corporation
19910 N Creek Pkwy, Suite 100
Bothell, WA 98011

REFERENCE ONLY
FOR ENGINEERING
DESIGN WORK

No.	Revision/Issue	Date
4	FOR BID BY S. KUBO	4.11 2025
3	70% BY A. CLINGMAN S. KUBO	11.3 2022
2	70% BY A. CLINGMAN S. KUBO	6.6 2022
1	70% BY A. CLINGMAN S. KUBO	5.26 2022
0	60% BY A. CLINGMAN S. KUBO	5.18 2022

Drawing Name

Project Name and Address

NISQUALLY STATE PARK NEW FULL SERVICE PARK – PAHSE 3

Area

Drawing Number

Author

A. CLINGMAN/S. KUBO

Stamp

General Notes

For Earth, For Life
Kubota

KUBOTA Water and Environment U.S.A. Corporation
19910 N Creek Pkwy, Suite 100
Bothell, WA 98011

REFERENCE ONLY
FOR ENGINEERING
DESIGN WORK

[C] SUPPLIED BY CONTRACTOR
[K] SUPPLIED BY KUBOTA

ALL PIPES ARE BY CONTRACTOR UNLESS OTHERWISE SPECIFIED

SECTION 010000 - GENERAL REQUIREMENTS

PART 1 - GENERAL

DESCRIPTION OF WORK

A. The Washington State Parks and Recreation Commission proposes Phase 3A improvements to Nisqually State Park. This project includes a new Wastewater Treatment Facility, Pump House, Host Campsite, Utility Infrastructure, and expansion of the existing Maintenance Building. Work includes, but is not limited to, site preparation, erosion control, excavation, construction of building, aggregates, cast-in-place concrete, concrete, asphalt paving, on-site drain fields, water lines, sanitary sewer lines, fences/slide gate, catch basins, and subsurface drainage, topsoil, restoration plantings and miscellaneous site improvements.

TIME FOR COMPLETION OF PROJECT

B. Substantially complete project in accordance with the drawings and specifications within 365 calendar days stated in the Bid Proposal from date on Notice to Proceed letter.

HOURS OF WORK

C. Work hours are between 7:00 a.m. and & 7:00 p.m. Monday through Friday, excluding national holidays.

LIQUIDATED DAMAGES

D. If Contractor fails to complete Contract within stipulated time, an assessment of $500.00 per day will be made against Contractor for each additional day required to complete contract, unless an extension of time was granted through Change Order. This assessment is to cover Commission's liquidated damages and is not to be construed as a penalty.

E. Contract authorizes the Washington State Parks and Recreation Commission to deduct liquidated damages from money due at completion of contract.

PRE-CONSTRUCTION CONFERENCE

F. Following notification of award to Contractor, the date for an on-site pre-construction conference will be set. Do not commence Work prior to conference or until written clearance has been obtained from Engineer.

G. Furnish Engineer with following:

1. Complete list of sub-contractors, including business address, telephone numbers, items of Work, and registration numbers. List is to be updated during contract life.

2. Name of Contractor's superintendent who will be on job at all times.
3. A progress schedule in accordance with General Conditions.
4. A Detailed Schedule of Values breakdown for lump sum bid items. Furnish a fair evaluation of actual cost of each item of Work listed. This will be used in processing Contractor's requests for partial payment. Submittal of Schedule of values does not affect the Contract terms.

H. Engineer will supply a list of hazardous products that could be encountered on Project. Appropriate Safety Data Sheet (SDS) will be on file at park.

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT)

I. Washington State Department of Transportation Standard Specifications (WSDOTSS) and Drawing apply to this project except none of WSDOT General Requirements, measurement or payment provisions apply.

UTILITY MONUMENTS

J. Contractor is responsible for installing monuments in accordance with drawings and at locations designated by Engineer to permanently mark utilities installed on Project. Install monuments in trenches during backfilling operations.

AS-BUILT DRAWINGS

K. In order to prepare As-Built Drawings, keep a clean set of full-sized drawings at job site to use to identify changes.

PROJECT CONDITIONS

L. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

M. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Project Representative and Owner. Owner will remove hazardous materials under a separate contract.

PROJECT SIGN

N. Provide the temporary sign herein this section. Sign Placard shall be 4’x6’, landscape orientation, secured to top/bottom 2x4 rails mounted on 4x4 posts. Sign Placard shall be professionally printed on a vinyl canvas with black lettering on a white background. Bottom of Sign Placard shall be 3’ from existing grade. Posts shall be secured so there is zero movement under human pressure. Provide sign mock-up for approval prior to fabrication. Sign location shall be determined by Engineer. Upon Project completion, remove sign and restore area to original condition.

PROJECT SIGN LETTERING

TITLE OF PROJECT: Phase 3A Maintenance Building and Wastewater Treatment Facility

NAME OF FACILITY: Nisqually State Park

NAME OF CONTRACTOR:(Place Contractor's Name here)

ADDRESS OF CONTRACTOR: (Place Contractor's Address here)

FUNDING TITLE NUMBER 1: State Building Construction Account

FUNDING TITLE NUMBER 2 Leave blank for this project

In addition to above, Owner will provide graphic files of 3 logos to be printed at the bottom of the Sign Placard, so each logo is a minimum of 5 inches high.

PARTNERSHIP IN THE CONTRACT

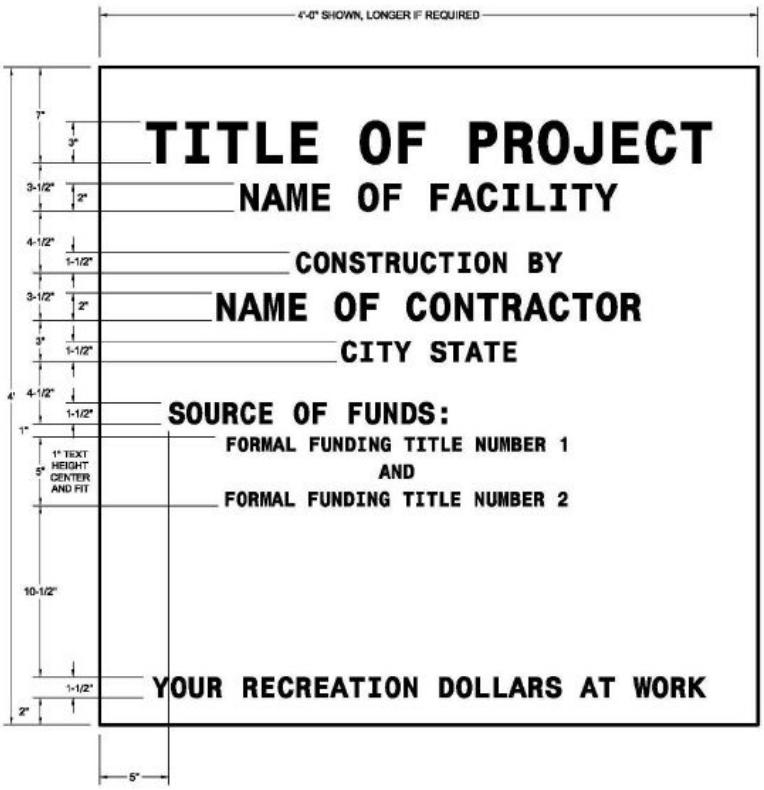
O. As partners in this contract, both Contractor and Commission recognize the value of a successful Project. Both parties recognize, besides the tangible benefits to Contractor and the Commission, the citizens of Washington State and visitors to Washington State Parks will benefit immensely from the successful completion of a quality Project.

PART 2 - EXECUTION (NOT USED)

PART 3 - PART 3- EXECUTION

PROJECT SIGN DETAIL

PROJECT SIGN DETAIL

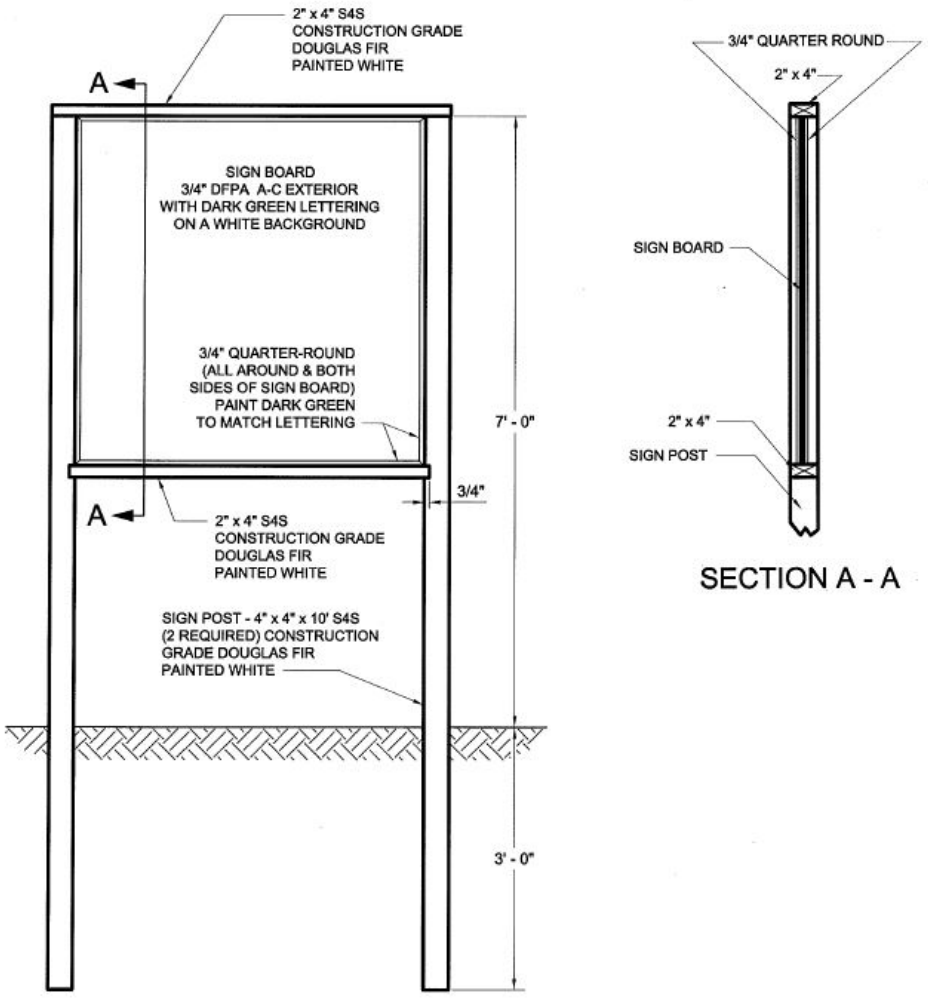


LAY OUT SIGN TO FIT ON A PORTION OF ONE (1) SHEET OF PLYWOOD. IF PLYWOOD IS THE FINAL SURFACE, PAINT IT WITH TWO (2) OR MORE COATS OF WHITE PAINT TO FORM A SMOOTH, NONABSORBENT SURFACE. PROVIDE DARK GREEN WELL FORMED LETTERS, EVENLY SPACED, NEAT IN APPEARANCE, AND ALIGNED AS SHOWN ABOVE.

WASHINGTON STATE PARKS
PROJECT SIGN DETAIL

PROJECT SIGN DETAIL

PROJECT SIGN DETAIL



END OF SECTION

SECTION 010099 – SURVEYING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section addresses work covered by construction survey work necessary to establish and maintain alignment and grades necessary for construction.

B. Set and maintain alignment and grades necessary for construction; including clearing/grubbing limits, grading, utilities, roads, trails, and structures. Except for the data specified to be furnished by the Owner, the Contractor is responsible for calculations, surveying materials and measuring required for setting and maintaining the necessary lines and grades. Furnish copies of calculations and staking data, when requested by Project Representative. AutoCad design data will be supplied by the Project Representative per Section 013600 – Digital File Request. AutoCAD design data for Architecture will be supplied by the Project Representative per section 013601 – Electronic Media Release.

C. Staking requirements that do not fit field conditions will be reviewed and, if necessary, adjusted by the Engineer. Revisions to the staking information will be provided for completing the work.

1.2 SURVEY CONTROL AND DATA

A. To facilitate establishment of lines and elevations, Owner will furnish the following survey control and data:

1. Elevation benchmarks, and horizontal control points, for one time only.
2. Provide technical advice, if requested.

B. Give three weeks' notice to allow adequate time to provide data.

1.3 TOLERANCES

A. Ensure accuracy of line and elevations within a tolerance of 0.01 foot.

B. Set subgrade blue tops and surfacing red and yellow tops at 50 foot intervals in tangent sections, 25 foot intervals in curve sections and 10 foot intervals in intersection radii.

C. In disputes concerning line and elevation accuracy, resolve dispute to Project Representative's satisfaction. Correct discrepancies before proceeding. No additional time or compensation will be provided for corrective work.

1.4 PAYMENT

A. Lump sum price for "Surveying" includes full pay costs for labor, tools, survey instruments, materials, other equipment, and traffic control necessary for the setting and maintaining horizontal locations and grades as specified shall be measured and paid in the Base Bid under Phase 3A Wastewater Treatment Facility and Maintenance Building Bid Item "Maintenance Building Pumphouse and Utilities".

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SURVEYING SERVICES

A. Contractor shall provide Surveying Services as required to define the horizontal and vertical control and staking to implement the contracted scope of work accurately.

END OF SECTION

SECTION 010100 SCHEDULE OF MAJOR EQUIPMENT ITEMS BASIS OF BID

This form is to be completed and included with bid.

Refer to Section 010101, "Substitution of Major Equipment Items," for details on what major equipment prices are to be included with bid document:

Reference	Basis of Bid Description and Equipment Nos.	Column 1		Column 2	
		'Basis of Bid' Manufacturer	'Basis of Bid' Price for Contract	'Proposed Alternate' Manufacturer	'Proposed Alternate' Price
Appendix E	MBR System	Kubota FS125 SMU	$		$

END OF SECTION

SECTION 010101 SUBSTITUTION OF MAJOR EQUIPMENT ITEMS GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section defines the total bid price format for major equipment items. The "Basis of Bid" for major equipment items for preparation of the Total Bid Price listed on the Bid Item Schedule consists of the items identified in Column 1 of Table 1 in Section 010100, "Schedule of Major Equipment Items Basis of Bid."

B. The use of this bidding format specified herein and included in Section 010100 is intended to:

1. Provide a basis for all bidding contractors (Bidders) on which to base their TOTAL BID PRICE.
2. Protect the Owner and Bidders so that no one Bidder gains an unfair bid price advantage by quoting a lower price for a major equipment item which is not "or equal" in the opinion of the Owner and Engineer.
3. Ensure that the Owner receives full benefit of the savings in cost involved in any substitution of a major equipment item.

C. The project has been designed to specifically include Basis of Bid Equipment furnished by Basis of Bid Equipment Manufacturers. Alternate Equipment from Bidder Proposed Alternate Equipment manufacturers may be considered if the Equipment is determined by the Owner and Engineer, in their opinion, to meet or exceed the quality, performance, function, reliability, and ease of operation and maintenance of the Basis of Bid Equipment and also is determined to conform to the requirements and constraints for installation within the work specified in the Contract Documents. If Proposed Alternate Equipment is selected by the Owner after shop drawings submittals are reviewed and accepted as described in Paragraph 1.3, the Owner may accept the "Proposed Alternate" cost for one or both of the Bidder Proposed Alternate Equipment and incorporate the lower cost in the Total Base Bid Amount.

1. Bidders shall only fill in Column 2 of the Schedule of Major Equipment Items – Basis of Bid form if the Proposed Alternate Equipment cost is lower than the Basis of Bid Equipment listed in Column 1.

D. Bidders shall only select and list one Bidder Proposed Alternate Equipment and associated Approved Equal Cost for each specification section listed in the Schedule of Major Equipment that meets the requirements listed in Paragraph 1.1.C and offers the largest cost savings to the Owner.

E. If the Owner and Engineer determine the Bidder Proposed Alternate Equipment is not equal or well suited for use at this project location, the bidding Contractor's Proposed Alternate shall not be accepted, and the Basis of Bid Equipment shall be provided at no increase in the Total Base Bid Amount.

1.2 BID ITEM SCHEDULE

A. The Bid Item list included in Section 010100, "Schedule of Major Equipment Items Basis of Bid," lists the Specification Sections for Basis of Bid Equipment and Basis of Bid Equipment Manufacturers for this project.

B. If the Bidder proposes to offer a price for a Proposed Alternate Equipment Manufacturer, the Bidder shall enter the Price for each Proposed Alternate Equipment Manufacturer, and legibly write-in the name of the Proposed Alternate Equipment Manufacturer. The Price shall include the labor and material cost, profit and overhead, and necessary appurtenances to provide a complete system to furnish and install the Bidder Proposed Alternate Equipment in accordance with the Contract Documents. If the Owner does not accept the Bidder's Proposed Alternate Equipment Manufacturer, either individually or wholly, the Bidder shall provide the Basis of Bid Equipment furnished by the Basis of Bid Equipment Manufacturer for the amounts included in the Total Base Bid Amount.

C. Where more than one manufacturer is listed as approved for inclusion as the Basis of Bid, the Bidder shall indicate which of the listed items that the Bid is based on by circling the chosen manufacturer, or crossing out all except for the chosen manufacturer.

D. It is not the intent of the Contract Documents to contain proprietary, exclusionary, or discriminatory requirements other than those based on performance. Manufacturers who believe that their equipment can meet the performance requirements and, with the exception of minor details, the technical requirements of the Contract Documents, are encouraged to submit "Qualification Packages" for a Proposed Alternate major equipment item after the bidding period ends.

1.3 SHOP DRAWING SUBMITTALS

A. The supply of Basis of Bid or Bidder Proposed Alternate Equipment listed in the Schedule of Major Equipment Basis of Bid in the Legal Documents section does not eliminate the need for shop drawing submittals and reviews during construction, nor does it eliminate the requirement that the equipment manufacturer satisfy the requirements of the Contract Documents.

B. The Bidder, when requested by the Owner at some period after the bids are opened, shall submit the following information to the Owner in a timely manner for all Bidder Proposed Alternate Equipment Manufacturers written into the Schedule of Major Equipment Items – Basis of Bid table included in the Legal Documents.

1. Complete catalog information, brochures, and cut sheets of proposed equipment, size, number, or quantity supplied.
2. Shop drawings from a similar installation to show equipment configuration.
3. Manufacturer's certification letter stating the proposed equipment meets or exceeds all specified performance, functional, operational, and materials requirements.
4. Name, address, and phone number of the Washington service representative for the proposed equipment, and number of years the representative has serviced the proposed equipment.
5. Installation list including contact names and telephone numbers for similar equipment in operation.

6. Any other requested information deemed necessary to determine the Proposed Alternate equipment is equal to or exceeds the quality, performance, function, reliability, and ease of operation of the basis of bid equipment.

C. Shop drawings shall be furnished in accordance with Section 013300, "Submittal Procedures."

D. Should the Contractor furnish a major equipment item requiring changes to the Contract Documents, he shall notify the Engineer in writing of all dimensional, mechanical, electrical, and structural changes and/or requirements for the major equipment item's use in the Work and shall reimburse the Owner for any associated redesign and/or construction drawings. All changes shall be approved in writing by the Owner prior to Contractor taking action.

E. Bidders shall consider all costs associated in furnishing and installing the basis of bid equipment item in their installed price proposals. Redesign and Contract Drawing revisions to accommodate Bidder Proposed Alternate Equipment will be prepared by the Engineer during the shop drawing review process. Reimbursement by the Contractor to the Owner for this engineering and design effort shall be based on 3.25 times the Engineer's salary cost plus reimbursable expenses at cost.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 013000 - ADMINISTRATIVE PROCEDURES

PART 1 - GENERAL

1.1 CONDITIONS OF CONTRACT

A. Contractor shall be thoroughly familiar with the Agreement and provisions of the Project Manual.

1.2 COMMUNICATIONS

A. The Contractor shall follow the procedure and furnish information to the Owner as follows:

1. Letters to the Owner's Representative: Original and one copy.
2. Drawings and Specifications: Owner will provide electronic files of the Conformed Set (Project Manual and Plans). Three complete paper copies of the Conformed Set will be provided to the General Contractor at no cost to Contractor for the following purposes: one copy for field uses, one copy to remain on site for recording field changes and as-built information, one copy for office uses. One additional copy may be obtained by the General Contractor, at no cost to Contractor, from the Owner for each subcontractor. Additional paper copies may be obtained from the Owner at the cost of reproduction.
3. Communication. All communication concerning the Work shall take place between the Owner and the Contractor or their authorized agents. No other communication shall be recognized. Instructions from Owner will be given to General Contractor or his/her authorized agent (job superintendent) for distribution to subcontractors and tradesmen on job.

1.3 SUBMITTALS PRIOR TO STARTING WORK

A. Prepare Schedule of Values cost breakdown showing quantities and values for the various parts of the Work. This shall be itemized and match the total of Bid Award.

B. Materials lists showing all materials proposed for use in the Work and order dates necessary to ensure timely delivery to the site.

C. List of subcontractors proposed for the principal parts of the Work.

D. Progress Schedule showing proposed dates of commencement and completion of the various parts of the Work. Subdivisions of the schedule shall coincide with order and delivery dates on the material lists.

E. Certificates of Liability and Property Insurance on forms supplied by Owner.

1.4 PERMITS

A. Refer to Section 014100 – Regulatory Requirements for Environmental & Construction Permits.

B. The Contractor shall notify the Owner and coordinate with the permitting authority for extension of all permits that expire prior to final acceptance. The Owner will be responsible for permit fees and/or related extension costs for the Owner furnished permits only.

C. The Contractor shall comply with the requirements/conditions of the permits.

1.5 OTHER SIGNS

A. No signs of contractor, subcontractor, or advertising of any kind are to be erected.

1.6 PROTECTION OF MATERIALS

A. The Contractor is responsible for protection of materials and completed work from vandalism until the work is accepted.

1.7 DUST CONTROL

A. The Contractor shall be responsible for alleviation or prevention of any dust nuisance arising from the work on this project, by the use of water or dust palliatives as required and as approved by the Owner.

1.8 VANDALISM

A. The Contractor is hereby advised to take all lawful and prudent precautions against vandalism on any work and equipment connected with this project. The Owner will not in any way be held responsible or financially accountable for vandalism or be responsible for repairing or replace property impacted by vandalism.

1.9 WEATHER

A. Since work will be done during inclement weather, each bidder shall satisfy themselves before submitting their bid to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any U.S. Weather Bureau Office.

1.10 EROSION CONTROL

A. The Contractor shall be responsible at all times for erosion control during construction and for repair of any completed work damaged by erosion - until final acceptance.

1.11 MAINTENANCE OF STREETS, UTILITIES, ETC.

A. The Contractor shall be responsible at all times for the maintenance of streets and other utilities affected by construction operations. Streets and utilities shall be kept in full operation during the

entire course of the project. Debris and rubbish shall not be permitted to accumulate, and all premises shall be maintained in a neat and workman-like condition, as determined by the Owner.

B. In the event the Contractor fails to conform to these requirements, the Owner shall have the right to have the work done by others and the cost will be deducted from monies due the Contractor.

1.12 EXISTING SITE TOPOGRAPHY

A. The existing topography is shown as contour lines and spot elevations as indicated in the legend on the grading plans. Notify Owner immediately should actual conditions vary significantly from those shown.

1.13 SUBMITTALS DURING CONSTRUCTION

A. Shop drawings and samples in accordance with Project Manual.

B. Written statement to Owner's Representative of completion and request for Final Inspection.

1.14 NUMBER OF SPECIFIED ITEMS REQUIRED

A. Wherever these specifications, an article, device, or piece of equipment is referred to in the singular number, such reference applies to all and as many such articles as are shown on the drawings or required to complete the installation.

1.15 DIMENSIONS AND MEASUREMENTS

A. Dimensions govern. Do not scale drawings, unless so indicated on the plans. Check all dimensions in the field and verify them with respect to the adjacent or incorporated work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 013110 – PROJECT MANAGEMENT COORDINATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Coordination with work by the Owner.

B. Coordination.

C. Field engineering.

D. Pre-construction conference.

E. Progress meetings.

F. Pre-installation conferences.

1.2 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure proper, efficient, and orderly sequence of surface preparation and installation of interdependent construction elements, with provisions for accommodating items installed later by Owner.

B. Coordinate completion and clean-up of Work of separate sections in preparation for Completion.

C. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Owner will schedule a conference after Notice of Award.

B. Attendance Required: Owner, Owner's Representative, and Contractor.

C. Agenda:

1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents including permit documents and requirements.
4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
5. Designation of personnel representing the parties in Contract, and the Owner's Representative.

6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Inspection Procedure and Testing.
8. Scheduling.
9. Coordination with Owner.
10. Notice to Proceed.

1.4 PROGRESS MEETINGS

A. Owner will schedule and administer meetings throughout progress of the work at weekly intervals.

B. Contractor shall attend meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Owner's Representative, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:

1. Review minutes of previous meetings.
2. Review of submittals and status of submittals.
3. Review of RFI's (Requests for Information and Status).
4. Review of change orders.
5. Review of schedule and maintenance of schedule.
6. Review plans and specifications related to anticipated work.
7. Review of Work progress. Field observations, problems, and decisions.
8. Review of as-built drawings
9. Other business relating to Work.

1.5 PRE-INSTALLATION CONFERENCES

A. When required in individual specification Section, convene a pre-installation conference at work site prior to commencing work of this Section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section. Notify Owner seven (7) days in advance of meeting date.

C. Prepare agenda, preside at conference.

D. Review conditions of installation, preparation, and installation procedures, and coordination with related work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 WORK IN THIS SECTION

A. General: The types of submittal requirements specified in this Section include Shop Drawings, product data, Samples, and miscellaneous Work-related submittals. Specialized submittal requirements are specified in applicable Sections for each unit of Work. Refer to other Division 01 Sections and other Contract documents for requirements of administrative submittals.

1. Shop Drawings: Specially prepared technical data for this Project, including Drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements, and similar information not in standard printed form for general application to several projects.
2. Product Data: Standard printed information on materials, products and systems; not specially prepared for this Project, other than the designation of selections from among available choices printed therein.
3. Samples: Fabricated and unfabricated physical examples of materials, products and units of Work; both as completed units and as smaller portions of units of Work; either for limited visual inspection or (where indicated) for more detailed testing and analysis.
4. Miscellaneous: Submittals related directly to the Work (non-administrative) include warranties, informational, maintenance agreements, workmanship bonds, Project photographs, survey data and reports, physical Work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, and similar information, devices and materials applicable to the Work and not processed as Shop Drawings, product data or Samples. See Specification Sections.

1.2 RELATED REQUIREMENTS

A. Section 014000 – Quality Requirements

B. Section 017700 – Closeout Procedures

1.3 GENERAL SUBMITTAL REQUIREMENTS

A. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the Work so that Work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same Work, and for interfacing units of Work, so that one will not be delayed for coordination with another.

B. Preparation of Submittals: Provide permanent marking on, or with, each submittal to identify Project, date, Contractor, sub-contractor, submittal name and similar information to distinguish it from other submittals.

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

A. General:

1. Except as otherwise indicated in individual Work Sections, comply with requirements specified herein for each indicated category of submittal.
2. Provide and process intermediate submittals, where required between initial and final, similar to initial submittals.
3. Include a transmittal with all submittals.

B. Shop Drawings:

1. General: No claims for extras may be initiated, based on Work shown on Shop Drawings.
2. Where Work of more than one sub-contractor is involved, submit composite Drawings, clearly defining the Work of each separate sub-contractor.
3. No extension of time in respect to the final completion date of building will be granted to Contractor because of failure to have any Shop Drawings submitted in ample time to allow for checking and approval.
4. Verify all dimensions by taking field measurements. Do not begin Work until required submittals have been returned by the Engineer with stamp and initials indicating review. If Work has been done which is contrary to the approved Drawings, it will be corrected at no additional cost to the Commission. Maintain one complete set of shop drawings at the site for use by the Engineer.
5. Submit four (4) copies. Engineer will retain two (2) copies and return two (2) copies.

C. Product Data:

1. General:

   a. Collect required data into one submittal for each unit of Work or system; and mark each copy to show which choices and options are applicable to Project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked, and modify details as required for application into the Work. Include color selection information where necessary.

   b. Do not proceed with installation of materials, products or systems until final copy of applicable product data is in possession of Installer. Maintain one complete set of product data at the site for use by Engineer.

2. Preparation and Processing: Do not submit product data, or allow its use on the Project, until compliance with requirements of Contract documents has been confirmed by Contractor. Submittal is for information and record, unless otherwise indicated. Initial submittal is final submittal unless returned by Engineer, marked with an "Action" which indicates an observed noncompliance.
3. Submit four (4) copies. Engineer will retain two (2) copies and return two (2) copies to the Contractor.

D. Samples:

1. General: Provide units identical with final condition of proposed materials or products for the Work. Include "range" Samples (not less than three (3) units) where there are unavoidable variations between units of each set. Provide full set of optional Samples where Engineer's selection is required. Prepare Samples to match Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by Engineer. Engineer will not "test" Samples (except as otherwise indicated) for compliance with other requirements, which are, therefore, for exclusive responsibility of the Contractor.
2. Processing: Submit two (2) sets of Samples for Engineer's review and "Action"; one (1) set will be returned. Large Samples, which may be incorporated into the Work, may be submitted singly.
3. Reusable Samples: Returned Samples which are intended or permitted to be incorporated in the Work are so indicated in the individual Work sections and must be in undamaged condition at time of use.

E. Warranties and Guarantees: In addition to copies desired for Contractor's use, furnish three (3) executed copies, except furnish additional copies where required for maintenance manuals.

F. Survey Data: Refer to other Sections for specific general requirements on property surveys, field measurements, quantitative records of actual Work, damage surveys, photographs and similar data required by individual Work Sections of these specifications. None of specified copies will be returned.

1.5 ACTION ON SUBMITTALS

A. Engineer's Action: Engineer will review each submittal, mark with "Action", and where possible return within two (2) weeks of receipt. Where submittal must be held for coordination, they will be returned to the Contractor within two (2) weeks of receipt for the Contractor to resubmit when it is appropriate.

1. Final Unrestricted Release: Work may proceed, provided it complies with Contract documents, when submittal is returned with marking: "Approved as Submitted".
2. Final-But-Restricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with Contract documents, when submittal is returned with the marking: "Approved as Noted".
3. Returned and Rejected: Do not proceed with Work. Submittal item is not acceptable and may not be used on the Project when noted as "Not Approved".

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 013500 – PROJECT MEETINGS

PART 1 - GENERAL

1.1 GENERAL

A. The construction of this project will be planned and recorded with a conventional Gantt Chart. The chart shall be used for coordination, monitoring, and payment of all work under the contract including all activity of subcontractors, vendors, and suppliers.

B. Contractor is responsible for preparing the initial schedule in the form of an Activity on arrow diagram. All costs incurred by Contractor in preparing the Schedule shall be borne by the Contractors as a part of its responsibility this contract.

C. The initial schedule as reviewed by the Owner and signed by the Contractor will become the Original Baseline Schedule. The Contractor shall preserve the Original Baseline Schedule in its original form on an electronic readable medium until final payment has been made and all claims arising from the Project are resolved.

D. The Contractor shall utilize the most recently updated detailed Construction Schedule in planning, scheduling, coordinating, performing, and controlling the work under this contract (including all activities of subcontractors, equipment vendors and suppliers, and scheduling the delivery of "Furnished by Owner, Installed by Contractor" (FOIC) items).

E. The Owner's review of schedules shall not constitute approval or adoption by the Owner of the Contractor's plan or schedule for construction method or plan reflected. It shall not relieve the Contractor from the sole responsibility for the accuracy of the schedule and its compliance with all Contract requirements.

F. Progress schedules shall be revised weekly and presented at the weekly construction progress meeting.

1.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

G. Provide a horizontal bar chart type construction schedule and submit for initial review at the Preconstruction Conference.

1. Provide separate time bar for each significant construction activity measured in days.
2. Provide the same breakdown of units for the Work as indicated in the "Schedule of Values".
3. Within each time bar indicate estimated completion percentage in 10 percent increments. As work progresses, place contrasting mark in each bar to indicate Substantial and Final Completion.
4. Prepare schedule on a sheet of sufficient size to show entire construction period.
5. Coordinate the Contractor's construction schedule with the schedule of values.
6. Indicate Physical Completion on the schedule.

H. The construction time, for the entire project or any milestone, shall not exceed the specified contract time. In the event that any milestone date or contract completion date is exceeded in the schedule, logic and/or time estimates will be revised.

I. Following review of the initial schedule, if revisions to the proposed schedule are required, the Contractor make revisions before the next weekly construction progress meeting. Failure to finalize the schedule by that date will result in withholding all contract payments until the schedule is finalized.

1.3 SCHEDULE REQUIREMENTS

A. All activities on Gantt Chart shall include:

1. Activity nodes.
2. Activity description.
3. Activity duration.
4. Any and all major construction activities.
5. Tentative dates for Inspections and Testing required by Specifications and Project Permits.

B. The activity on Gantt Chart shall show the sequence and interdependence of all activities required for complete performance of all items of work under this contract, including shop drawing submittals and approvals and fabrication and delivery activities. The Project critical path shall be clearly identified on the chart.

C. The activities are to be described so that the work is readily identifiable, and the progress of each activity can be readily measured. For each activity the Contractor shall identify the trade or subcontractor performing the work, the duration of the activity in calendar days, the manpower involved by trade, the equipment involved, the location of the work, and a dollar value of the activity. The dollar value assigned to each activity is to be reasonable and based on the amount of labor, materials, and equipment involved. When added together the dollar value of all activities are to equal the contract price.

D. The Contractor shall also provide the following information: workdays per week, holidays, number of shifts per day, number of hours per shift, and major equipment used.

E. Any activity on arrow diagram submitted by the Contractor shall be computer plotted. Regardless of the type of diagram, the network must be legible, readable, and understandable. Network diagram will be on standard D letter or Tabloid sheets. Standard media driven printouts may be used if approved by the Owner.

1.4 SCHEDULE UPDATES AND PROGRESS PAYMENTS

A. Job site progress meetings will be held weekly by the Owner, Owner's Representative, and Contractor for the purpose of updating the project work schedule and determining the appropriate amount of partial payment due the Contractor. Progress will be reviewed to verify finish dates of completed activities, remaining duration of the completed activities, and any proposed logic and/or time estimate revisions.

B. The Contractor will revise activity on arrow diagrams for the following: delay in completion of any critical activity; actual prosecution of the work which is, as determined by the Owner, significantly different than that represented on the schedule; or the addition, deletion, revision of activities required by contract modification. The contract completion time will be adjusted only for causes specified in this contract.

C. The revised schedule shall become the complete "Revised Baseline Schedule" for the Project and will thereafter serve as the basis for adjustment of the time of performance of the work.

D. If the Contractor does seek a time extension of any milestone or contract completion date, it shall furnish documentation as required by the Owner to enable the Owner to determine whether a time extension is appropriate under the terms of the contract.

E. If Inspections and Testing needs to be postponed, Contractor shall notify Owner, Inspector and Testing Agent at least 24 hours in advance.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 013501 – INADVERTENT DISCOVERIES OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

PART 1 - GENERAL

1.1 PROJECT SPECIFIC REQUIREMENTS

A. No cultural resource sites are known to exist within the Work area. However, there always exists the potential for unanticipated discoveries during excavation work.

1.2 EMERGENCY CONTACTS

WSPRC Archaeologists	
Jennifer Wilson, Archaeology Program Manager	(360) 787-6511 (cell)
Email: jennifer.wilson@parks.wa.gov	(360) 902-8637 (office)
Shari Silverman, Archaeologist	(435) 260-9894 (cell)
Email: shari.silverman@parks.wa.gov	(360) 902-8640 (office)
Sarah DuBois, Archaeologist	(509) 972-5884 (cell)
Email: sarah.dubois@parks.wa.gov	(509) 665-4336 (office)
Sean Stcherbinine, Archaeologist NW Region	(360) 770-1419 (cell)
Email: sean.stcherbinine@parks.wa.gov	
Laura Syvertson, Archaeologist NW Region	(360) 770-0444 (cell)
Email: laura.syvertson@parks.wa.gov	
Maurice Major, Stewardship Archaeologist	(360) 701-6218 (cell)
Email: maurice.major@parks.wa.gov	(360) 902-8503 (office)
WSPRC Curator of Collections/NAGPRA Specialist	
Alicia L. Woods, Statewide Curator of Collections & NAGPRA Specialist	(360) 586-0206 (office)
State Physical Anthropologist	
Guy Tasa, PhD, Dept. of Archaeology and Historic Preservation	(360) 790-1633 (cell)
Assistant State Physical Anthropologist	
Julie Berger, Dept. of Archaeology and Historic Preservation	(360) 890-2633 (cell)
County Coroner/Examiner	
Thomas B. Clark III, Pierce County Medical Examiner's Office	(253) 798-6494 (office)
Email: tclark@co.pierce.wa.us	
Local Law Enforcement	
Alicia Feist, Park Ranger 3	(360) 902-8642
	(360) 628-0529 (cell)
If local law enforcement cannot be reached, call Sheriff at:	(253) 798-4668

Area Manager	
Janet Halstead, Washington State Parks and Recreation Commission	(360) 753-1519
Region Manager	
Kevin Goodrich, Washington State Parks and Recreation Commission	(360) 755-2801
Local Law Enforcement (if can't get ahold of any park staff)	
Pierce County Sheriff's Office (911, if an emergency; non-emergency call	(253) 287-4455)

1.3 INADVERTENT DISCOVERIES OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

A. Many of Washington's most important heritage sites reside on lands owned or managed by the Washington State Parks and Recreation Commission (WSPRC). Nearly all Washington State Parks contain one or more important historic buildings, structures, or archaeological sites. For this reason, archaeological surveys and historic building inventories are ordinarily commissioned as a part of background analysis and information gathering for park developments and undertakings. Results of these surveys are used during project planning to ensure every effort is made to avoid impacts to cultural resources. Yet, despite these efforts, there **always** remains some potential for unanticipated discoveries while working in Washington State Parks.

B. All unanticipated discoveries, both cultural resources and human skeletal remains, are subject to all applicable federal and state statues, regulations, and executive orders. For these reasons, the Inadvertent Discovery Plan (IDP) provides useful guidance and instructions for circumstances when cultural resources or human skeletal remains are found. Please carefully read these instructions. If you have any questions, please contact the appropriate WSPRC Area Manager or the WSPRC archaeologist assigned to the undertaking. It is also strongly recommended that anyone conducting ground-disturbing activities watch the training video produced by Washington State Dept of Ecology: Inadvertent Discovery of Cultural Resources or Human Remains: Training for Field Staff. This IDP for cultural resources and human skeletal remains is based on **RCW 27.53**, **RCW 68.50.645,** **RCW 27.44.055**, and **RCW 68.60.055** and **recommended language** from the Department of Archaeology and Historic Preservation (DAHP).

1.4 INADVERDENT DISCOVERY PLAN FOR CULTURAL RESOURCES

A. If cultural resources are found during a project, activity in the immediate area of the find should be discontinued (**stop**), the area secured (**protect**), and the WSPRC archaeologists notified to assess the find (**notify**). ***When in doubt, assume the material is a cultural resource and implement the IDP outlined below.***

B. **Recognizing Cultural Resources-***Types of Historic/Prehistoric Artifacts and/or Activity Areas That May Be Found*

1. Artifacts- Both historic and prehistoric artifacts may be found exposed in backhoe trenches or back dirt piles.

a) Prehistoric artifacts may range from finished tools such as stone pestles, arrowheads/projectile points, shell beads, or polished bone tools to small pieces or "flakes" or "chips" of exotic stone such as chert, jasper, or obsidian.
b) Historic artifacts may include older (more than 50 years) nails, plates/ceramics, bottles, cans, coins, glass insulators, or bricks.
c) Old abandoned industrial materials from farming, logging, railways, lighthouses, and military installations.

2. Activity Area/Cultural Features- While excavating trench lines look for evidence of buried activity areas/cultural features such as old campfire hearths or buried artifacts.

a) An area of charcoal or very dark stained soil with artifacts or burned rocks may be a fire hearth.
b) A concentration of shell with or without artifacts may be shell midden deposits.
c) Modified or stripped trees, often cedar or aspen, or other modified natural features, such as rock drawings or carvings

3. Historic building foundation/structural remains- During excavation, buried historic structures (e.g., privies, building foundations) that are more than 50 years old may be found.
4. Bone- Complete or broken pieces of bones may be discovered exposed in trench walls or in back dirt piles. Bone of recent age is usually transparent or white in color. Older bone is usually found in various shades of brown. Burned bone is usually black or, if heavily burned, bluish-white.

C. STEPS TO TAKE IF A CULTURAL RESOURCE IS FOUND DURING CONSTRUCTION

1. **Stop** if a cultural resource(s) is observed or suspected, all work within the immediate area of the discovery must stop.
2. **Protect** the area from further disturbance. Do not touch, move, or further disturb the exposed materials/artifacts. Create a protected area with temporary fencing, flagging, stakes, or other clear markings that is large enough (30 feet or larger) to protect the discovery location area. The WSPRC archaeologist can help determine the size of the protected area. Do not permit vehicles, equipment, or unauthorized personnel to traverse the discovery site.
3. **Notify** the WSPRC archaeologist. If the area needs to be secured, notify the Park Ranger or Park staff as well.
4. If requested by the WSPRC archaeologist, take photographs with a scale (e.g., pen, coin, etc.) and collect geospatial information of the discovery site to document the initial finds.

D. WHAT NOT TO DO IF A CULTURAL RESOURCE IS FOUND DURING CONSTRUCTION

1. Do not remove any artifacts from the site of the discovery.
2. Do not dig out objects protruding from any trench walls as this may cause further damage to artifacts and/or destroy important contextual information.
3. Do not share any information about the find, including on social media, except as necessary to implement the IDP.

E. WHAT HAPPENS NEXT?

1. The find will be assessed by a professional archaeologist (may be a WSPRC archaeologist or an archaeology consultant).

    a) If the find is not a cultural resource, construction work may resume.
    b) If the find is a cultural resource, the WSPRC archaeologist will contact the DAHP and affected Tribes, as appropriate, to develop a suitable treatment plan for the resource.

2. Construction work may resume in the protected area after the WSPRC archaeologist assigned to the undertaking has determined that the find has been adequately investigated and, if necessary, a treatment plan and monitor are in place to protect any remaining archaeological deposits.

1.5 INADVERDENT DISCOVERY PLAN FOR HUMAN SKELETAL REMAINS

A. Native American burials and historic grave sites are uncommon features on Washington State Park lands. These remains, as well as any associated artifacts or funerary objects, are protected under state law and, if the park is a federal lease, applicable federal law. If you discover human remains (or bones that you believe may be human remains) during construction, please follow these important instructions. It is imperative that reporting and treatment of any human remains found during construction or any ground-disturbing activities are treated with utmost dignity and respect.

B. Steps to Take If Human Skeletal Remains are Found During Construction

1. **Stop** if human skeletal remains observed or suspected, all work within the immediate area of the discovery must stop.
2. **Protect** the area from further disturbance. Do not touch, move, or further disturb the remains. Cover the remains with a tarp or other materials (not soil or rocks) for temporary protection in place and shield them from being photographed. Create a protected area with temporary fencing, flagging, stakes, or other clear markings that is large enough (30 feet or larger) to protect the discovery location area. The WSPRC archaeologist can help determine the size of the protected area. Do not permit vehicles, equipment, or unauthorized personnel to traverse the discovery site.
3. **Notify** law enforcement and the appropriate county medical examiner/coroner as soon as possible. If you are unsure if the remains are human, the physical anthropologist at DAHP may be called. Also notify the Park Ranger, the WSPRC archaeologist, and the WSPRC Curator of Collections/NAGRPA Specialist of the discovery of the remains.
4. If requested by law enforcement, the county coroner/examiner, the DAHP physical anthropologist, or the WSPRC archaeologist, take photographs with a scale (e.g., pen, coin, etc.) and geospatial information of the discovery site to document the initial finds.

C. What Not to Do If Human Skeletal Remains are Found During Construction

1. Do not pick up or remove anything.
2. Do not take any photographs of the remains unless instructed to do so by law enforcement, the county coroner/examiner, the DAHP physical anthropologist, or the WSPRC archaeologist. If pictures are requested, be prepared to photograph them with a scale (e.g., pen, coin, etc.) and collect geospatial information of the remains.

3. Do not call 911 unless you cannot reach law enforcement or the coroner/examiner by other means.
4. Do not share any information about the find, including on social media, except as necessary to implement the IDP.

D. **What Happens Next?**

1. The county medical examiner/coroner will assume jurisdiction over the human skeletal remains and decide whether those remains are forensic (crime-related) or non-forensic.

   a) If forensic, the county medical examiner/coroner will retain jurisdiction over the remains.
   b) If non-forensic, the county medical examiner/coroner will report that finding to the DAHP who will then take jurisdiction over the remains. The DAHP will notify any appropriate cemeteries and all affected Tribes of the remains. The State Physical Anthropologist will decide whether the remains are Indian or Non-Indian and report that finding to any appropriate cemeteries and the affected Tribes. The DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains.

      Note: The WSPRC archaeologist assigned to the undertaking will be coordinating and consulting with the DAHP, affected Tribes, and other groups as necessary. Additionally, WSPRC's Curator of Collections/NAGPRA Specialist should be included on all written and/or verbal correspondence until the remains have been officially transferred from WSPRC's possession to an outside authority. Until the remains are transferred off of WSPRC's property, it is the responsibility of the Curator of Collections/NAGPRA Specialist to document and track the information regarding all human remains and associated funerary objects (including all material from excavation areas/units from which the human remains were removed).

2. Construction work may resume in the protected area after the WSPRC archaeologist assigned to the undertaking has determined that the find has been adequately investigated and, if necessary, a treatment plan and monitor are in place.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 013573 – DELEGATED DESIGN PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative procedures for performing Delegated Design portions of Work.

1.2 DEFINITIONS

A. Applicant: Person applying for building permit and person coordinating Delegated Design engineered systems with basic building and with each other. Includes coordination of required submittals.

B. Approval Stamp: Certification that AHJ has reviewed submittal and finds it acceptable with respect to applicable code compliance.

C. Delegated Design: Certain components of Work for which Contractor coordinates and assumes or assigns responsibility for design, engineering, calculations, permitting, submittals, fabrication, transportation, and installation.

D. Delegated Design Components: Products, materials, operational systems, and other identified items, provided for their intended use.
   1. Delegated Design Components include components subject to gravity, lateral, vertical, wind, and seismic loads not designed by Architect.

E. Delegated Design Engineer: Professional, responsible design engineer engaged by Contractor to provide engineering services required by AHJ for Delegated Design Components and systems.

F. Delegated Design Engineer Seal: Certification that Delegated Design Components were designed and prepared under direct supervision of Delegated Design Engineer responsible for preparation of Delegated Design.

G. Review Stamp: Certification that Architect has reviewed Delegated Design documents bearing seal of Delegated Design Engineer to verify conformance with information given and design concept set forth in Drawings and Specifications.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate Delegated Design Components with adjacent products, components, systems, and equipment, whether or not these products, components, systems, and equipment were designed by Architect or are Delegated Design Components.

B. Sequencing:
   1. Before Work is allowed to proceed, ensure the following:
      a. Complete, legible documents have been submitted to Building Department.
      b. Documents have been examined and approved by Building Department.
   2. Documents not completed prior to issuance of building permit shall be completed and submitted for approval prior to fabrication.

1.4 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit written request for additional information to Architect.

B. Delegated Design Services Statement:
   1. Submit statement, signed and sealed by responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that products and systems are in compliance with performance and design criteria indicated.
   2. Include list of codes, loads, and other factors used in performing these services.

C. Delegated Design Services Certification:
   1. In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by Delegated Design Engineer, for each component and system specifically assigned to Contractor as Delegated Design.
   2. Indicate that products and systems comply with performance and design criteria in Contract Documents.
   3. Include list of codes, loads, and other factors used in performing these services.

D. BIM Incorporation: Develop and incorporate Delegated Design drawing and data files into BIM established for Project.
   1. Comply with digital data file requirements specified in Section 013100 – Project Management and Coordination for preparation of BIM files.

1.5 ACTION SUBMITTALS

A. Proposed Delegated Design Engineers
   1. Submit list of engineers proposed for performing Delegated Design engineering a maximum of 15 days after executing Notice to Proceed.
   2. Submit Delegated Design Summary Sheet to AHJ, if required, listing Delegated Design Engineers' names, addresses, and telephone numbers prior to issuance of components approval.

B. Delegated Design Services:
   1. Submit statement, signed and sealed by responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that products and systems comply with performance and design criteria indicated.
   2. Indicate ultimate factor of safety.
   3. Include list of calculations, codes, loads, and other factors used in performing these services.

C. Delegated Design Components:
   1. Delegated Design Components shown in Contract Documents are shown for design intent. Refer to descriptions of Delegated Design Components in individual Specification Sections.
   2. Include the following information:
      a. Complete design criteria.
      b. Design assumptions.
      c. Details.
      d. Calculations.

e. Structural elements certified by Delegated Design Engineer.
f. Instructions for fabrication, assembly, installation, and interface with other trades.

D. Building Department Delegated Design Submittals:
1. Coordinate with AHJ for electronic submittal requirements, document formats accepted, required documents to include, and quantities of each document type.
a. Drawings and Specifications: Clearly and legibly indicate components, dimensions, connections, and materials, including how components are attached to main structure.
b. Calculations: Include design criteria, assumptions, substantiating computations, and additional data sufficient to show correctness of drawings and compliance with building code for the State in which Project is located.
2. Include the following on Delegated Design documents:
a. Delegated Design Engineer's certification stamp and signature indicating engineer is registered in the State in which Project is located.
b. Architect's signed review stamp indicating general conformance for design intent.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Delegated Design Engineer: Include the following:
1. Documentation indicating engineer's experience providing delegated design engineering services of type indicated.
2. Documentation indicating delegated design engineer is licensed in the State in which Project is located.

1.7 QUALITY ASSURANCE

A. Delegated Design Engineer's Qualifications: Professional engineer, registered in the State in which Project is located, engaged by Contractor to provide drawings, specifications, computations, calculations, and other information required by AHJ for Delegated Design Components and systems.

B. Specification Sections with Delegated Design Components.
1. Refer to individual Specification Sections for minimum acceptable quality standards for Delegated Design Components.
2. Where quality standards for Delegated Design are not specified in individual Specification Sections, comply with printed industry standards for standard quality practices.

C. Owner Responsibilities: Owner will not pay for the following:
1. Progress delays, additional products, additional hours of Work, restocking, or reworking required by Contractor failure to coordinate Delegated Design Work with Project Work.
2. Failure of Contractor to coordinate Delegated Design Work with Subcontractors, suppliers, fabricators, and other relevant parties.
3. Contractor delays in providing components to meet Project Schedule.
4. Modifying Delegated Design Documents to incorporate changes required by AHJ.

D. Architect Responsibilities:
1. Review Delegated Design submittals prior to submittal to AHJ for initial and final reviews for limited purpose of checking for general conformance for design intent with information given and design concept expressed in Contract Documents.
2. Approve or take other appropriate action on submittals consistent with this limited purpose.
3. Architect not responsible for coordination of Delegated Design Components with Contract Documents or review of materials submitted as result of Delegated Design Components.

4. Architect's review of Delegated Design submittals does not lessen nor shift burden of Contractor's Delegated Design responsibilities.

E. Contractor Responsibilities:
   1. Perform responsibilities for Delegated Design Work in a timely manner to avoid delays to Project Schedule.
   2. Coordinate and assume or assign to Subcontractors, suppliers, fabricators, and other relevant parties complete responsibility for design, documentation, engineering, calculations, submittals, permits, fabrication, transportation, and installation of this Work.
   3. Submit Delegated Design Documents to Architect for initial review prior to submitting Documents to AHJ.
   4. Submit Delegated Design documents to AHJ for initial and final reviews.
   5. Make corrections to Delegated Design Documents required by AHJ.
   6. Submit Delegated Design Documents to Architect for final review prior to submitting Documents to AHJ.
   7. Allow sufficient, specified time for Architect's and AHJ's reviews to avoid delays in Project Schedule.
   8. Complete and submit Delegated Design Summary in format acceptable to Owner and Architect.

F. Delegated Design Engineers Responsibilities:
   1. Preparation of Delegated Design submittals.
   2. Design, coordination, and installation of Delegated Design Components.
   3. Design anticipated loads and load reactions of Delegated Design Components attached to, supplemental to, and interfacing with structural frame as indicated on structural Drawings or as required by building code.
   4. Include drawings, specifications, computations, and calculations related to each Delegated Design Component.
   5. Site Observations: Perform periodic site observations as appropriate to progress of Delegated Design Work.
      a. Review progress and quality of Delegated Design Work, including field sample and mockup installations that include Delegated Design Components, to determine if Delegated Design is proceeding in general conformity with Contract Documents, including approved Shop Drawings and design calculations.
      b. After each site observation, prepare and submit report to Architect and AHJ, if required, and in accordance with applicable building codes.
      c. Include costs for site observations, including preparation and submitting of reports in Contract Sum.
   6. Completion of Delegated Design-related Work:
      a. Prepare letter of general conformity for Delegated Design Components of Work certifying that Delegated Design Components have been provided in accordance with requirements of Contract Documents and AHJ.
         1) Submit report to Architect and to AHJ, if required.
   7. Allow for a review of Delegated Design by Architect relevant to discipline of Delegated Design Component.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 013600 – DIGITAL FILE REQUEST FORM

The Contractor may request the digital file of the Site and Grading Plans to facilitate construction survey by filling out and submitting this form. Digitals files will not be distributed during the Bidding process.

Date: _____

Contractor Requesting Digital Files: _____

Name of Contractor's Staff, Contractor's address, phone, and email: _____

_____

Digital Files (Drawings) Requested: _____

_____

Consultant Authorization: Name: _____

Signature: _____

Date: _____

The undersigned acknowledges that the use of information contained on these files is at their own risk. The information contained herein may not include final information included in the Contract Documents, and/or Addenda (Amendments) revisions. The accuracy of information, scale and dimensions is not guaranteed. The undersigned agrees to indemnify and hold harmless the Owner, Consultant, their agents, employees, and sub-consultants from all claims, losses, expenses, damages and liability, including attorney's fees, arising out of their use of the information contained herein. The undersigned warrants that he/she has authority to sign and bind the company for and to the foregoing.

Acknowledged for: _____
(Company Name)

By: _____
(Name and Title)

Signature: _____ Date: _____

END OF SECTION

906 Columbia Street SW, Suite 400
Olympia, Washington 98501
360.352.8883
www.KMB-architects.com

Electronic Media Release

Agreement with Contractor for Delivery of Electronic Documents

This release for electronic media is dated the [Day] day of [Month] , [Year] between "[Contractor's Name]" ("Contractor") and KMB architects ("KMB").

It is understood that Contractor, with the express authorization of "[Client's Name]" ("Client"), has requested KMB to supply Contractor with electronic media (disks, tapes, optical disk, etc.) containing information on "[Project Name]" ("Project") for use by Contractor or others as appropriate.

Therefore, in consideration of the release of the materials, Contractor and KMB agree as follows:

1. The delivery of this drawing in electronic format is for the benefit of the Client for whom the design services have been performed. Nothing in this transfer should be construed to provide any right of the Contractor to rely on the information provided or that the use of this electronic information implies the review and approval by the design professional of any drawing based on the information.
2. It is our professional opinion that this electronic information provides design information current as of the date of this release. Any use of this information is at the sole risk and liability of the user who also is responsible for updating the information to reflect any changes in the design following the preparation date of this information.
3. The electronic files are provided solely as a convenience and shall NOT be considered "Contract Documents", "Construction Documents" or any type of a certified document. All documents considered "Contract Documents", "Construction Documents" or any type of a certified document shall be hard copy and shall be accompanied by a professional's stamp and signature. The hard copy shall be referred to and shall govern in the event of any inconsistency between the hard copy and the electronic files. The information contained in the electronic files may not be used in lieu of obtaining information by other means required by other agreements, including those with Client, such as by survey or other procedures or sources, and any conclusions or information obtained or derived from such electronic files will be at user's sole risk. By providing information in this format, KMB makes no representations, whether express or implied, whether user's means, methods, techniques, sequences, or procedures are adequate, appropriate, or approved, and whether the use of the information contained in the electronic files is appropriate.
4. Contractor is advised to check all electronic media for computer viruses before loading the files. Contractor is fully responsible for intercepting and disabling viruses, if any, that may be inadvertently transmitted with the electronic files and hereby agrees to indemnify and hold KMB harmless from and against all claims of any type or nature asserted by Contractor or any third party as a result of viruses inadvertently transmitted with the electronic media.
5. Files distributed electronically are subject to data erosion, erasure and/or alteration, and computer systems and software become obsolete in time. By accepting these electronic files, Contractor acknowledges these risks and agrees to waive all claims against KMB should data erosion, erasure and/or alteration of these electronic files occur.
6. If Contractor, employees, or agents choose to use or alter in any way, in whole or in part , the electronic files provided for the Project or any future project(s), or the electronic files are inadvertently altered in any way, Contractor agrees to indemnify KMB and hold KMB harmless from all claims, injuries, losses, damages, costs and expenses (including without limitation, attorneys' fees) arising out of such alteration or use.

KMB architects

Signed:_____

Title:_____

Date:_____

Contractor

Signed:_____

Title:_____

Date:_____

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. Testing/Inspections compaction, rebar, concrete, asphalt, and steel will be paid for by the Owner. All other testing shall be paid for by the Contractor. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Project Representative, Owner, or Authorities Having Jurisdiction are not limited by provisions of this Section.

C. Related Requirements:

1. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Project Representative.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to Authorities Having Jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Project Representative for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Project Representative for a decision before proceeding.

1.4 QUANTITY SHEETS/WEIGHT TICKETS

A. For bulk items, supply quantity sheets (load receipts) to account for each load delivered to the jobsite. Deliver quantity sheets to Inspector on job at delivery time. If Inspector is not on job, deliver quantity sheets on a daily basis to place designated by Project Representative.

B. No payment shall be made for materials delivered for which quantity tickets have not been turned into Inspector or delivered to designated place at end of working day. Backdated tickets are not acceptable as a basis for payment, except at Project Representative's discretion.

C. If bid item for material to be delivered to jobsite is stated in TONS, only weight slips from approved scale are acceptable for payment purposes, unless approved in advance by Project Representative.

D. No payment for materials will be made until proper accounting has been made. Final quantity records are approved by Project Representative, with payment at Project Representative's discretion.

1.5 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.

5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of Authorities Having Jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction; and with additional qualifications specified in individual Sections; and, where required by Authorities Having Jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Project Representative.
2. Notify Project Representative seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Project Representative's approval of mockups before starting work, fabrication, or construction.

    a. Allow three days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 120 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Project Representative and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Project Representative and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Delivery of samples to testing agencies.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by Authorities Having Jurisdiction, as indicated in individual Specification Sections and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Project Representative and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Project Representative with copy to Contractor and to Authorities Having Jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Project Representative.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Project Representative's and Commissioning Authority's**,** during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014100 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 PERMITS, CODES AND REGULATIONS

A. The following permits have been applied for (or are on file) and incorporated into the contract:

1. S.E.P.A.
2. Shoreline Substantial Development
3. Conditional Use
4. Commerical Building Development
5. Commercial Site Development
6. Forest Practice
7. Gate
8. Driveway Approach
9. Off-Site Public Road Improvement
10. Critical Fish and Wildlife Review
11. Traffic Impact Analysis Review

B. Conform with the requirements of listed permits and additional or other applicable permits, codes, and regulations as may govern Work.

C. Obtain and pay fees for licenses, permits, inspections, and approvals required by laws, ordinances, and rules of appropriate governing or approving agencies necessary for proper completion of Work (other than those listed under item 1.1A. above and Special Inspections called for by the International Building Code).

D. Conform with current applicable codes, regulations and standards, which is the minimum standard of quality for material and workmanship. Provide labor, materials, and equipment necessary for compliance with code requirements or interpretations, although not specifically detailed in the Drawings or specifications. Be familiar with applicable codes and standards prior to bidding.

E. Process through Project Representative, requests to extend, modify, revise, or renew any of the permits (listed in 1.1A above). Furnish requests in writing and include a narrative description and adequate Drawings to clearly describe and depict proposed action. Do not contact regulatory agency with requests for permit extensions, modifications, revisions, or renewals without the prior written consent of Project Representative.

1.2 VARIATIONS WITH CODES, REGULATIONS AND STANDARDS

A. Nothing in the drawings and specifications permits Work not conforming to codes, permits or regulations. Promptly submit written notice to Project Representative of observed variations or discrepancies between the Contract documents and governing codes and regulations.

B. Appropriate modifications to the Contract documents will be made by Change Order to incorporate changes to Work resulting from code and/or regulatory requirements. Contractor assumes responsibility for Work contrary to such requirements if Work proceeds without notice.

C. Contractor is not relieved from complying with requirements of Contract documents which may exceed, but not conflict with requirements of governing codes.

1.3 COORDINATION WITH REGULATORY AGENCIES

A. Coordinate Work with appropriate governing or regulating authorities and agencies.

B. Provide advance notification to proper officials of Project schedule and schedule revisions throughout Project duration, in order to allow proper scheduling of inspection visits at proper stages of Work completion.

C. Regulation coordination is in addition to inspections conducted by Project Representative. Notify Project Representative of scheduled inspections involving outside regulating officials, to allow Project Representative to be present for inspections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 014200 – REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the General Conditions of the Contract.

B. "Approved": When used to convey Project Representative's action on Contractor's submittals, applications, and requests, "approved" is limited to Project Representative's duties and responsibilities as stated in the General Conditions of the Contract.

C. "Directed": A command or instruction by Project Representative. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. Project Representative and Owners Representative are interchangeable terms.

J. “Owner”; Washington State Parks & Recreation Commission staff or the designated representative.

K. “Owner Furnished/Contractor Installed”: Owner will furnish a finished product to the Contractor and Contractor is responsible for securely storing the Owner furnished products till the Contractor is prepared to install it. The Contractor is responsible for the full installation of the Owner Furnished products.

L. “Owner’s Representative (O.R.), “Project Engineer”, “Project Architect”, “Engineer”, “Landscape Architect”, and “Architect” are interchangeable terms.

M. “As-Built Drawings”: Drawings done by the Contractor in the field showing changes to the Work.

N. "Work": the project requirements in the Contract Documents.

O. "As-Built Drawings": Drawings prepared based on the changes in the Work as documented in writing by the Contractor.

1.2 GENERAL

A. Applicable standards of the construction industry have the same force and effect (and are made a part of the Contract Documents by reference) as if directly copied or bound herein.

1.3 PUBLICATION DATES

A. Where compliance with an industry standard is required, comply with the standard in effect on Bid Date.

1.4 ABBREVIATIONS AND NAMES

A. The following acronyms or abbreviations, referenced in the Contract documents, are defined to mean the associated name. Applicable standards include, but are not limited to the following:

1.	AASHTO	American Association of State Highway & Transportation Officials
2.	ACI	American Concrete Institute
3.	AGA	American Gas Association
4.	AI	Asphalt Institute
5.	AIA	American Institute of Architects (The)
6.	AISC	American Institute of Steel Construction, Inc.
7.	AISI	American Iron and Steel Institute
8.	AITC	American Institute of Timber Construction
9.	ANSI	American National Standards Institute
10.	APA	Engineered Wood Association (The)
11.	APWA	American Public Works Association
12.	ASME	American Society of Mechanical Engineers
13.	ASTM	American Society for Testing and Materials International
14.	AWPA	American Wood Protection Association
15.	AWS	American Welding Society
16.	AWWA	American Water Works Association
17.	CRSI	Concrete Reinforcing Steel Institute
18.	EPA	Environmental Protection Agency
19.	HPVA	Hardwood Plywood and Veneer Association
20.	IBC	International Building Code
21.	IEEE	Institute of Electrical & Electronics Engineers, Inc. (The)
22.	IES	Illuminating Engineering Society of North America
23.	LPI	Lighting Protection Institute
24.	MCAA	Mechanical Contractors Association of America, Inc.
25.	NIST	National Institute of Standards and Technology
26.	NCMA	National Concrete Masonry Association
27.	NEC	National Electrical Code

28. NECA National Electrical Contractors Association, Inc.
29. NFPA National Fire Protection Association
30. NHLA National Hardwood Lumber Association
31. NSF National Sanitation Foundation International
32. OSHA Occupational Safety & Health Administration
33. PCA Portland Cement Association, (The)
34. SEPA State Environmental Policy Act
35. UL Underwriters Laboratories, Inc.
36. UPC Uniform Plumbing Code
37. WCLIB West Coast Lumber Inspection Bureau (Grading Rules)
38. WRI Wire Reinforcement Institute
39. WSDOE or ECY Washington State Department of Ecology
40. WSDOH or DOH Washington State Department of Health
41. WSDOT Washington State Department of Transportation
42. WSDOTSS Washington State Department of Transportation Standard Specifications
43. WSPRC Washington State Parks and Recreation Commission
44. WWPA Western Wood Products Association (Grading Rules)

B. The following abbreviations, referenced in the Contract Documents, are defined as follows.

@	at
ABI	Alternate Bid Item
CLR	Clear
CONC.	Concrete
CONT.	Continuous
CSBC	Crushed Surfacing Base Course
CSTC	Crushed Surfacing Top Course
DIM	Dimension
EX.	Existing
ES	Equally Spaced
GALV.	Galvanized
GPM	Gallons Per Minute
HMA	Hot Mix Asphalt
MIN.	Minimum
O.C.	On Center
O.D.	Outside Diameter
PCC	Portland Cement Concrete
PSI	Pound per square inch
SS	Stainless Steel
TESC	Temporary Erosion & Sedimentation Control
TYP.	Typical
VERT.	Vertical
WSDOTSS	Washington State Department of Transportation Standard Specifications

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 014300 – INSPECTIONS & TESTS

PART 1 - GENERAL

1.1 SCOPE

A. Various testing, special inspections, and laboratory services will be provided by the Contractor as an assurance that Contract Document provisions are met. Results of Contractor-procured tests and inspections will be submitted to the Owner. Owner's acceptance of Contractor provided testing, special inspections and laboratory services are in no way to be construed as relieving the Contractor of their obligations to provide materials and workmanship in accordance with the specifications. Refer to General Conditions 5.15.

1.2 COSTS

A. Unless otherwise specified in the Contract Documents, the Contractor shall pay for the testing, special inspections, and laboratory services defined herein. All other tests, such as Material Testing by Vendors/Suppliers will not be paid for by the Owner and will be considered incidental. When initial tests indicate non-compliance with the Contract Document, the costs of subsequent tests associated with that non-compliance will be solely be the responsibility of the Contractor.

1.3 TESTING TYPE AND QUANTITY

A. The following list the type and quantity of testing, special inspections, and laboratory to be provided by the Contractor.

1.4 CODE COMPLIANCE TESTING

A. Inspections and tests required by codes, ordinances or by a plan approval authority shall be coordinated by the Contractor and paid for by the Owner for the initial inspection. Any inspections or tests associated with non-compliance will be deducted by the Owner from the Contract Sum.

1.5 SUBMITTALS

A. Promptly process and distribute all required copies of test reports and related instructions.

1.6 DUTIES OF INSPECTORS AND TESTING SERVICES

A. General: Inspection and testing services will be engaged by the Owner for the checking and testing of the following phases of the Work.

B. Site Work and Utilities:

1. Compaction of Fill: Test fill after compaction for required densities.
2. Composition of Fill: Test prior to import for compliance with granular size specification.
3. Earthwork: Verify bearing capacity of all excavating bearing surfaces.
4. Subgrade: Test subgrade for compaction and planarity.

C. Concrete Work:

1. Standard Reinforcing Steel and Embedded Items: Check reinforcing bars and fabric in place prior to any placing of concrete. Verify condition of surfaces for bond integrity with concrete, locations and sizes of all items imbedded, and anchorage for prevention of displacement.
2. Structural Concrete: Make tests of water/cement ratio by weight. Check batch consistency. Make slump tests for each pour per ASTM C143. Furnish continuous inspection during placement, form removal, repair and patching, and curing of concrete. Contractor shall provide at least three test cylinders of each strength of concrete for each 150 cubic yards placed, or for each day's pour, whichever is greater.

1.7 CONTRACTOR'S RESPONSIBILITY

A. Schedule: Layout and Plan Work so that parts of the Work requiring special inspection and laboratory testing are available at appropriate time. Contractor to coordinate inspections with inspection agency.

B. Notification: Notify Owner at least forty-eight (48) hours before inspection will be required.

C. Access: Allow inspection and testing personnel free access to the parts of the Work for which they have evaluation responsibility. Furnish records and drawings or data as may be required by testing and inspection personnel for the performance of their duties.

D. Defective Work: Remove and replace or bring into conformance with the Contract Documents any materials and work found defective by testing and inspection personnel at no additional cost to the Owner.

E. Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of the work, all extra costs attributable to the delay may be charged to the Contractor.

1.8 SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 014339 - MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Integrated exterior mockups.
   2. Other mockups indicated in Specification Sections.

1.2 DEFINITIONS

A. Contained: Moisture (water) found on flashings, gutters, or sills of glazed assemblies as a result of testing. Contained moisture is not considered moisture penetration.

B. Integrated Exterior Mockups: Mockups of exterior envelope constructed on-site either as freestanding temporary built elements or part of permanent construction, consisting of multiple products, assemblies, and subassemblies.

C. Moisture (Water) Penetration: Appearance of moisture on interior side of any part of glazed assembly, including interface conditions with adjacent envelope systems, that is not contained and drained to exterior or that can cause damage to adjacent materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate schedule for construction of mockups so testing and reviewing of mockups do not impact Project schedule.

B. Preinstallation Meetings: Conduct meetings at Project site.
   1. Timing: No less than 7 days prior to starting construction of mockups.
   2. Attendees: Owner, Architect, Contractor, testing and inspecting agency representative, and Installers of major systems whose Work is included in mockups.
      a. Participants shall be familiar with Project and authorized to conclude matters relating to mockup Work.
   3. Review locations and extent of integrated exterior mockups.
   4. Review testing procedures to be performed on mockups.
   5. Review and finalize mockup schedule.
   6. Verify availability of materials, personnel, equipment, and facilities needed to complete mockups and testing to maintain construction schedule.

C. Scheduling:
   1. Allow sufficient time in Project schedule for construction of mockups as necessary to allow testing, modifications to failed mockups, and retesting, in addition to obtaining Architect's' approval to avoid delays in Project schedule.
      a. Update Construction Schedule to reflect required revisions to mockups.
   2. Do not proceed with ordering of materials or start building construction until mockups have been approved by Architect.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups.

1. Include plans, elevations, and sections, and mounting, attachments, and support details.
2. Indicate vertical-to-horizontal intersections of exterior enclosure assemblies, including details for assembly seismic performance, expansion and contraction, and for draining moisture occurring within assemblies to exterior.
3. Indicate manufacturer and model number of individual components, subassemblies, and assemblies.
4. Include site location drawing indicating orientation of mockup.
5. Revise and resubmit Shop Drawings to reflect approved modifications in details and component interfaces resulting from changes made during testing procedures.
6. Submit Shop Drawings that have been engineered and certified by professional engineer licensed in the State in which Project is located.
    a. Include seal and signature of professional engineer on Shop Drawings.

B. Mockup Shop Drawings: For integrated exterior mockups.
1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Include the following:
    a. Axonometric drawings for conditions difficult to illustrate in 2 dimensions.
    b. Half size details of conditions for every member, joint, anchorage, weld size, glazing system, wall panel system, and provisions for expansion and contraction and sealant application.
    c. Coordination details for related and adjoining Work. Insert templates and erection diagrams to completely describe and construct mockup.

1.5 QUALITY ASSURANCE

A. Build mockups to:
1. Verify selections made under Sample submittals.
2. Demonstrate aesthetic effects.
3. Demonstrate qualities of products and workmanship.
4. Demonstrate acceptable coordination between components and systems.
5. Perform preconstruction testing, such as window air- and water-leakage testing.

B. Fabrication: Before fabricating or installing portions of Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as specified and required for Work.
1. Build mockups of each type of exterior enclosure assembly incorporating a maximum number of edges and intermediary joints as possible.
    a. Mockup Size: Minimum of 100 sq. ft. unless indicated otherwise.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed by Architect unless otherwise indicated.

C. Notifications:
1. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
2. Notify Architect, Owner, and manufacturers of materials being incorporated into mockups 14 days in advance of dates and times when mockups will be tested.

3. Allow 7 days for initial review and each re-review of each mockup.

D. Approval: Obtain Architect's approval of mockups and related submittals before starting fabrication or construction of corresponding Work.
   1. Unless otherwise indicated, approved mockups establish the standard by which Work will be judged.
   2. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Structural Performance:
   1. Seismic Performance: Mockups and support structure to withstand effects of earthquake motions determined in accordance with ASCE 7.
   2. Wind Loads: As indicated on Drawings.

B. Mockup Testing Performance Requirements: Perform tests using design pressures and performance criteria indicated for assemblies and products that are specified in other Sections and incorporated into integrated exterior mockups.

2.2 INTEGRATED EXTERIOR MOCKUPS

A. Construct integrated exterior mockups, as directed by Architect, to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.

B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.

C. Build integrated exterior mockups using Installers and construction methods that will be used in completed construction.

D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.

E. Work of integrated exterior mockups may include the following:
   1. Concrete Unit Masonry.
   2. Cold-formed metal framing and sheathing.
   3. Air and weather barriers.
   4. Roofing system to air and weather barriers.
   5. Thermal insulation.
   6. Through-wall flashing.
   7. Flashing and sheet metal trim.
   8. Joint sealants.
   9. Metal wall panels.
   10. Windows.

11. Glazing.

F. Photographic Documentation: Document construction of integrated exterior mockups with digital photographs.
   1. Provide photographs showing details of interface of different materials and assemblies.
   2. Document testing procedures, including water leakage and other deficiencies. Photograph modifications to component interfaces intended to correct deficiencies.

G. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.

H. Retain approved mockups constructed in place. Incorporate fully into Work when applicable.

PART 3 - EXECUTION

3.1 TESTING OF MOCKUPS, GENERAL

A. Mockups that do not pass tests and inspections will be considered defective.
   1. For mockups that fail to meet specified requirements, determine reason for failure and make necessary repairs to mockup and retest until mockup meets specified requirements.
      a. Retesting shall be done at no additional cost to Owner.
   2. Document corrective repairs made to mockup that achieved successful test results and incorporate into completed Work to provide specified system performance.

B. Prepare test and inspection reports, and within 72 hours of completion, distribute copies to Owner, Architect, Contractor, and manufacturer.

3.2 TESTING OF INTEGRATED EXTERIOR MOCKUPS

A. Integrated Exterior Mockup Testing Services: Perform the following tests in the following order:
   1. Water Penetration: ASTM E1105 at minimum uniform and cyclic static-air-pressure differential specified for laboratory testing in "Performance Criteria" Article and shall not evidence water penetration.
      a. Perform tests in each test area as directed by Architect. Perform at least 3 tests, prior to 10, 35, and 70 percent completion.
      b. Include a minimum of 4 cycles, each lasting a minimum of 5 minutes.
   2. Air Infiltration: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Criteria" Article but not more than 0.09 cfm/sq. ft.at a static-air-pressure differential of 1.57 lbf/sq. ft.
      a. Perform tests in each test area as directed by Architect. Perform at least 3 tests, prior to 10, 35, and 70 percent completion.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and installations, including connections, and also to observe testing for the following systems and assemblies.
   1. Aluminum windows, specified in Section 085113 – Aluminum Windows.

3.3 CLEANING

A. When authorized by Architect, demolish, remove, and legally dispose of mockup materials not indicated to remain in completed Work.

3.4 PROTECTION

A. On completion of mockup Work, provide relevant protection of mockups indicated to remain in completed Work. Use protective materials properly suited for the various components.

B. Protection is Contractor's responsibility, regardless of assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014521 - MANUFACTURER'S SERVICES

PART 1 - GENERAL

1.1 DEFINITIONS

A. Person-Day: One person for 8 hours, at the project site, within regular Contractor working hours.

1.2 SUBMITTALS

A. Training Schedule: Submit not less than 20 days prior to start-up of equipment and revise as necessary for acceptance.

B. Quality Control Submittals:

1. When specified in the individual specifications, submit:

   a. Qualifications of manufacturer's representative performing specified services.
   b. Manufacturer's Certificate of Proper Installation

1.3 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system. Additional qualifications may be specified elsewhere.

1.4 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Where manufacturers' services are specified, furnish manufacturer's qualified representative. Where time is necessary in excess of that stated in the Specifications for manufacturer's services, additional time required to perform the specified services shall be considered incidental work.

B. Coordinate and schedule manufacturer's services to avoid conflicting with other on-site testing or other manufacturer's on-site services.

C. If specified, manufacturer's on-site services shall include as a minimum:

1. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish written approval of installation.
2. Revisiting the site as required to correct problems and until installation and operation are acceptable to Engineer and Owner.
3. Assistance during functional and performance testing and startup demonstration, and until product acceptance by the Owner.

4. Training of Owner's personnel in the operation and maintenance of respective product as required.
5. Completion of Manufacturer's Certificate of Proper Installation with applicable certificates for proper installation and initial, interim, and final test or service.
6. Meet and coordinate with the Engineer on site for all equipment that includes a control system (headworks screens, UV system, reuse pumps, MBR system, chemical pumps, etc.) to ensure all control communication is agreed to and working properly.

1.5 TRAINING SCHEDULE

A. List specified equipment and systems with respective manufacturers that require training services or manufacturers' representatives and show:

1. Estimated dates for installation completion.
2. Estimated dates for start-up testing.
3. Estimated training dates to allow for multiple sessions when several shifts are involved.

B. Adjust training schedule to ensure training of appropriate personnel as deemed necessary by Owner.

1.6 TRAINING OWNER'S PERSONNEL

A. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual.

B. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, and component) and as may be required in applicable specifications.

1. All training sessions for Owner's personnel shall be scheduled to take place on a date and time coordinated with Owner.
2. Training sessions may be video recorded by Owner at Owner's expense.
3. Provide training sessions for operators in order to allow all operators to attend training session. Operations training sessions shall follow the following outline:

1.7 GENERAL OUTLINE FOR MANUFACTURER PRESENTATIONS

A. Familiarization:

1. Show catalog, parts lists, drawings, etc., in the plant files and operation and maintenance manuals.
2. Check out the installation of the specific equipment items.
3. Demonstrate the unit and show that all parts of the Specifications are met.
4. Answer questions.

B. Safety:

1. Point out safety references.
2. Discuss proper precautions around equipment.

C. Operation:

1. Point out reference literature.
2. Explain all modes of operation (including emergency).
3. Check out Owner's personnel on proper use of the equipment (let them do it).

D. Preventive Maintenance (PM):

1. Pass out PM list including:

    a. Reference material.
    b. Daily, weekly, monthly, quarterly, semi-annual, and annual jobs.

2. Show how to perform PM jobs.
3. Show Owner's personnel what to look for as indicators of equipment problems.

E. Corrective Maintenance:

1. List possible problems.
2. Discuss repairs – point out special problems.
3. Open up equipment and demonstrate procedures, where practical.

F. Parts:

1. Show how to use parts list and order parts.
2. Check over spare parts on hand. Make recommendations.

G. Local Representatives:

1. Where to Order Parts: name, address, and telephone.
2. Service Problems:

    a. Who to call.
    b. How to get emergency help.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 014524 - INSTALLATION, TESTING, COMMISSIONING, AND TRAINING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the installation, testing, commissioning, and training for all mechanical, electrical, and instrumentation systems furnished by the Contractor and completed portions of the Work, functioning as completed facilities and a complete project.

1.2 CONFLICTS WITH MANUFACTURER'S INSTALLATION RECOMMENDATIONS

A. All mechanical, electrical, and instrumentation equipment provided under this Contract shall be installed in conformity with the details shown and specified and with the manufacturer's requirements. Should a manufacturer's installation recommendations conflict with specific requirements of this Contract Document, the Contractor shall bring the matter to the attention of the Engineer. Any costs incurred by the Contractor through failure to timely notify the Engineer of a difference between Contract Document and manufacturer's installation requirements shall be borne by the Contractor.

1.3 SUBMITTALS

A. Logbook: A master test logbook shall be maintained by the Contractor, which shall cover all tests, including piping, reservoir, equipment, electrical, and instrumentation. The master test logbook shall be maintained by the Contractor during testing and transmitted to the Owner prior to submitting the final payment application.

B. Installed Testing Procedures: The Contractor shall be solely responsible for determining, detailing and documenting the individual procedures for the installed testing, operational testing and commissioning requirements specified herein. Prior to receipt of any progress payments in excess of 60 percent of the Contractor's total bid for the Work, the Contractor shall submit to the Owner details of the installed tests and inspections procedures.

1. The procedures shall be divided into two distinct stages: pre-operation checkout and startup test. Testing procedures shall be designed to duplicate, as nearly as possible, all conditions of operation and shall be carefully selected to ensure that the equipment is not damaged. Once the testing procedures have been reviewed by the Engineer, the Contractor shall produce checkout, alignment, adjustment, and calibration sign-off forms for each item of equipment to be used in the field by the Contractor and the Engineer jointly to ensure that each item of electrical, mechanical, and instrumentation equipment has been properly installed and tested. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question.
2. Once the testing procedures have been reviewed by the Engineer, the Contractor shall develop and produce sign-off forms for each item of equipment being tested. The content of these forms shall be such to ensure that each piece of equipment, mechanical item, and

instrumentation has been properly installed and tested. The Owner reserves the right to add checks and tests to the prestart-up and start-up schedule submitted by the Contractor, if the Owner feels that the Contractor's schedule is not adequate or complete.

C. Operational Testing Plan: Contractor shall develop an operational testing plan containing procedures that fulfill the requirements specified herein. The testing plan shall be in sufficient detail such that the Owner is fully aware of all the requirements that need to be provided to the Contractor-operated items during operational testing. Contractor shall be responsible for all coordination with the Owner and Owner's operations staff required for development of this testing plan.

D. Commissioning Plan: Contractor shall develop a commissioning plan detailing the services and assistance the Contractor will provide in order to fulfill the requirements specified herein. Contractor shall be responsible for all coordination with the Owner and Owner's operations staff required for development of this plan.

1.4 TESTING

A. All equipment and partially complete or fully complete portions of the Work included in this Contract shall be tested and inspected to prove compliance with the requirements of these Specifications. Unless otherwise specified, all costs of testing, including temporary facilities and connections, shall be borne by the Contractor.

B. Installed structural tanks shall be tested for watertightness as specified in Division 3. Installed leakage tests and other piping tests shall be as specified in Division 40. Installed tests for heating, ventilation, and air conditioning systems shall be as specified in Division 23. Installed tests for electrical devices and systems shall be in accordance with Division 26. Installed tests for instrumentation devices and systems shall be in accordance with Division 40. Installed tests for equipment shall be as specified in Divisions 40, 41, 43 and 44.

C. No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test.

D. Tests and inspection shall include:

1. The delivery acceptance test and inspections.
2. The installed tests and inspections.
3. The operational testing of completed portions of the water reclamation facility.
4. Simulate power outage with utility provider.

    a. Contractor shall coordinate with utility provider to simulate a single-phase loss for primary power to the utility transformer resulting in power transfer to the standby generator.
    b. And coordinate with utility provider simulate power loss for primary power to utility transformer resulting in power transfer to the standby generator.

5. The commissioning of completed portions of the facility by Owner's personnel.

E. Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry. The Contractor shall see that scheduling and performance of all tests are coordinated with involved subcontractors and suppliers.

F. A master test logbook shall be maintained by the Contractor, per paragraph 1.3. The master test logbook shall be provided with loose-leaf pages, which shall be copied weekly after updating for transmittal to the Engineer.

1.5 DELIVERY ACCEPTANCE TESTS AND INSPECTIONS

A. The form of evidence of satisfactory fulfillment of delivery acceptance test and inspection requirements shall be, at the discretion of the Engineer, either by tests and inspections carried out in his presence or by certificates or reports of tests and inspections carried out by approved persons or organizations. The Contractor shall provide and use forms, which include all test information including specified operational parameters. The forms used shall be acceptable in content to the Engineer.

B. The delivery acceptance tests and inspections shall be at the Contractor's expense for any equipment specified in these Contract Documents and shall include the following:

1. Test of items at the place of manufacture during and/or on completion of manufacture, comprising hydraulic pressure tests, electric and instrumentation subsystems tests, performance and operating tests, and inspections in accordance with the relevant Standards of the industry and more particularly as details in individual clauses of these Specifications to satisfy the Engineer that the items tested and inspected comply with the requirements of this Contract.
2. Inspection of all items delivered at the site or to any authorized place of storage in order that the Engineer may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery. The Contractor shall be prepared to remove all coverings, containers, or crates to permit the Engineer to conduct his inspection. Should the Engineer find, in his opinion, indication of damage or deficient quality of workmanship, the Contractor shall provide the necessary documentation, or conduct such tests deemed necessary by the Engineer, to demonstrate compliance.

1.6 PRE-OPERATIONAL INSPECTIONS AND START-UP TESTING

A. General: All equipment shall be tested by the Contractor to the satisfaction of the Engineer before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned, adjusted, and connected. Any changes, adjustments, or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the Work.

B. Pre-operation Checkout:

1. The installed tests and inspection procedures shall incorporate all requirements of these Specifications and shall proceed in a logical, step-wise sequence to ensure that all equipment has been properly services, aligned, connected, calibrated, and adjusted prior to

operation. Pre-operation checkout procedures shall include, as applicable, but not necessarily be limited to:

a. Piping system pressure testing and cleaning as specified in Division 40.
b. Electrical equipment and systems testing as specified in Division 26.
c. Instrumentation and control systems testing as specified in Division 40.
d. Alignment of equipment.
e. Pre-operation lubrication.
f. Process Equipment as specified in Division 43.

1) Including freeze protection.

g. Manufacturer's Certificate of Proper Installation duly executed for each piece of installed equipment. A separate Manufacturer's Installation Certification Form shall be completed by the MBR Equipment Supplier for the installation of all equipment supplied by Kubota.

C. Start-Up Test:

1. Once all affected equipment has been subjected to the required pre-operational checkout procedures and the Engineer or Owner has witnessed and has not found deficiencies in that portion of the work, individual systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these Specifications. The equipment shall be operated a sufficient period of time to determine machine operating characteristics, including temperatures and vibration; to observe performance characteristics and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary instrumentation that has not yet been placed in service, the Contractor shall provide acceptable substitute sources capable of meeting the requirements of the machine, device, or system at no additional cost to the Owner.
2. If under test, any portion of the work should fail to fulfill the contract requirements and is adjusted, altered, renewed or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the work as are affected thereby, shall, if so required by the Engineer, be repeated within reasonable time and in accordance with the specified conditions. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner as a result of repeating such tests.
3. Once simulated operation has been completed, all machines shall be rechecked for proper alignment, realigned if necessary, and doweled in place. All equipment shall be checked for loose connections, unusual movement, or other indication of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Engineer or Owner. All machines or devices that exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. They shall then be repaired or removed from the site and replaced at no cost to the Owner.
4. Test results shall be within the tolerances set forth in the detailed Specification sections of this Contract Document. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice.
5. Unless otherwise specified, the Contractor shall provide at no expense to the Owner, all fuel (for Engine Generator set test), temporary facilities, compressed air supplies, labor, and all other necessary items and work required to complete all tests and inspection specified herein. The Contractor shall provide, at no expense to the Owner, temporary

heating, ventilating, and air conditioning for any areas requiring it in the case where permanent facilities are not complete and operable at the time of installed tests and inspections. Temporary facilities shall be maintained until permanent systems are in service.

6. Start-up tests shall be performed with clean water (including reuse water) unless otherwise required by equipment manufacturers. NOTE: Clean water testing will be done without the MBR cassettes permeating water. MBR cassettes cannot filter clean water for more than a few minutes. The following is a general description of how a portion of the clean water testing shall proceed. The final details of the testing are to be coordinated during construction.
7. Membrane cassettes are not installed during the clean water tests but shall be installed after those tests before seeding the tanks. Clean water is extracted directly from inside of MBR tank through permeate piping for testing. There are 2 types of clean water testing phases in MBR tanks. One is shallow water test (1 2 ft of water above membrane diffuser) only to check air distribution from the SMU diffuser. Next is testing equipment with full water depth to check if all equipment and instruments work per contract requirements.
8. During full water test, PERM flow control, air flow controls, diffuser cleaning, CIP system, inter-locks, degas operation and feed forward pump control are all checked. These tests shall be done in Permeate pump and gravity flow modes.
9. For the first stage of tank clean water testing, the MBR and Aeration tanks shall be filled to 12 inches above the diffusers with clean water to check the diffuser operation and installation. The Contractor is responsible for installing temporary facilities for clean water testing of equipment, including aeration equipment, blowers, permeate pumps, Feed Forward pumps, and instruments. Any transfer pumping, due to failed tests or providing more reuse water for a subsequent test, is the responsibility of the Contractor. Permeating clean water through the MBR membranes will not be part of the clean water test.

1.7 OPERATIONAL TESTING

A. After completion of all pre-operational and clean water start-up testing and certification by the manufacturers that all equipment and the installation complies with the requirements of the Specifications, the Contractor shall perform the operational testing with wastewater. All testing is to be coordinated with the Owner. The new MBR tank MLSS concentration shall be 5,000 mg/l or greater before wastewater is permeated through new membranes.

B. Unless otherwise noted, a time period of 7 days shall be allowed for each operational test of each facility or phase. Each portion of the plant being operationally tested must perform through its complete design range for a period of seven consecutive 24-hour days. Failure at any point in a 7-day operational test, as determined by the Engineer or Owner, shall require a restart of the 7-day test period.

C. Satisfactory completion of operational testing will be required by the Owner as a condition of determining when substantial completion has been achieved.

D. All costs for raw sewage, temporary power and chemicals required during this operational test shall be borne by the Owner. Sludge hauling, if required, will be performed by the Owner.

E. All manufacturers' O&M manuals shall have been submitted by the Contractor for review, and approved, prior to beginning operational testing.

1.8 COMMISSIONING

A. After completion of all operational testing specified herein, and certification by the Engineer that the systems did meet all performance requirements, commissioning will begin. The commissioning period shall be 30 consecutive days. The Contractor shall remove all temporary piping that may have been used during the operational testing and shall assist the Owner in placing the facilities in fully operational mode. The Owner's operations and maintenance personnel will be responsible for the operation of the facilities. The facilities shall be fully operational, accepting, pumping, and treating all flow called for in design and performing all functions as designed. After all these steps are completed, operational testing is successful, all control systems and alarms are operating per design, and the Owner is operating the facility for its designed use, this portion of the facility shall be considered Substantially Complete, but the Contractor shall be available to assist during the rest of the Commissioning period.

B. The Contractor shall be available at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being tested.

C. During the commissioning period, the Owner shall be responsible for all normal operational costs, and the Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials required to keep the portion of the facilities being commissioned operational.

1.9 SUBSTANTIAL COMPLETION

A. The Work is substantially complete when the Owner can be provided full-time, uninterrupted, and continuous beneficial operation of the facilities. In addition, all required functional, performance, and acceptance or start-up testing must have been demonstrated for all components, devices, equipment, and instrumentation and control to the satisfaction of the Engineer in accordance with the requirements of the Specifications. If applicable, training of Owner personnel by an authorized representative of the manufacturer must also have been completed.

B. The Owner has sole discretion for determination of Substantial Completion. If the Owner considers the work substantially complete, the Owner will notify the Contractor in writing that the work is accepted as substantially complete.

C. The guarantee and warranty periods begin with the date of Substantial Completion.

D. Partial Utilization: Prior to Substantial Completion of all the Work, the Owner may use or occupy any substantially completed part of the Work that has specifically been identified in the Contract Documents or that the Owner and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work that Owner believes to be ready for its intended use and substantially complete. If and when the Contractor agrees that such part of the Work is substantially complete, Contractor and Owner shall agree in writing.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and requires Owner to issue a certificate of Substantial Completion for that part of the Work.

1.10 PHYSICAL COMPLETION

A. The Work is physically complete when the Owner can be provided a complete and operable system. At a minimum, the following must occur:

1. All physical work must be completed.
2. Spare parts must be provided.
3. Punch list items must be completed to the satisfaction of the Owner.
4. All permits must be closed.

B. The Owner has sole discretion for determination of Physical Completion. If the Owner considers the work physically complete, the Construction Manager will notify the Contractor in writing that the work is accepted as physically complete. The acceptance notice will include a list of items required to issue Final Completion and Acceptance.

C. Upon Physical Completion, Owner may pay the Mobilization/Demobilization bid item in full. Refer to Contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Installation: Materials employed in the installation shall conform to the requirements of this Contract Document and the recommendations of the equipment manufacturers.

B. Testing:

1. Gauges, Meters, Recorders, and Monitors:

a. Gauges, meters, recorders, and monitors shall be provided by the Contractor as required by the Engineer to supplement or augment the instrumentation system provided under this Contract to properly demonstrate that all equipment fully satisfies the requirements of this Contract Document. All devices employed for the purpose of measuring the performance of the facility's equipment and systems shall specifically be selected to be consistent with the variable being monitored. All instruments shall be recently calibrated and the Contractor shall be prepared at all times to demonstrate, through recalibration, the accuracy of all instruments employed for testing purposes. Calibration procedures shall be in accordance with applicable Standards of ASTM, ISA, and IEEE. The adequacy of all gauges, meters, recorders, and monitors shall be subject to review of the Engineer.

2. Records:

a. The Contractor shall provide sign-off forms for all installed and operational testing to be accomplished under this Contract. The sign-off forms shall be produced in quadruplicate. Sign-off forms shall be provided for each item of mechanical, electrical, and instrumentation equipment provided or installed under this Contract and shall contain provisions for recording relevant performance data for original testing and not less than three retests. Separate sections shall be provided to record values for the pre-operation checkout, initials or representatives of the equipment manufacturers, the Contractor, and the Engineer.

b. The Contractor shall maintain a master file of all equipment sign-off sheets, which shall be available for inspection by the Engineer. Upon completion of testing, the Contractor shall furnish the Engineer with the original of the sign-off sheet for each equipment item.

2.2 METHODS

A. Installation: All equipment and apparatus used in testing shall be installed by specialists properly skilled in the trades and profession required to ensure first-class workmanship. Where required by detailed specifications, the Contractor shall cause the installation of specific equipment testing items to be accomplished under the supervision of factory trained installation specialists furnished by the equipment manufacturers. The Contractor shall be prepared to document the skills and training of all workmen engaged in the installation of all testing equipment furnished either by the Contractor or the Owner.

B. Testing:

1. Testing shall proceed on a step-by-step basis in accordance with the Contractor's written testing procedures. The Contractor's testing work shall be accomplished by a skilled team of specialists under the direction of a coordinator whose sole responsibility shall be the orderly, systematic testing of all equipment, systems, structures, and the complete facility as a unit. Each individual step in the procedures shall be witnessed by a representative of the Engineer.
2. During the operational testing period, all equipment and systems in operation shall be operated to the greatest extent practicable and at conditions that represent the full range of operating parameters as defined by this Contract Document.

C. Testing of all pumps intended to be operated on sewage at different levels of treatment may be accomplished using clean water.

2.3 TRAINING

A. During the phase of start-up testing of equipment, the Contractor shall make available experienced factory-trained representatives of the manufacturers of all the various pieces of equipment, to train the Owner's personnel in the operation and maintenance thereof. The time required for this training shall be as specified in the Specifications for the specific piece of equipment. The Contractor shall notify the Owner of the time of the training at least 20 days prior to the time of training.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 014525- INSTALLATION, TESTING, AND COMMISSIONING FOR MBR EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL

A. The MBR equipment included in the design documents for the Yelm WRF is based on a Kubota MBR system. Contact info: Kubota Membrane USA Co., 11807 North Creek Parkway South, Bothell, WA 98011. Kubota's project manager is Shingo Kubo (425) 543-1006. Refer to Sections 010100 and 010101 regarding submittal of bids for alternative MBR manufacturers.

B. The MBR equipment documents and drawings are provided in the appendices of the Contract Documents.

C. The MBR equipment is to be provided by the Contractor as part of the Work. There will be no contractual relationship between the MBR Equipment Supplier and the Owner. It is the Contractor's responsibility to ensure that a complete and fully functional installation, in accordance with the Contract Documents, is provided. By submitting a bid, the Contractor has represented that he has reviewed the MBR Proposal Documents and preliminary shop drawings for the equipment.

D. By submitting a bid, the Contractor agrees that all work necessary to install, test, and commission the MBR shall be included in the bid item for the construction of the WRF.

E. It is the Contractor's responsibility to coordinate his scope of supply with that of the MBR Equipment Supplier. Where the Contract Documents identify or differentiate between the scope of supply for the MBR Equipment Supplier and the Contractor, such identification is made for the convenience of the Contractor, and is not necessarily complete or accurate. It is the Contractor's responsibility to provide all materials for a fully functional WRF that conforms to the Contract Documents, whether or not those materials are supplied by the MBR Equipment Supplier, other Suppliers, or directly by the Contractor. The Engineer will not be responsible for clarifying the MBR Equipment Supplier's scope of supply or resolving disputes between the Contractor and the MBR Equipment Supplier.

F. Contractor shall be responsible for taking delivery (offloading) the MBR Equipment when it is delivered to the site. Contractor is responsible for storage of MBR Equipment after delivery to the site. Per MBR supplier requirements, all electrical, mechanical, and miscellaneous equipment and parts shall be stored in a dry enclosed heated (minimum 40 degrees Fahrenheit) space.

1.2 SHOP DRAWINGS

A. Preliminary shop drawings for the MBR equipment have been submitted by the manufacturer and reviewed by the Engineer and Owner. Portions of the preliminary shop drawings pertaining to the MBR installation are provided within Appendix E of the Contract Specifications.

B. The shop drawing information provided in the MBR Supply Contract Documents includes the MBR Equipment Supplier's scope of supply, equipment list, warranty information. Contractor is responsible for negotiating any MBR supplier's scope exclusions. Shop drawing information is provided for the membrane modules, diffusers, and control system. Information on valves and instruments to be provided by the MBR Equipment Supplier is not included in the Documents. Available drawings from Kubota, showing their process and instrumentation diagrams, the necessary electrical connections, and the mechanical installation of the equipment, are included with the project Drawings.

C. Where the drawings from the MBR Equipment Supplier and the Contract Drawings conflict, the Contract Drawings shall have precedence.

D. Submit final shop drawings for the MBR equipment for review and approval, as specified in Section 013300, "Submittal Procedures."

PART 2 - PRODUCTS

2.1 EQUIPMENT SUPPLIED BY MBR EQUIPMENT SUPPLIER

A. The Technical Specifications and Kubota Scope of supply and P&ID drawings, describe the scope of supply of the MBR equipment supplier.

B. Refer to the Kubota Scope of supply and P&ID drawings as a summary of the equipment provided by the MBR manufacturer. The Contractor shall be responsible for coordinating system installation and installing MBR equipment. The Contractor is also responsible for suppling and installing those portions of the MBR system not provided by the MBR Equipment supplier.

C. Supply all labor, tools, and materials required to complete the MBR, Headworks, Anoxic, Aeration, Permeate, Feed Forward, Waste Activated Sludge, CIP, Chemical Dose, UV Disinfection, and MBR Control equipment installation.

2.2 SPARE PARTS

A. All spare parts shall be cleaned, packaged neatly and submitted to the Owner along with a transmittal describing the items and quantities of each spare part.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ship, store, and install the MBR equipment in accordance with the manufacturer's recommendations and as shown on the Drawings.

B. Shipping, storage, and installation instructions for the MBR equipment provided by the MBR Equipment Supplier are included with the shop drawings. These instructions do not necessarily represent complete instructions for this equipment. It is the Contractor's responsibility to

determine what additional procedures, if any, are required to provide a fully functional and operational installation.

3.2 PAINTING

A. Paint equipment as specified in Section 099000, "Painting and Coating."

3.3 MANUFACTURER'S SERVICES

A. Services to be provided by the MBR Equipment Supplier during installation, testing, and start-up of the equipment and for the training of the Owner's staff in the operation and maintenance of the equipment, shall be as specified.

B. A minimum of 20-days' notice shall be provided to the Owner prior to on-site training or facility start-up.

C. Testing and Commissioning:

1. Testing and commissioning for the MBR equipment shall conform to the procedures described in the MBR shop drawings and the procedures specified in Section 014524, "Installation, Testing, Commissioning, and Training." The price quoted by the MBR Equipment Supplier for the supply of the MBR equipment includes the Supplier's costs for testing, including labor and travel. Contractor's costs for testing and commissioning shall be included in the MBR Treatment Facility construction bid item.
2. The manufacturer and the Contractor shall field test and calibrate the installed equipment to demonstrate that all equipment will satisfactorily perform the functions and criteria specified.
3. Manufacturer's Installation Certification Forms shall be completed for each piece of equipment provided by the MBR Equipment Supplier and for the MBR installation as a whole.

END OF SECTION

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide Temporary Facilities to facilitate the proper implementation of the Contract. Provide Controls for the planning, installing, inspecting, maintaining, and removing Best Management Practices (BMP) to prevent pollution of air and water.

1.2 PROTECTION OF PROPERTY AND EXISTING FACILITIES

A. Provide protections necessary to prevent damage to park property and facilities.

B. Only rubber-tired equipment are permitted to operate on paved park roads.

C. Protect existing trees and other vegetation indicated to remain in place against cutting, breaking or skinning of roots, skinning and bruising of bark, or smothering of trees by stockpiling materials within dripline. Provide necessary temporary guards to protect trees and vegetation to remain in place.

D. Make every effort to minimize damage and cutting major tree roots during excavation operations. Provide protection for larger tree roots exposed or cut during excavation operations.

1.3 ENVIRONMENTAL PROTECTIONS

A. Scope:

1. Provide labor, materials, equipment and perform Work required for protection of environment during and as a result of construction operations under contract.

B. Applicable Regulations:

1. Comply with applicable federal, state and local laws and regulations concerning environmental pollution control and abatement, and specific requirements elsewhere in specifications and drawings to prevent and provide for control of environmental pollution.

C. Protection of Land Resources:

1. Give special attention to the effect of Contractor’s operations upon surroundings. Take special care to maintain natural surroundings undamaged and conduct Work in compliance with following requirements:

a. When Work is completed, remove storage and other Contractor buildings and facilities, and sites restored to a neat and presentable condition appropriate to

surrounding landscape, unless otherwise specified. Remove debris resulting from Contractor's operation.

b. Store petroleum products, industrial chemicals and similar toxic or volatile materials in durable containers approved by the Authority Having Jurisdiction and located in areas where accidental spillage will not enter water. Store substantial quantities of materials in an area surrounded by containment dikes of sufficient capacity to contain an aggregate capacity of tanks.

D. Protection and Restoration of Property:

1. Preserve public and private property, monuments, power and telephone lines, other utilities, prevention of damage to natural environment, etc., insofar as they may be endangered by Work.
2. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in execution of Work, or in consequence of non-execution of Contractor, restore, or have restored at Contractor's expense, such property to a condition similar and equal to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring same, or make good damage or injury in some other manner acceptable to Project Representative.

E. Protection of Water Resources:

1. Perform Work not to create conditions injurious to fish or to their habitat, or which would make water unsuitable for private, municipal, or industrial use.
2. Take special measures to prevent chemicals, fuels, oils, grease, bituminous materials, waste washings, herbicides, insecticides, lime, wet concrete, cement, silt or organic or other deleterious material from entering waterways.
3. Dispose of offsite, in a lawful manner conforming to applicable local, state and federal laws wastes, effluents, trash, garbage, oil, grease, chemicals, cement, bitumen, etc., petroleum, and chemical products or wastes containing such products. Furnish Owner with documentation showing compliance with this requirement.
4. Conform to applicable local, state and federal laws for disposal of effluents. Dispose of waters used to wash down equipment in a manner to prevent their entry into a waterway. If waste material is dumped in unauthorized areas, remove material and restore area to condition of adjacent, undisturbed area. If necessary, excavate contaminated ground and disposed of as directed by Project Representative and replace with suitable compacted fill material with surface restored to original condition.

F. Dust Control:

1. Dust control is required on roads used by Contractor. Maintain excavations, embankments, stockpiles, roads, plant sites, waste areas, borrow areas and other Work areas within or without the Project boundaries free from dust which would cause a hazard or nuisance to others. Provide approved, temporary methods of stabilization consisting of sprinkling, chemical treatment, light bituminous treatment or equal methods to control dust. If sprinkling is used, sprinkling must be repeated at intervals to keep disturbed areas at least damp.

G. Temporary Water Pollution/Erosion Controls:

1. Provide for prevention, control and abatement of soil erosion and water pollution within the limits of Project, to prevent and/or minimize damage to adjacent bodies of water and Work itself.
2. Coordinate temporary soil erosion/water pollution control measures with permanent drainage and erosion control Work to ensure effective and continuous controls are maintained throughout Project life.
3. Develop a written spill prevention and response plan for construction activities adjacent to/and over any surface waters and/or wetlands. "Adjacent" means within 150' as measured on a horizontal plane. Plan addresses:

    a. Narrative description of the proposed construction methods, materials, and equipment to be used for Work
    b. Assessment and listing of hazardous materials and/or potential contaminants that could be released during execution of Work
    c. SDS sheets with cleanup instructions for potential contaminants
    d. Spill response/cleanup materials and instructions for use
    e. Procedures and precautions to prevent spills
    f. Spill response training for on-site personnel, including the location of the containment and cleanup materials at site
    g. Emergency notification in case of a spill or release. Park Manager and Project Representative must be included on the list of notified.

4. Comply with applicable codes and ordinances for spill prevention and response plan and submit a copy to Project Representative before commencing Work adjacent to or over any waters and/or wetlands.

H. Emergency Spill Response Notification

1. Under state law, Ecology must be notified when any amount of regulated waste or hazardous material that poses an imminent threat to life, health, or the environment is released to the air, land, or water, or whenever oil is spilled on land or to waters of the state. The spiller is always responsible for reporting a spill. Failure to report a spill in a timely manner may result in enforcement actions. If you are not responsible for a spill, making the initial notification does not make you liable. However, please consult with Ecology's response team before attempting any type of response or cleanup. Also notify Park Manager and Project Representative.
2. If oil or hazardous materials are spilled to state waters, the spiller must notify both federal and state spill response agencies. The federal agency is the National Response Center at 1-800-424-8802. For state notification, call the Washington Emergency Management Division (EMD) at 1-800-258-5990 or 1-800-OILS-911 AND the appropriate Ecology regional office for your county (see numbers below). An Ecology spill responder will normally call reporting party back to gather more information. The agency will then determine its response actions. Also notify Park Manager and Project Representative.
3. Ecology Regional Spill Reporting Numbers:

    a. Southwest Regional Office: (360) 407-6300 (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, and Wahkiakum counties)
    b. TDD: Washington Relay Service 711 or (800) 833-6388.

1.4 PARK TRAFFIC/PEDESTRIAN CONTROLS

A. Properly warn the public of construction equipment and activities, open trenches, and/or other unsafe conditions by providing all necessary warning equipment. Equipment includes warning signs, barricades, fencing, flashing lights and traffic control personnel (flaggers).

B. Conduct operations with the least possible obstruction and inconvenience to the public in accordance with appropriate Section(s) of the WSDOT "Standard Specifications".

1.5 PROTECTION OF WORK

A. Protect Work, materials, and equipment against damage, weather conditions, or other hazards. Equipment, Work or materials found damaged or in other than new condition will be rejected by Project Representative.

1.6 REMOVAL AND REPLACEMENT OF STATE-OWNED ITEMS

A. Should any state-owned items, such as signs, bumper blocks, or related items, interfere with the proper construction process, remove and reinstall such items to the satisfaction of Project Representative.

1.7 USE OF PARK SPACE

A. Only in areas of park that Contract covers and only during active inclusive dates of Contract.

B. Contractor vehicle and equipment parking only as designated by Project Representative.

C. Contractor will be issued temporary parking passes for construction crew, vehicles and equipment, valid for the duration of the contract only.

1.8 ROADWAY CLOSURE

A. Closure of the park is not in the best interest of the general public, only close roads being trenched while conduits, etc., are being installed, and immediately reopened for traffic. Supply necessary barricades, etc., to effectively prevent automotive traffic from entering upon any traveled way while trenches are open, unless other approved appropriate safety measures are taken.

1.9 UTILITIES

A. Existing subsurface utilities on Project are represented on Contract Drawings to the best of the Commission's knowledge. It is Contractor's responsibility to verify existence of utilities and determine exact location and depth. Maintain use of utilities during construction through temporary connections or other measures suitable to Commission. No extra compensation will be made for removal, temporary connections, relocations, or replacement of utilities.

1.10 SERVICE OUTAGES

A. Coordinate and schedule outages for, power, water, and sewer service connections/repairs with Park Manager, so as not to inconvenience park staff or public.

1.11 SANITARY FACILITIES

A. Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of Authorities Having Jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

B. Contractor to provide portable toilet facilities for the workers.

C. Locate on site as directed by the Owner.

D. Contractor responsible for keeping facility clean and in working order.

1.12 TEMPORARY ELECTRICITY

A. The Contractor shall provide his own separate power source to complete the work under this Contract. Provide all temporary power, including pole or poles, transformer(s), with voltage and phasing as required for the construction purposes.

B. Provide power outlets for construction operations, with branch wiring and distribution boxes. Provide flexible power cords as required.

1.13 TEMPORARY LIGHTING

A. Not Required.

1.14 TEMPORARY HEAT

A. Not Required.

1.15 TELEPHONE SERVICE

A. Contractor to furnish construction site with cellular phone and the contact information of Contractor’s supervisory personnel.

1.16 TEMPORARY WATER SERVICE

A. Contractor shall provide their own temporary water service until Contract water improvements have been implemented.

1.17 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, and to protect existing facilities from damage from construction operations and demolition.

B. Provide protection for plant life designated to remain. Replace damaged plant life.

C. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

D. Stake and flag with yellow construction tape the lines noted on the Drawings as the "Work Limits". All work and equipment is to remain inside the work limits.

1.18 FENCING

A. Provide temporary chain-link fencing, six (6)-foot high with lockable gate for all material and equipment to be stored on site.

1.19 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddle or running water. Provide water barriers as required to protect site from soil or erosion.

1.20 EXTERIOR ENCLOSURES

A. Provide temporary weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Section, and to prevent entry for unauthorized persons.

B. Provide access doors with self-closing hardware and locks.

1.21 INTERIOR ENCLOSURES

A. Not Required.

1.22 PROTECTION OF INSTALLED WORK

A. Protect installed work and provide special protection where specified in individual sections.

B. Provide temporary and removable protection for installed Work and Products.

C. Control activity in immediate work areas to minimize damage.

1.23 SECURITY

A. Provide security and facilities to protect Work and existing facilities from unauthorized entry, vandalism, or theft.

1.24 ACCESS ROADS

A. Provide and maintain access to Phase 1 Maintenance Building, free of obstructions.

B. Provide means of removing mud from vehicle wheels before entering roadways/streets.

C. Designated existing on-site roads may be used for construction traffic.

D. Do not obstruct Owner operations.

1.25 FIELD OFFICE

A. A Field Office is required to be present on-site for the contract performance period. Field Office shall contain conference room sufficient for twelve attendees, internet hardwire or wireless connection, telephone and fax. Field Office shall be heated. Contractor will provide access and use of Field Office to Owner.

1.26 PARKING

A. Contractor parking limited to the project staging area.

1.27 CONCRETE WASH BASIN

A. Contractor shall provide Concrete Wash Basin of the size, design, and location approved by the Owner.

1.28 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish.

B. Maintain site in a clean and orderly condition.

C. Remove waste materials, debris, and rubbish from site daily and dispose off-site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 015100 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 - LAYOUT

A. The Contractor shall provide all construction survey necessary to establish all alignment and grade stakes for the proper execution of this contract. The Contractor is responsible for maintaining all stakes and points or re-establishing stakes, monuments, lines, and grades which are lost or destroyed at Contractor's cost.

1.2 - VERIFICATION

A. The Contractor shall verify all measurements shown on the Drawings and shall consult the plans, drawings and specifications of Work. The Contractor shall notify Owner of any discrepancies in the contract documents prior to commencement of construction. Failure of Contractor to notify Owner of discrepancies will result the Contractor being responsible for any and all resolutions and remedies.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 015526 – TRAFFIC CONTROL

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

A. Section 015000 – Temporary Facilities and Controls

1.2 GENERAL

A. Provide flaggers, signs, and other traffic control devices in accordance with the Washington State Department of Transportation (WSDOT) Current Edition, Standard Specifications for Road, Bridge, and Municipal Construction and the Manual on Uniform Traffic Control Devices (MUTCD). Erect and maintain construction signs, warning signs, detour signs, and other traffic control devices necessary to warn and protect the public from injury or damage as a result of the Contractor's operations that may occur on highways, roads, drives, streets, or sidewalks and walkways. Do no work on or adjacent to the above locations until necessary signs and traffic control devices are in place.

B. These flaggers, signs, and other traffic control devices are for the safety of the public, the Contractor's employees, and Commission's personnel and to facilitate the movement of the traveling public. They may be used for the separation or merging of public and construction traffic when in accordance with a specific approved traffic control plan.

C. Upon failure of the Contractor to immediately provide flaggers; erect, maintain, and remove signs; or provide, erect, maintain, and remove other traffic control devices, the Commission may, without further notice to the Contractor, shut down the Contractor's activity until adjacent traffic control is implemented.

D. Providing adequate flaggers, signs, and other traffic control devices for the protection of the work and the public at all times, regardless of whether or not the flaggers, signs, and other traffic control devices are ordered by the Project Representative, furnished by the Commission, or paid for by the Commission or by any modifications made by the Contractor. The Contractor shall be liable for injuries and damages to persons and property suffered by reason of the Contractor's operations or any negligence in connection therewith.

E. Lane closure or diversion: advise Project Representative a minimum of two calendar days prior to implementation.

1.3 CONFORMANCE TO ESTABLISHED STANDARDS

A. Flagging, signs, and other traffic control devices: conform to the standards established in the latest edition of the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, to the WSDOT Traffic Control Plans 1 through 18 (TC1-19) as published by

WSDOT at https://www.wsdot.wa.gov/Design/Standards/PlanSheet/Work-Zone-Typical-TCPs.htm and to the Manual on Uniform Traffic Control Devices (MUTCD).

1.4 SUBMITTALS

A. Submit a temporary traffic control plan for Project Representative review.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, and access by emergency vehicles. Monitor parking of construction personnel's vehicles. Maintain vehicular access to and through parking areas. Prevent parking on or adjacent to access roads or in non-designated areas. Construction Parking shall occur within the Work and Staging Area.

END OF SECTION

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the administrative and procedural requirements for the protection of trees, shrubs, and plant material not designated for removal. Trees, shrubs, and plant material not designated for removal shall be left in place and protected from damage or injury during construction using full and adequate methods of protection in order to preserve these natural resources, ecological function, and aesthetic character of the park.

1.2 REFERENCES

A. Definitions

1. Arborist Qualifications: An Arborist approved of by the Project Representative or certified by the International Society of Arboriculture (ISA) or Association of Consulting Arborists (ASCA) and licensed in the jurisdiction where project is located.
2. Critical Root Zone (CRZ): The portion of the root system nearest the stem that is critical for the stability and vitality of the tree. The minimum CRZ is a circular area having a radius of one foot for each one inch of trunk diameter defined by measuring the trunk diameter at 4.5 feet above ground level. For example, a tree that has a diameter of 20 inches would have a CRZ with a radius of 20 feet from the base of the tree. This is a MINIMUM CRZ radius for healthy trees; the CRZ often extends beyond the dripline of the tree. A critical root zone defined by 2.5 feet radius for each 1-inch diameter is desirable for old growth, historic, and character trees as designated by the Project Representative.
3. Vegetation Protection Zone (VPZ): A defined area of any size within the project area where existing vegetation (trees, shrubs, or other plant material) is to be protected from construction impacts. The zone may be accomplished by physical barriers or other means (e.g., soil protection layers or treatments).
4. Soil Protection Zone (SPZ): A defined area of any size within the project area where sensitive native soils are to be protected from construction impacts. The zone may be accomplished by physical barriers or other means (e.g., soil protection layers, durable matting, or other treatments as specified by the Project Representative.
5. High Risk Tree: Any tree with a structural defect and/or disease that makes the tree highly prone to failure, and which has a target and may result in personal injury or property damage. A high risk tree is the same as an “Emergency Tree” as defined in WAC 352-28-005 (https://apps.leg.wa.gov/wac/default.aspx?cite=352-28-005)

B. Reference Standards

1. ANSI A300. Specifications for Tree, Shrub, and Other Woody Plant Management including Section 5: Management of Trees and Shrubs During Site Planning, Site Development, and Construction.
2. ANSI Z133-2012. Safety Requirements for Arboricultural Operations.

3. Council of Tree and Landscape Appraisers. (2020). Guide for Plant Appraisal, 10th ed. International Society of Arboriculture, Champaign, Illinois.

1.3 SUBMITTALS

A. Tree Removal and Pruning Schedule: Written schedule from project Arborist detailing scope and extent of tree removals and pruning of trees to remain that interfere with or are affected by construction.

B. Certification: From project Arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From project Arborist, for care and protection of trees affected by construction during and after completing the Work.

1.4 QUALITY ASSURANCE

A. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."

B. Construction Management Standard: Comply with ANSI A300 (Part 5): Management of Trees and Shrubs During Site Planning, Site Development, and Construction

C. Tree Planting: Comply with ANSI A300 (Part 6) Planting and Transplanting

D. Tree Root Protection and Management: Comply with ANSI A300 (Part 8) - 2013 Root Management Standard

PART 2 - PRODUCTS

2.1 TREE PROTECTION MATERIALS

A. Temporary Fencing

1. Chain link fencing panels 6 feet tall by any length up to 14 feet. Panels must be braced and must be secured to stands and weighted per manufacturers specifications.
2. Continuous molded safety mesh 36 inches wide with clear openings no more than 1-1/2 inches x 2 inches. Orange, 40 grams per square foot, high density polyethylene with U-V inhibitor suitable for above-grade use installed around the circumference of the CRZ.
3. Posts five-foot steel heavy-duty “T” posts, 1-3/8 inches x 1-3/8 inches x 7/64 inches with steel anchor placed at 8’ intervals at or beyond the CRZ.
4. Nylon zip straps having a minimum breaking strength of 150 lbs.

2.2 SOIL AND ROOT PROTECTION

A. Mulch: Ground, shredded bark, or wood and bark chips, or "hog fuel" free from deleterious materials. Or new straw mulch, free from weeds, weed seeds, and foreign materials.

B. Landscape fabric: American Excelsior Stabilenka 140, Celanese Mirafi 140, Propex 45-45, or approved equivalent geotextile.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Ground staples: 9 inches x 9 inches wire staples sufficient for holding landscape fabric or filter fabric in place for required time period.

E. Ground protection mats: Construction mats or timber mats, as a temporary road surface of sufficient weight rating for the equipment being operated in the work area.

2.3 TREE TRUNK PROTECTION

A. Where work has been approved to take place within the CRZ, tree trunk protection shall be installed vertically around tree trunk on all sides exposed to construction activity.

B. Common wood 2 inches x 4 inches lumber, 8 feet long, without nails, other hardware, concrete residue, or other material that may be detrimental to plant health.

C. Strapping sufficient to hold 2 x 4's

PART 3 - EXECUTION

3.1 PLANNING AND NOTIFICATION

A. Where existing trees and other vegetation are in the area of work, or where existing trees outside the area of work have a CRZ extending into the area of work, employ methods to minimize adverse impact to the existing trees (including limbs, stems, and roots), understory vegetation and their root systems, and soils. Where VPZ are designated by the Project Representative and/or in project plans, observe protection measures set forth herein. Notify the Project Representative of any construction work within the CRZ of trees at least two (2) working days before the scheduled activity.

3.2 PREPARATION

A. Prior to Construction: Erect tree and plant protection prior to beginning any site work. Protect trees to remain against cutting, breaking, skinning, or compaction of roots; skinning or bruising of bark; breaking of branches and foliage. Review locations, fencing, and other markings of any VPZ and CRZ for trees within the construction area with the Project Representative.

B. Tree Removal: Trees that are scheduled for removal as part of the project should be removed before construction to prevent hazards during construction.

C. Material Storage: Do not store construction materials, debris, or excavated material inside critical root zones or vegetation protection zones.

D. Vehicle and Foot Traffic: Designate access routes within construction area and limitations on equipment and vehicles. Designate parking on existing pavement or away from critical root zones of trees. Tree protection fencing will serve as an exclusion zone within the CRZ except for where plans stipulate work will take place within the CRZ.

3.3 CRITICAL ROOT ZONE AND VEGETATION PROTECTION ZONE DESIGNATION

A. Temporary Fencing: Install temporary fencing around CRZ, VPZ, or SPZ of either chain link or plastic mesh as indicated by Project Representative. Maintain temporary fence during construction and remove only when construction is complete.

1. For plastic mesh, line posts space at eight feet maximum. Set posts vertically to minimum 18 inches depth. Posts may be driven provided method of driving does not damage posts. Ensure that posts do not damage tree roots.
2. Where plastic fence is used, secure plastic fencing to posts with nylon zip-straps, minimum three per post. Draw fence material tight and vertical. Where chain link panels are used join panels with manufacturers clamps that require tool removal.
3. With Project Representative's approval, sections of tree protection fencing may be removed temporarily to allow approved short-term construction activities. Reinstall fencing immediately when construction operations permit.

B. Tree Trunk Protection: Where required tree trunks shall be protected by placing 2 x 4 lumber around the trunk, spaced so that strapping will not come in contact with the tree bark and lumber does not damage branches. Use strapping to hold lumber in place. Secure straps without nailing into or otherwise damaging tree bark.

3.4 SOIL COMPACTION, LOSS, AND DAMAGE WITHIN THE CRITICAL ROOT ZONE

A. Protection against soil compaction within the CRZ may include but will not be limited to the following methods:

1. Application of a minimum 6-inch thick layer of mulch (or wood chips salvaged from clearing and grubbing operations) within the CRZ. Replenish mulch as necessary to maintain a 6-inch depth. Do not place mulch within 6 inches of tree trunks. Where mulch is to be removed following project completion it should be underlayed with a porous geotextile.
2. Ground protection mats, such as: timber or steel planking, construction mats, 1/2 inches thick CDX grade (or better) plywood, or brush for protection of surface roots and vegetation from equipment.
3. Where equipment operating within the CRZ exceeds 12,000 lbs use a 6-inch layer of mulch overlayed with ground protection mats described above.

B. Protection of soils against erosion and loss within the critical root zone of trees may require application of mulch, wood chips, ground protection mats, or landscape fabric at the request of the Project Representative.

C. Noxious Materials: Protect soils from damage caused by runoff or spillage of noxious materials while operating, mixing, placing, or storing construction materials and equipment; this includes washout of concrete mixing vessels, dewatering operations, equipment cleanup, maintenance, and service; ponding, erosion, or excessive wetting may incur a Stop-Work order at the discretion of the Project Representative.

3.5 TRENCHING, DIGGING, TUNNELING, AND GRADING WITHIN THE CRITICAL ROOT ZONE:

A. Disturbance to soils and impacts to roots within the CRZ may require any of, and will not be limited to, the following methods, practices, and restrictions:

1. Maintain existing grade within CRZ of trees unless otherwise directed.

    a. Lowering grades (cutting): Where existing grade is above new finish grade shown around trees, carefully excavate within CRZ to new grade. Document roots exposed in this process with photographs to be shared with project Representative.
    b. Raising grades (filling): Where existing grade is raised within the CRZ to greater than 4 inches above existing grade these roots shall be considered damaged by smothering. Methods to increase air exchange of tree roots within these areas may be required. Examples of such methods may include and will not be limited to:

        1) Application of a 6 inch or thicker layer of large clean aggregate (2 inches by 4 inches or larger) covered with landscape fabric below fill material to maintain large pore space.
        2) Selection of a fill material with high porosity and minimal compressibility, which may include mulch. Compaction will not be required except as required by structural load requirements, to limit soil compaction.

2. Alternative excavation methods that minimize root damage may be required. These may include but are not limited to: hand digging, horizontal boring, use of an air excavation tool, or other methods as otherwise deemed necessary by the Project Representative.

B. Only limited intrusions into tree CRZ zones will be allowed as shown on the plans and with the approval of the Project Representative. Where trenching for utilities or irrigation is required within CRZ's of trees the following may be required:

1. No cutting of roots greater than two inches diameter. Tunnel under or around roots by drilling, auger boring, air excavation, or digging by hand.
2. Where necessary for installation, cut roots with sharp pruning instruments flush with the edge of the trench or tunnel; do not break or chop.
3. Avoid hitting roots with heavy equipment. Roots that are ripped by equipment should be excavated by hand, photographed, kept moist with mulch or burlap layers, and inspected by the Project Representative.

4. Pile excavated soil outside of the CRZ of residual trees and return area to original grade upon completion of work.
5. Cover exposed roots with soil as soon as possible or at the end of each day; the soil compacted to the original firmness only; and, watered when conditions are dry.
6. Tree root pruning or other tree root treatments may be required as directed by the Project Representative.
7. Root painting is not permitted.

3.6 STEM AND BRANCH PRUNING:

A. Any unnecessary cutting, breaking, skinning, or bruising of bark; breaking of branches and foliage; damage or clearing of vegetation in the work area will not be permitted. Where permitted, stem and branch pruning must follow ANSI A300 Standards (including Part 1 and Part 5).

B. Temporarily tie-up of low limbs is permitted where designated by the project representative.

C. All final pruning cuts shall be made in branch tissue close to the trunk or parent limb, without cutting into the branch bark ridge or branch collar and without leaving a stub. Flush cuts to the tree trunk that remove the branch collar are unacceptable. Flush cuts result in a larger wound and expose trunk tissues to the possibility of decay.

D. All significant tree pruning must have prior approval of Project Representative. An approved Arborist may be required, at the Contractors expense, for extensive or technically challenging pruning activities. Such requirements will be made explicit to the Contractor prior to the start of work.

E. Only proper branch pruning techniques will be accepted. Improperly pruned trees could be irreparably damaged and are subject to section 3.7 DAMAGE TO TREES AND TREE REPLACEMENT.

3.7 DAMAGE TO TREES AND TREE REPLACEMENT:

A. Should any tree or vegetation designated to remain be damaged in the course of construction activities immediately notify the Project Representative for inspection and direction for remedy.

B. Remedies for damage will, at the Owner's discretion, require removal and disposal of the damaged tree(s) and be one of the following, at the discretion of the Project Representative.

1. Compensate the Owner in cash or as a credit to the contract for up to the full value of the damaged tree, as appraised by an ISA certified Arborist according to the latest edition of the "Guide for Plant Appraisal".
2. Replace each damaged tree under 6 inches diameter at breast height measurement with one replacement tree of 1-3/4 inches caliper measure. Replace each damaged tree over 6 inches diameter at breast height measurement with one replacement tree of 1-3/4 inches caliper measure for each 6 inches of diameter at breast height measure of the damaged tree. The new trees may or may not be the same species, at the discretion of the Project Representative. Select nursery stock, plant, and maintain as specified in Section 1.4 QUALITY ASSURANCE.

3. For identified old-growth trees specified to remain, the Project Representative may be provided alternative remediation requirements from Parks Stewardship staff above and beyond requirements of 3.7.B.1 and 3.7.B.2.

C. Notify Project Representative in any case where construction called for in the contract documents cannot be completed without damage to trees identified to remain. Approval of the Project Representative is required prior to beginning construction described in the contract documents that might damage a tree designated to remain. Any tree designated to remain which is damaged without Project Representative's written approval, even if damage is necessary to complete the work, will subject the Contractor to remedies described in section 3.7 B above.

END OF SECTION

SECTION 015713 – TEMPORARY EROSION AND SEDIMENTATION CONTORL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes Temporary Erosion and Sedimentation Control (TESC) measures including but not limited to silt fence, coir logs, catch-basin inlet protection, temporary storm conveyances, plastic sheeting, stabilized construction exits, and measures necessary to filter dewatering discharge prior to release from the site.

B. This section includes the requirements for the Stormwater Pollution Prevention Plan (SWPPP) provided in accordance with the terms of the Washington Department of Ecology 2024 Stormwater Management Manual for Western Washington, regarding construction activities pertaining to this project.

C. Protect all receiving waters from deleterious effects of construction.

D. Provide the erosion control measures shown on the Plans and required herein and all additional measures that may be required by the Owner's Representative and the Contractor's means and methods of construction, as needed to control erosion and sediment at the construction site.

E. Prevent violation of surface water quality, ground water quality, or sediment management standards.

F. Erosion control measures shall be maintained throughout the course of construction and until all disturbed soil is stabilized in finished grades.

G. This section includes the requirements for the Contractor's Spill Prevention Control and Countermeasures (SPCC) Plan.

1.2 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Clearing and Grubbing – 311100
2. Earth Moving – 312000

1.3 QUALITY ASSURANCE

A. The Contractor shall designate the TESC Lead person at the preconstruction meeting. The TESC Lead shall implement the TESC plan, the SWPPP, and the SPCC plan.

B. TESC measures shown on the drawings are to be considered the minimum required measures necessary to initiate construction activities in typical weather conditions and with the Contractor providing all due care to protect the work from precipitation and runoff.

C. Actual weather conditions, management of earthwork operations, and quality of installation of erosion control measures may cause the need for implementation of additional measures not specified on the drawings. The Contractor shall be responsible for all costs associated with implementation of additional TESC measures required by the Owner's Representative and as necessary to meet the requirements of the Clean Water Act, Department of Ecology, and City Standards.

D. The Owner reserves the right to monitor water quality characteristics of all runoff and dewatering discharges. The Contractor is responsible for all fees, fines, and delays related to TESC, SWPPP, and SPCC plan non-compliance and other stormwater and dewatering system discharges.

1.4 CONSTRUCTION STORMWATER PERMIT

A. Owner will retain Washington State Department of Ecology's Construction Stormwater NPDES and State Waste Discharge General Permit. The Owners Representative will perform monitoring reports necessary for the permit. Contractor is responsible for all TESC Measures, and keeping the site within conformance of all NPDES Permit. Contractor to notify Owners Representative of any triggering discharges.

1.5 SUBMITTALS

A. Monthly TESC Conditions Report

1. As a condition of payment, the Contractor shall submit monthly reports regarding TESC measures to the Owner's Representative that document the performance and any maintenance required of the TESC measures installed on-site.
2. This requirement shall be waived for months during which no rainfall event greater than 0.5 inches per day or no dewatering occurs.
3. Inspection reports shall include a record of:

    a. Daily weather logs including observations of stormwater runoff from the site.
    b. Test results of any water quality testing executed by the Contractor.
    c. When, where, and how TESC measures were installed, removed, or modified.
    d. Repairs to TESC measures that are made or required.
    e. Observations of TESC measures effectiveness and proper placement.
    f. Recommendations and implementation of improvements and additional TESC measures required as a result of the contractor's means and methods of prosecuting the work.

4. The reports shall be considered to be part of the SWPPP required by the Department of Ecology's Stormwater Management Manual. Copies of the TESC reports, this section of the specifications, and sheet 12 of the SWPPP shall be retained on site and shall be provided to DOE inspectors upon request.

5. The Contractor shall submit updated TESC Plans for each phase of the work. The updated phased TESC Plans shall include all TESC measures shown in the Contract Documents together with any enhancements or additional measures as required by the Owner's Representative or the Contractor's means and methods to meet the performance objectives of the Stormwater Pollution Prevention Plan (SWPPP).

B. Contractor's Spill Prevention Control and Countermeasures Plan (SPCC)

1. The Contractor shall submit a SPCC Plan prior to commencement of any construction activities.
2. The SPCC Plan shall include the following:

   a. Construction phasing and identify potential spill sources at the site and the location of contaminant absorption and containment supplies.
   b. Description of responsive actions in the event of a spill or release of contaminants and shall identify notification and reporting procedures.
   c. Contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
   d. Description of measures the Contractor shall take to prevent the release or spread of the following:

3. All hazardous material found on site or encountered during construction.
4. All hazardous materials that the Contractor stores, uses, or generates on the construction site during construction activities.
5. Hazardous material as referred to within this specification is defined in RCW 70.105.010 under "hazardous substance".
6. A template for this plan can be found at the following web address: http://www.wsdot.wa.gov/eesc/environmental/programs/hazwqec/docs/modelplan.pdf

PART 2 - PRODUCTS

2.1 GENERAL TESC MATERIALS

A. All materials for BMPs shall conform to the requirements of the Sustainability Plan for the Washington State Parks and Recreation Commission.

2.2 SILT FENCE FABRIC

A. Mirafi 100x, AMOCO 2130, or approved equal.

2.3 COIR LOG

A. Provide Sediment Stop, 9" diameter x 50 ft long roll by North American Green (ACF West Inc. Geosynthetic Products, 15540 Woodinville-Redmond Road, Woodinville, WA 98072. Phone: (425) 415-6115) or approved equal.

2.4 CATCH BASIN FILTER

A. Catch Basin Filter shall be StreamGuard Sediment Insert #3003, as procured from Bowhead Environmental and Safety, LLC, phone: (206) 905-4676, or approved equal.

2.5 PLASTIC COVERING

A. Clear plastic (polyethylene) sheeting having a minimum thickness of 6 mil.

2.6 COMPOST

A. Medium Compost as defined in WSDOT Standard Specifications Section 9-14.4(8) Compost.

2.7 TEMPORARY CONSTRUCTION ACCESS

A. Woven polypropylene Geotextile, LINQ Industrial Fabrics GTF 200S, or approved equal.

B. Quarry spalls as specified on Plans.

C. Contractor may use existing concrete walk provided Commission approved structural protective measures are deployed.

PART 3 - EXECUTION

3.1 STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A. The following 12 elements compose the narrative section of the SWPPP. See the contract plans for drawings of the project vicinity map, site map, conveyance systems, erosion and sediment control measures, and erosion and sediment control details.

1. Element #1: Mark Clearing Limits.

   a. Prior to beginning land disturbing activities, including clearing and grading, clearly mark all clearing limits and trees that are to be preserved within the construction area as shown on the drawings.
   b. Temporary Security Fence shall be used to mark the clearing limits.

2. Element #2: Establish Construction Access.

   a. Limit construction vehicle access and exit to one route for each area of work or as shown on the Plans.
   b. All exit points shall be stabilized with quarry spalls in conformance with the temporary construction access detail shown in the Plans.
   c. Adjacent public roads shall be left in a clean and serviceable condition at the end of each day. Sediment shall be removed from roads by shoveling and street sweeping and shall be transported to a controlled sediment disposal area. Street washing will

be allowed only after sediment is removed in this manner. Street washing shall only be performed with a truck equipped with vacuum water recovery equipment.

d. Construction access restoration shall be equal to or better than the preconstruction condition.

3. Element #3: Install Sediment Controls.

   a. The duff layer, native topsoil, and natural vegetation shall be retained in an undisturbed state to the maximum extent practicable, except where noted otherwise on the drawings.
   b. Sediment control measures shown on the drawings and additional measures required by the Contractor's means and methods shall be put in place prior to earthwork or site clearing operations or any other site disturbance within tributary areas of those controls.

4. Element #4: Stabilize Soils.

   a. From October 1 through April 30, all disturbed soils shall be stabilized with hydromulch, plastic sheeting, or other soil stabilization measures within 2 days of completion of grading. From May 1 to September 30, soils shall be stabilized within 7 days of completion of grading. This stabilization requirement applies to all soils on site outside active work areas, whether at final grade or not.
   b. Soils shall be stabilized before a holiday or weekend if no earthwork is scheduled for that weekend or holiday and rain is forecasted.
   c. Soil stockpiles must be covered with plastic sheeting and protected with sediment trapping measures, such as coir logs.
   d. Remove all TESC measures as soon as practical after establishment of uniform grass growth or installation of other permanent stabilization measures. Repair any damage to stabilized surfaces after removal of TESC measures.

5. Element #5: Protect Slopes.

   a. Design, construct, and phase cut and fill slopes in a manner that will minimize erosion.
   b. Do not clear and grub slopes greater than 4(horizontal):1(vertical) unless stabilization is scheduled for less than one week from completion of clearing and grubbing, or unless other temporary stabilization measures are put in place.
   c. Consider soil type and its potential for erosion.
   d. Reduce slope velocities on disturbed slopes by providing temporary barriers (such as coir logs) and by roughening the slope surface.
   e. Stabilize soils on slopes, as specified in Element #4.

6. Element #6: Protect Drain Inlets.

   a. Storm drain inlets operable during construction and within 200' downstream of the project site shall be protected with catch basin filters so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment. Catch basin filters in the roadway will be sediment filters.
   b. Approach roads shall be kept clean. Sediment and street wash water shall not be allowed to enter storm drains without prior and adequate treatment.

c. Inlet protection devices should be cleaned or removed and replaced before six inches of sediment can accumulate.

7. Element #7: Stabilize Channels and Outlets.

a. Temporary on-site conveyance channels required by the contractor's means and methods shall be designed, constructed, and stabilized to prevent erosion from the expected flow velocity of a 2-year, 24-hour frequency storm for the developed condition. In lieu of design, the Contractor may elect to line temporary channels with erosion control mat at contractor's expense.

8. Element #8: Control Pollutants.

a. This element is addressed in the Spill Prevention Control and Countermeasure (SPCC) Plan submitted by the Contractor. See Part 1.4.B of this Section for SPCC plan requirements.

9. Element #9: Control Dewatering.

a. The Contractor shall be responsible for meeting water quality standards for all dewatering discharge.
b. Highly turbid or contaminated dewatering water from construction equipment operation shall be handled separately from stormwater.

10. Element #10: Disposal options include:

a. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.
b. On-site treatment using approved chemical treatment.
c. Use of a sedimentation bag (Dirtbag or approved equal) with outfall to a ditch or swale for small volumes of localized dewatering.

11. Element #11: Maintain BMPs.

a. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs and maintenance to ensure continued performance of erosion and sediment controls.
b. When sediment accumulation in sedimentation structures, other than inlet protection devices, has reached a point one-third depth of sediment structure or device, or if flow through the device is reduced by more than one-third capacity, the Contractor shall remove and replace disposable devices or clean and dispose of sediment.
c. Temporary erosion and sediment control BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soils shall be permanently stabilized.

12. Element #12: Manage the Project.

a. Phasing of Construction

1) Minimize disturbance and compaction of native soils except as necessary for the current phase of work.
2) Stabilize areas immediately after work has been finished for that phase.
3) Inspection and Monitoring
4) An Erosion and Sediment Control lead shall be identified at the preconstruction meeting and shall be on-site or on-call at all times. Emergency contact information shall be kept on-site.

b. If inspection and/or water monitoring of site runoff reveals that the BMPs identified in the Construction SWPPP are inadequate, the Contractor shall immediately add BMPs to the SWPPP as necessary.
c. The Construction SWPPP shall be retained on-site. The Contractor's TESC record of rainfall, TESC measures, and inspection shall become part of the SWPPP. The Construction SWPPP shall be modified by the contractor's TESC record whenever there is a significant change in the design, construction, operation, or maintenance of any BMP.

3.2 COMPOST FILTER BERM

A. Install Compost Filter Berms in the dimensions and the alignment shown in the Plans or as needed. Berms shall be smooth lined, uniform surface and neat in appearance. Do not compact the compost during or after berm construction.

3.3 CLEANUP AND REMOVAL OF TESC MEASURES

A. Completely remove all TESC measures, except compost filter berms, when directed by the Owner's Representative prior to Project Acceptance.

B. Repair areas damaged by removal operation to match the conditions of non-damaged areas.

END OF SECTION

SECTION 016000 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 OWNER FURNISHED/CONTRACTOR INSTALLED ITEMS

A. The Owner furnishes no items, except for following:

Owner Furnished Item	**Approximate Delivery Date to Project Site**
Tuff Shed, existing at Maintenance Building to be relocated to Host Campsite	N/A
ADA Picnic Table	March 31, 2026
ADA Fire Ring	March 31, 2026
All Regulatory & Directional signs for sitework (exterior only, all interior signs or signs on buildings to be contractor furnished)	March 31, 2026

Contractor shall make all arrangements for, and provide all fasteners and materials required to install the Owner Furnished items.

1.2 IMPLIED/INCIDENTAL MATERIALS

A. Contractor shall provide all minor materials required for proper Project completion. These minor materials, although not specifically mentioned or shown in Contract Documents, are part of materials to be provided by Contractor as a part of Contract and are considered incidental to the total cost of Project. No additional compensation is due to the Contractor for providing such items.

1.3 QUALITY OF MATERIALS

A. Materials are to be new, free from defects, and of quality specified in the drawings and specifications.

B. Select and provide materials to ensure satisfactory operation and rated life in prevailing environmental conditions were installed.

C. Same make and quality throughout the entire job, for each type. Furnish materials of latest standard design products of manufacturers regularly engaged in their production.

1.4 SPECIFIED MATERIALS

A. Drawings and specifications generally reference only one make and model for each item of material or equipment required. This is not intended to be restrictive but indicates the standard of quality, design, and features required.

B. Specified product is the basis of design regarding physical size, strength, and performance. Products named indicate minimum acceptable product and are "or equal" unless noted otherwise.

1.5 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Project Representative will consider Contractor's request for substitution when the following conditions are satisfied:

    a. Requested substitution is consistent with Contract Documents and will produce indicated results.
    b. Requested substitution provides sustainable design characteristics that specified product provided.
    c. Requested substitution will not adversely affect Contractor's construction schedule.
    d. Requested substitution has received necessary approvals of Authorities Having Jurisdiction.
    e. Requested substitution is compatible with other portions of Work.
    f. Requested substitution has been coordinated with other portions of Work.
    g. Requested substitution provides specified warranty.
    h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Project Representative will consider requests for substitution if received within 40 days after the Notice to Proceed.

1. Conditions: Project Representative will consider Contractor's request for substitution when the following conditions are satisfied:

    a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    b. Requested substitution does not require extensive revisions to Contract Documents.

c. Requested substitution is consistent with Contract Documents and will produce indicated results.
d. Requested substitution provides sustainable design characteristics that specified product provided**.**
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of Authorities Having Jurisdiction.
g. Requested substitution is compatible with other portions of Work.
h. Requested substitution has been coordinated with other portions of Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

1.6 SUBSTITUTION OF MATERIALS ("OR EQUAL")

A. Proposed equipment to be considered "or equal" will necessitate written approval by the Engineer prior to substitution.

B. On requests for substitution of materials clearly define and describe proposed substitute.

C. Accompany requests by complete specifications, samples, records of performance, certified test reports, and such other information as the Engineer may request to evaluate the substitute product.

D. Contractor is responsible for a substitute item suiting the installation requirements and for additional costs incurred as a result of substitution.

E. Final decisions regarding quality and suitability of proposed substitutions rests solely with Engineer and will be based on information submitted.

1.7 TECHNICAL DATA

A. Technical data and information contained herein relies entirely on tests and ratings provided by manufacturers who are solely responsible for their accuracy. Project Representative, by use of this information in no way implies that Project Representative has tested or otherwise verified the results of published manufacturer's information.

1.8 DELIVERY, STORAGE AND HANDLING

A. For Owner Furnished/Contractor Installed items listed in 1.1.A, the Owner will deliver these items to the Project Site at a date/time mutually agreed upon by the Owner and Contractor. Contractor shall provide the labor, equipment, materials, space, and everything needed to safely and properly unload all items. Once the delivery vehicle arrives at the Project Site, Contractor and Owner shall inspect Owner Furnished and record the condition of all items. Thereinafter Contractor accepts all responsibility for safely and securely unloading and storing all Owner Furnished items. Contractor accepts responsibility for replacing any and all damage to Owner

Furnished items, at Contractor's sole costs, till Final Completion. Replacing items damaged while in Contractor's custody in part, of in whole, will solely be the decision of the Owner.

B. Transport products by methods to avoid product damage. Only deliver products to the site that are undamaged and free from defects.

C. Provide proper equipment and personnel to handle and transport materials/products to the Project sites safely and undamaged.

D. Promptly inspect material to assure that products comply with Contract requirements, quantities are correct, and products are undamaged.

E. Store and/or stockpile materials and products only in areas of park designated and approved by Project Representative prior to delivery.

F. Arrange storage to provide easy access for inspections. Original product labels, certifications, stamps, etc. to be intact and readily visible for inspection purposes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

TO:

PROJECT NAME: NISQUALLY STATE PARK NEW FULL SERVICE PARK – PHASE 3A MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

CONTRACTOR:

We hereby submit for consideration the following product instead of specified item for above project:

Section	**Paragraph**	**Specified Item**
_____	_____	_____

Proposed Substitution: _____

Attach complete dimensional information and technical data, including laboratory tests, if applicable.

Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Submit with request all necessary samples and substantiating data to prove equal quality, performance, and appearance to that which is specified. Clearly mark manufacturer's literature to indicate equality performance. Differences in quality of materials and construction shall be indicated.

Fill in the blanks below:

A. Reason for substitution request:

_____

_____

_____

_____

B. Does the substitution affect dimensions shown on Drawings?
Yes_ No If yes, clearly indicate changes.

_____

_____

_____

_____

C. Will the undersigned pay for changes to the design, including engineering and detailing costs caused by the request substitution?

Yes No Comment:

D. What affect does this substitution have on other trades, other Contracts, and Contract completion date:

E. What affect does this substitution have an applicable code requirement:

F. Differences between proposed substitution and specified item:

G. Manufacturer's guarantee of the proposed and specified items is:
Same Different (explain):

H. List of names and addresses of three similar projects on which product was used, date of installation, and Architect's name and address:

I. Cost and supplier of specified product:

J. Cost and supplier of proposed substitution product:

The undersigned attests function and quality equivalent or superior to specified items.

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE.

Submitted By:

Signature Title

Firm

Address

Telephone

FOR USE BY OWNER'S REPRESENTATIVE:
Accepted:
Accepted as Noted:
Not Accepted:
Received Too Late:

By:

Date:

Remarks:

Date

Signature must be by person having authority to legally bind his firm to the above term.

Concurrence by Owner's Representative:

END OF SECTION

SECTION 017329 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: For work not clearly indicated as cutting and patching on the drawings or specifications, submit a proposal describing procedures at least seven (7) days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information, as applicable:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
5. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
6. Roofing Elements: Where cutting and patching involve cutting and patching roofing. Submit product data and samples of roofing material to be used.
7. Noise and Dust Protection Plan.

B. Architect or Engineer's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity, load-deflection ratio, or seismic bracing capacity.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Conveying systems.
8. Electrical wiring systems.
9. Operating systems of special construction in Division 13 Sections

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection:

1. Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
2. Take precautions required by regulations and Standard Specifications to protect personnel and property.
3. Take all necessary precautions for temporary fire protection during welding and cutting.

a. Carefully mask or shield adjacent surfaces to prevent damage from heat or welding materials. Take particular care to prevent fires.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting. If a valve is used, provide access to the valve.
5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 DEBRIS DISPOSAL

A. No disposal site has been provided by the state for any debris or waste generated by or resulting from the specified Work. The Borrow Pit shall not be used for disposal of any organic and inorganic materials generated from on, or off site sources, except boulders as outlined in section 311100 Clearing and Grubbing.

B. All waste and debris removed from the worksite and not specified for reuse becomes the responsibility of the Contractor and disposed of off the park property in areas authorized by the applicable county and/or state agencies and in accordance with current rules and regulations governing the disposal of solid waste. All disposal fees and sundry charges are paid by the Contractor and are incidental to the contract.

C. Tree limbs, branches, brush, and other small organic debris generated by the Work shall be chipped into mulch material and dispersed over specified areas of the Project. Only those areas in park specifically designated are to be used for these chipped/mulched materials may be disposed of in those areas which are shown on the Plans.

D. Burning will not be permitted on this Project.

1.2 DAMAGE TO FACILITIES, ROADS, VEGETATION OR PROPERTY

A. During the course of construction, should any park facility be damaged by the Contractor's actions, operations or neglect, repair any such damages to their original condition, as acceptable to the Engineer, at no cost to the Commission.

B. Repair, restore or replace any park and County roads, vegetation or property damaged by the Contractor to the original condition at the time construction began. Repair or replace trees and vegetation indicated to remain, which has been damaged by construction operations, in a manner acceptable to the Engineer.

1.3 PROGRESS CLEANING

A. Remove rubbish and debris from park property daily unless otherwise directed so as not to allow accumulation. Store materials that cannot be removed daily only in areas specified by the Engineer.

B. Maintain worksites in a neat and orderly condition at all times.

C. All cleanup operations are incidental to the Contract and no extra compensation will be made.

1.4 FINAL CLEAN-UP

A. Upon completion of the Work and prior to final inspection and acceptance, Contractor shall clean up the entire construction site and all grounds occupied and disturbed by the Contractor in connection with the Work.

B. Fine graded, rake clean and smooth all worksites and disturbed areas. Remove from the park all rubbish, surplus and discarded materials, falsework, temporary structures, equipment and debris.

C. Leave all phases of the Project clean and ready for public use prior to final acceptance.

D. Inspect all materials and surfaces for damage, scratches, marring, untreated ends of sawcuts, etc. and repair to original or intended condition.

E. Sweep all pavements and clean all rooves of all debris.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 017423 - TANK CLEANING AND FINAL CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. This section specifies the tank cleaning and final project cleaning on the work performed or areas affected by work. See Sections 014524, and 014525 regarding tank cleaning and pressure washing requirements and schedule. Anoxic, Aeration and MBR tanks shall require pressure washing, debris removal, cleaning and vacuuming before they can be placed in operation.

1.2 PURPOSE

A. The purpose of the tank cleaning is to remove material from the tanks. Any debris, grit, filings or other materials can damage the MBR membranes. All tanks also need to be cleaned prior to clean water testing.

B. The purpose of other cleaning is to clean up from the construction which occurred during the work of this Contract.

C. The site shall be maintained at the highest level of readiness and cleanliness. Take due care that materials purchased under this Contract remain undamaged and free of dust and dirt at all times.

1.3 CLEANING REQUIREMENTS

A. Perform a wipe down of equipment, pipe, etc. with a wet towel and cleaning solvent as appropriate for the item being cleaned.

B. Clean all items affected by the work and ensure they are free of litter, trash, dust, dirt, stains, damage, or defects.

C. Wash, sweep, polish, or otherwise clean all new and existing finished wall surfaces, floors, windows, hardware, mirrors, lighting fixtures, and items of equipment.

D. Clean and pressure wash new flow channels, Distribution structures and pipes.

E. Replace damaged, defaced, or marred items.

1.4 TANK CLEANING REQUIREMENTS

A. Anoxic, Aeration and MBR tanks need to be completely free of dirt, bioslime and debris prior to filling.

B. All tanks listed and SBR 3 Basin shall be high-pressure washed, wash debris removal, cleaning, and vacuum cleaned before clean water testing and membranes are placed or transferred to them.

MBR manufacturer representative or Owner shall make tank inspections after cleaning is complete and before membranes can be placed.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Use cleaning materials and processes recommended by the manufacturers of the surfaces to be cleaned.

B. Use non-toxic cleaning agents when possible.

PART 3 - EXECUTION

3.1 TIMING

A. As noted, all process tanks need to be cleaned prior to clean water testing and all tanks shall be cleaned before placed into operation. Upon approval of schedule by the Project Contracting Agency, clean rooms' materials, and equipment within the MBR Building, including, but not limited to, all fixtures, equipment, flooring, piping, conduit, handrailing, and tanks.

3.2 CLEANING

A. Use experienced workers or professional cleaners.

B. Remove dirt, stains, labels, and foreign materials.

C. Repair and touch-up marred areas.

D. Broom clean paved surfaces; rake clean other surfaces of grounds; vacuum, polish, and mop floors.

E. Remove snow and ice from access to buildings.

F. Replace air conditioning and ventilation unit filters if units were operated during construction.

G. Clean ducts, blowers, and coils if air conditioning units were operated without filters during construction.

H. Clean inside of electrical panels, abiding by the requirements of the manufacturer.

I. Provide painting and coating touch up for any scratches on equipment.

END OF SECTION

SECTION 017700- CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 OPERATING AND MAINTENANCE (O&M) INSTRUCTION MANUAL

A. Final payment will be held to no more than 95 percent completion percentage until receipt of the O & M Instruction Manuals. Payment for Contract closeout item will be made after receipt and approval of the manuals by the Owner. Have O & M Instruction Manuals prepared before final payment. Lack of O & M Instruction Manuals will not be a cause for Contract extensions.

B. Furnish three (3) complete hard copy sets of binders and one (1) electronic PDF copy on a storage device (USB) containing the following data for each mechanical, pumping, electrical equipment, major hardware, and plumbing installation or provided on this Project:

1. Installation instructions
2. Operating instructions (start-up and shutdown)
3. Maintenance instructions, including trouble shooting guide
4. Electrical schematics
5. Illustrated parts breakdown and code (if available)
6. Parts list (complete)
7. Technical manuals
8. Provide a complete list of manufacturer's representatives sales offices, or suppliers of all major parts used on this Project, including their business address and telephone number, for the Park Manager's use when maintaining/repairing the system being constructed. Major parts are defined as other than miscellaneous plumbing, wire, piping fittings, etc.
9. List of subcontractors contact information, and specific items of work performed by them.
10. Tab binders and clearly mark all information contained.

C. Affix to walls, panels, boxes or at other locations, the following data sealed in heavy plastic:

1. Operating instructions (start-up and shutdown)
2. Electrical schematics

D. Operating instructions refer to designated parts of each particular installation as necessary and tag such parts with permanent markers as directed by Owner. This includes operational equipment.

1.2 AS-BUILTS DRAWINGS

A. Before final acceptance of Project, furnish Owner "As-Built Drawings" which shows as-built locations and dimensions of major items constructed. Include locations and elevations of existing utilities encountered during excavation. Show location of pipes, manholes, buildings, structures, etc. by field measurements consisting of at least two (2) ties to permanent surface objects such as hydrants, buildings, etc.

B. Final payment: No more than 95 percent until As-Builts Drawings received. Payment made after receipt and approval of drawings by Owner. Lack of As-Builts Drawings will not be a cause for contract extensions.

1.3 SPECIAL TOOLS

A. Deliver special tools required for maintenance and adjustment of equipment to Owner upon completion and before final acceptance of Project.

1.4 SPARE MATERIALS AND PARTS

A. Before final acceptance, deliver spare materials, parts and other similar items storage locations specified by Owner.

1.5 CERTIFICATES AND PERMITS

A. Submit signed original certificates of compliance and final approval from Authorities Having Jurisdiction.

1.6 OUTSTANDING DOCUMENTS

A. Expedite and submit outstanding administrative documents including outstanding cost proposals, Change Orders, etc.

1.7 PRIOR OCCUPANCY

A. Reference General Conditions.

B. Commission has the right to occupy completed portions of Project prior to final acceptance, and such occupation is not an acceptance of Project. Prior to occupancy, Owner and Contractor mutually agree to a date for prior occupancy; the area to be occupied; that occupancy is commencing within the requirements of applicable codes and ordinances; that endorsements from insurance companies, as necessary to maintain full insurance of Project regardless of prior occupancy, have been obtained; and that other necessary provisions are completed.

C. The Owner will inspect areas designated for prior occupancy and issue a letter of acceptance, or provide a list of deficiencies to be corrected, to Contractor. Correct deficiencies prior to date of occupancy.

1.8 SUBSTANTIAL COMPLETION

A. Reference General Conditions.

B. Notify Owner in writing a minimum of seven (7) days in advance of the scheduled date of completion. Owner will conduct a "pre-final" inspection and formulate a final punchlist of Work

items to be completed prior to final inspection. Owner will establish the date of substantial completion based on pre-final inspection findings. Following this inspection, Owner will either issue notice of substantial completion or advise the Contractor of deficient items which must be corrected prior to issuance of substantial completion.

1.9 DAMAGE TO FACILITIES, ROADS, VEGETATION OR PROPERTY

A. During the course of construction, should any park facility be damaged by the Contractor's actions, operations or neglect, repair any such damages to their original condition, as acceptable to the Project Representative, at no cost to the Owner.

B. Repair, restore or replace any park roads, vegetation or property damaged by the Contractor to the original condition at the time construction began. Repair or replace trees and vegetation indicated to remain, which has been damaged by construction operations, in a manner acceptable to the Project Representative.

1.10 FINAL INSPECTION AND ACCEPTANCE

A. Reference General Conditions.

B. Notify Owner in writing when Work, including punchlist items, have been completed.

C. Owner will schedule and conduct a final inspection to verify that outstanding Work items are complete.

D. Owner will establish the date of final acceptance based on the results of final inspection. Complete/correct any items identified as outstanding during final inspection prior to final acceptance of Project.

1.11 FINAL CLEANUP

A. Execute final Project cleanup prior to final inspection.

1. Reference Section 017419 – Construction Waste Management and Disposal.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 017839 – PROJECT AS-BUILT DRAWINGS

PART 1 - GENERAL

1.1 MAINTENANCE OF AS-BUILT DRAWINGS AND SAMPLES

A. Maintain and store apart from documents used in construction:

1. Contract Drawings annotated as work progresses.
2. Project Manual and Specifications, as work progresses.
3. Addenda.
4. Change Orders and other Contract Modifications.
5. Accepted Shop Drawings, product data, samples, etc.
6. Field Test Reports.
7. Current Construction Schedule.

B. Maintain As-Built Drawings in clean orderly and legible condition. Do not use for construction purposes.

C. Make documents available at all times for inspection by Owner.

D. Label each document “PROJECT AS-BUILT” in neat large block letters.

E. As-Built information concurrently with construction progress.

F. Clearly mark all changes using an erasable colored pencil. Use different color pencil for overlapping changes.

G. Indicate the following:

1. Accurate measurements of underground utilities and services
2. Note changes in directions and locations, slopes, and vertical and horizontal dimensions, as construction progresses.
3. As-Built accurate locations of underground sleeves, piping, valves, etc.
4. Show all detail and locations not on original drawings.
5. Indicate field changes of dimension and detail.
6. Indicate revisions to drawings with a “cloud” drawn around the revision and note revision and date of revision.

1.2 SUBMITTALS

A. With each submittal of Payment Application and Certificate form, As-Built drawings, specifications, updated construction schedule and other documents will be made available for inspection by the Owner for complete and timely maintenance in accordance with the Contract Documents.

B. At Contract Closeout and before final payment, deliver As-Built documents to the Owner.

1. One set As-Built Drawings legibly marked to As-Built actual construction.
2. As-Built Drawings shall include the exact location of all underground and aboveground utilities, including the horizontal and vertical location of all service connections, valves, tees, and elbows. Upon completion a certified, PDF electronic copy of the As-Built Drawings shall be provided to the Owner.

C. Request for Information: Contractor shall report, in writing, any errors, inconsistencies, omissions, or other questions regarding the work to the Owner in a timely fashion.

1. Form: The request for information shall include Date, related section and sheet number, detail number, as applicable, project name, contractor name, contract number, and the issue being discussed.
2. The Owner shall be allowed seven calendar days to respond to Contractor generated Request for Information.
3. Contractor shall maintain Request for Information Log and provide to Owner.

1.3 OPERATING, SERVICE AND MAINTENANCE MANUALS AND CONTRACTS

A. Assemble Operating, Service and Maintenance Manuals and Contracts, executed by each of the respective Manufacturer, Suppliers and Subcontractors.

B. Contractor and each Subcontractor shall submit a completed Vendor Contact List as attached to this section or in a similar format.

C. Format

1. Assemble Operating, Service and Maintenance Manuals and Contracts into a three-ring, heavy-duty, vinyl, hardboard cover binder manual.
2. On cover, imprint the "" Operating, Service and Maintenance Manuals and Contracts"; name of project, Owner, Landscape Architect; and date of Substantial Completion.
3. On bound edge, imprint name of project and owner and date of substantial completion. Pages to be neat clean sheets, 8-1/2 by 11-inch maximum size or accordion foldouts to same size.
4. Items to be identified with tabbed dividers showing name and number of appropriate specification sections.
5. Arrange dividers and items in order they occur in specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Refrigerant recovery.

1.2 DEFINITIONS

A. Competent Person: As defined in 29 CFR 1926.32(f)]:
   1. One who is capable of identifying existing and predictable hazards in surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

B. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to items and surfaces; disposing of items unless indicated to be reinstalled.

C. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be reinstalled.

D. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be reinstalled.

E. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

1.3 MATERIALS OWNERSHIP

A. Demolition waste becomes property of Contractor, per Section 017419 – Construction Waster Management and Disposal.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Arrange selective demolition schedule so as not to interfere with Owner's operations.

B. Predemolition Meeting: Conduct meeting at Project site.
   1. Inspect and discuss with Owner and competent person, condition of construction to be selectively demolished. Make complete inspection of condition of existing building within Project limits of construction, including visible defects. Carefully note conditions of existing work, including the following:
      a. Review structural load limitations of existing structure.
      b. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
      c. Review requirements of Work performed by other trades that rely on substrates exposed by selective demolition operations.

d. Review areas where existing construction is to remain and requires protection.

2. Inspection report shall be accepted and signed by Contractor and Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates measures proposed for protecting individuals and property, environmental protection, dust control, and noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal Work, with starting and ending dates for each activity. Ensure Owner's and occupants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations.
1. Photographs shall be taken with a digital camera with a minimum sensor resolution of 10 mega pixels.
2. Photographs shall be unaltered original files, uncropped, date and time stamped.
3. Photographs shall be taken using the maximum range of depth of field, in focus, to clearly show the work and wider location of the work. Multiple photos to show the detail needed and location can be submitted.
4. Submit before Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that refrigerant that was present was recovered and that recovery was performed according to EPA regulations.
1. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed for reinstallation.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   1. Before selective demolition, confirm with Owner which, if any, items will be removed.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in Work.
   1. Hazardous materials will be removed by Owner before start of Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Regulatory Requirements:
   1. Comply with governing EPA notification regulations before beginning selective demolition.
   2. Comply with hauling and disposal regulations of AHJ.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner.
   1. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

B. Engage a competent person to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
   1. Perform surveys as Work progresses to detect hazards resulting from selective demolition activities.

C. Survey of Existing Conditions:
   1. Record existing conditions by use of preconstruction photographs or video.
   2. Inventory and record conditions of items to be removed and reinstalled.
   3. Provide photographs or video of conditions that might be misconstrued as damage caused by demolition operations.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of AHJ.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to Remain:
   1. Maintain services/systems indicated to remain and protect them against damage.
   2. Do not disrupt public utilities without permit from AHJ.
   3. Provide Owner a minimum of 5 days' prior written notice before closing, shutting off, or disrupting existing life safety systems that are currently in use.
      a. At time of closing, shutting off, or disrupting existing life safety systems that are currently in use, provide 24 hour fire watch and other safety controls required by AHJ. Keep these safety controls in place until existing life safety systems are returned to operation.
   4. Provide Owner a minimum of 3 days' prior written notice before closing, shutting off, or disrupting existing utility branches or take-offs that are currently in use.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain while maintaining access to core services of building by building occupants including staff toilets.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. Prior to cutting operations on concrete, conduct X-ray or sonoscope testing as specified in Section for Cutting and Patching.

B. Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required.
      a. Use cutting methods least likely to damage construction to remain or adjoining construction.
      b. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping.

c. Temporarily cover openings to remain.

3. Cut or drill from exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until Work area is cleared of flammable materials.
   a. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations.
   b. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly and legally dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly and legally. Comply with Disposal of Demolished Materials Article below.

C. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated.
   a. Comply with installation requirements for new materials and equipment.
   b. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain:
1. Protect construction indicated to remain against damage and soiling during selective demolition.
2. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition, cleaned, and reinstalled in their original locations after selective demolition operations are complete.

F. Below-Grade Construction: Abandon in place below-grade construction as indicated.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 – Construction Waste Management and Disposal.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.7 CLOSEOUT ACTIVITIES

A. At completion of demolition Work in each area, work with Owner to examine possible damage to existing building construction caused by demolition Work.

B. Where no damage is apparent, inspection report shall be accepted and signed by Contractor and Owner.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
   1. Clean roadways of debris caused by debris transport.

3.9 SELECTIVE DEMOLITION SCHEDULE

A. Remove: Remove everything in area of Work unless indicated otherwise.
   1. Owner will remove security cameras prior to starting construction;

END OF SECTION

SECTION 031000 – CONCRETE FORMING & ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide all labor, materials and equipment required to complete the Work indicated on the drawings and specified herein.

B. Provide labor, equipment, and materials necessary to construct formwork for cast-in-place concrete, with shoring, bracing, and anchorage if necessary.

C. Provide openings for other work.

D. Furnish and install all associated form accessories.

E. Stripping and removal of formwork.

F. Cleanup of formwork and adjacent elements, materials, and surfaces

1.2 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033001 - Cast-In-Place Concrete – Sitework.

1.3 REFERENCE STANDARDS

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 301 - Specifications for Structural Concrete 2016.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014

D. ACI 347R - Guide to Formwork for Concrete 2014, with Errata (2017).

E. PS 1 - Structural Plywood 2009.

1.4 SUBMITTALS

A. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, most current edition at time of Bid.

B. Design, engineer, and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line, and dimension.

C. Wet concrete shall be prevented from entering waters of the State. Forms for any concrete structure shall be constructed to prevent leaching of wet concrete. Impervious materials shall be placed over any exposed concrete not lined with forms which will come in contact with State waters. Forms and impervious materials shall remain in place until the concrete is cured (HPA Provision #28).

D. Any form release agent used shall be a 100% natural, organic chemical release agent acceptable for use in sensitive aquatic environments. Refer to Products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

C. Materials shall be immediately returned to the Staging Area after use. Any cleaning of forms or equipment shall be done in an approved area within the Staging Area.

PART 2 - PRODUCTS

2.1 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Chamfer outside corners of beams and walls.

D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

E. Comply with relevant portions of ACI 301, ACI 318, ACI 347R, ACI 301, ACI 318, ACI 347R, ACI 301, ACI 318, and ACI 347R.

2.2 WOOD FORM MATERIALS - GENERAL

A. Plywood: Douglas Fir species exterior type minimum 5/8" thick; medium density overlaid one side grade; sound undamaged sheets with clean, true edges and surfaces suitable for the required finish.

B. Lumber forms shall be boards selected for straightness in both planes and having no surface defects which will prevent achieving the required finish.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

C. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.

D. Corners: Chamfered, rigid plastic type; 3/4 x 3/4-inch (19 x 19 mm) size, unless shown otherwise; maximum possible lengths.

E. Keyways shall be formed using wood or removable plastic or metal preformed units to sizes indicated.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

G. Embedded Anchor Shapes, Plates, Angles and Bars: As shown on Drawings.

H. Isolation/Expansion Joints: Furnish resilient bituminous type, Sternson Ltd. "Flexcell", Grace Construction Products "Fiber", Homosote Co. "Homex 300", Old North Mfg. Co., Inc. "Gray-Flex", or approved, non-extruding type, 1/2-inch thickness unless otherwise shown, of depth as required to bring top to within 1/4 inch of surface of slab.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Earth forms are not permitted.

3.3 ERECTION - FORMWORK - GENERAL

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 347R.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Provide chamfer strips on external corners of formwork including retaining wall tops.

F. Coordinate this section with other sections of work that require attachment of components to formwork.

G. Joints and Stoppages:

1. Construction Joints:

a. Install in accordance with provisions of ACI 318, Section 26.5.6.2, and as specified herein. Located where indicated or otherwise required and approved as to not impair strength of structure.
b. Provide nominal 3/4" x 2-1/2" key at construction joints, unless otherwise shown on drawings, or as directed by Structural Engineer.
c. Make joints perpendicular to principal reinforcement. Continue half reinforcement and mesh across joints except at isolation joints; provide longitudinal keys at least 1-1/2 inches deep at all joints in walls and between walls and slabs or footings.
d. Remove key-forming wood inserts and thoroughly clean surface of concrete at all joints, removing all laitance, before placing next lift.
e. Immediately prior to placing next lift and/or adjacent slab, dampen hardened concrete of joint surface and coat with neat cement mortar of similar proportions to mortar in concrete.

2. Isolation/Expansion Joints for Slabs-On-Grade: Do not extend reinforcement through where bonded on both sides of joint; smooth dowels may extend through joint. Position accurately and support against displacement in locations listed hereinafter.

a. Interior Work:

1) Install isolation/expansion joints between new interior ground-supported slabs and building foundation walls, and around isolated slabs at column structures; elsewhere where shown on Drawings.

2) Install joints with top surface recessed below finish elevation 1/4 inch and fill with joint sealer as specified in Section 07 92 00, finished flush with slab surface.

b. Exterior Work:

1) Install as required in new walks and slabs in locations and/or spacings shown, elsewhere not more than 16 feet apart. Coordinate exact locations and alignment with Architect.
2) Install isolation/expansion joints between concrete walks/slabs and vertical building walls and retaining walls.
3) Install at all other locations indicated.
4) Install joints with top surface recessed below finish elevation 1/4 inch and fill with joint sealer as specified in Section 07 92 00, finished flush with slab surface.

3. Control Joints: As specified in Section 033000 Cast-in-Place Concrete - Architecture and shown on the Drawings.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set-in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

F. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

G. Install joint covers in one piece longest practical length, when adjacent construction activity is complete.

3.6 FORM CLEANING

A. All form cleaning will be accomplished within the Staging Area. No exceptions.

B. Clean forms as erection proceeds, to remove foreign matter within forms.

C. Clean formed cavities of debris prior to placing concrete.

D. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

E. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. All curves shall have a consistent radii and vertical grade. Successive curves shall flow smoothly from one into another with no visible angle points. Straight tangents shall be unwavering in the horizontal and vertical alignment.

3.8 FIELD QUALITY CONTROL

A. Quality Control: Field inspection and testing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure. Do not reuse wood formwork more than 2 times. Do not patch formwork.

3.9 INSPECTION

A. Notify Owner’s Representative at commencement of formwork.

B. Schedule an inspection of formwork with Owner’s Representative 48 hours prior to expected time of completion of formwork. Obtain Owner’s Representative’s approval of formwork before placing concrete.

3.10 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 031100 – CONCRETE FORMING (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Standards:

1. ACI 318-19 Building Code Requirements for Structural Concrete, Section 26.11.
2. ACI 347 Recommended Practice for Concrete Formwork.
3. ACI 301 Specifications for Structural Concrete for Buildings.
4. U.S. Product Standard PS 1 for Plywood.
5. Standard Grading and Dressing Rules No. 17 of the West Coast Lumber Inspection Bureau.

1.02 DELIVERY, STORAGE, AND HANDLING

A. On delivery to jobsite, place materials in an area protected from weather.

B. Store materials aboveground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Handle materials to prevent damage.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Plywood: New or in new condition “B-B Plyform Class 1 Exterior” grade plywood, 5/8-inch minimum thickness.

B. Steel Panels: Flat steel sheet or plate of sufficient thickness, or braced sufficiently, to prevent noticeable deflection from pressure of concrete. Steel forms galvanized and/or coated to prevent rust and staining.

C. Framing, Studding, and Bracing: “Standard” or “Construction” grade West Coast Species lumber.

D. Form Ties: Prefabricated rod of the cone-type snap-tie configuration, or approved threaded internal disconnecting type, to resist all imposed loads of freshly placed concrete, and permit tightening and spreading of forms. Plastic cone snap-ties shall break back 1 to 1-1/2 inches.

E. Form Coating: Lacquer, plastic, or epoxy coating, or nonstaining form oil that will not impair the bonding quality for final finish of the painting or protective coating. Coatings containing mineral oils or other nondrying ingredients will not be permitted.

F. Shores and Falsework: Standard patented, manufactured shores, or sound commercial construction lumber.

G. Chamfer Strips: Chamfer strips (for all edges exposed to view) 3/4-inch, 45-degree bevel wood strips or reusable plastic triangular strips.

PART 3 – EXECUTION

3.01 DESIGN OF FORMWORK

A. Design formwork to safely support vertical and lateral loads, which might be applied until such loads can be supported by the concrete structure. Carry vertical and lateral loads by formwork system to ground or to in-place construction, which has attained adequate strength for that purpose.

B. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

D. Form facing materials shall be supported by structural members spaced to prevent deflection. Design camber in formwork as required for anticipated deflections.

E. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent material.

F. Keep oil or other agents from getting on reinforcing steel, embedded items, or other surfaces requiring bond with concrete.

3.02 LAYOUT OF FORMWORK

A. Locate and stake out all forms and establish all lines and levels and elevations.

3.03 CONSTRUCTION OF FORMS

A. Formwork – General:

1. Before concrete is placed in any form, verify horizontal and vertical form position and correct all inaccuracies. Complete all wedging and bracing in advance of placing of concrete.
2. When setting form ties leave no metal to remain in walls closer than 1 inch from surface. Ties shall fit tight to prevent mortar leakage at holes in forms. Ties shall be protected from rusting at all times. No wire ties or wood spreaders will be permitted. Cutting ties back from concrete face will not be permitted.

3. At construction joints, anchor forms by using an adequate number of form ties in the new pour a few inches from the construction joints. Do not rely on ties adjacent to the joint used in previous placements.
4. For exposed concrete, forms shall be of new plywood, metal panel, or approved panel materials, smooth, and continuous.
5. For unexposed concrete, forms shall be plywood, metal, boards, or approved material. Boards, nominal 1-inch-minimum thickness, sound and tight, commercial construction lumber, shiplapped or tongue-and-grooved, dressed on at least one side and both edges for tight fit. Use plywood, metal, or approved material equal to or better than board surface.

B. Chamfered Corners: Chamfer all corners that will be exposed to view 3/4 inch, unless shown otherwise on Drawings. Provide 45-degree triangular moldings in forms for all chamfering required.

1. Inspection and Cleanout Openings: Provide inspection and cleanout openings at the bottom of all forms for columns, pilasters, walls over 8 feet in height, and for forms for irregularly shaped placement where cleaning and inspection from the top would be impractical.

C. Coordination: Coordinate the installation of all items to be inserted or embedded in concrete. Support all items to maintain accurate alignment and prevent distortion during concrete placement.

D. Cleaning: All dirt, chips, sawdust, mud, water, and other foreign matter shall be removed from within the forms or within the excavated areas before any concrete is deposited therein.

3.04 NOTIFICATION AND INSPECTION

A. Prior to placing of any concrete, and after placement of reinforcing steel in the forms, notify the Engineer at least 24 hours in advance of placing concrete to permit inspection.

3.05 DEFECTIVE WORK

A. Any form movement or deflection during construction or finished surface variations in excess of the tolerances specified will be basis for rejection of cast-in-place product and requirement for replacement of same.

3.06 REMOVAL OF FORMS

A. Do not remove forms and supports until concrete has attained sufficient strength to support anticipated loads.

B. The listing below serves only as a guide in determining the minimum length of time required before removal of forms and is based on the use of Type I Portland cement. When high early strength Portland cement is used, the length of time listed below may be reduced to not less than one-third time listed, but not less than 1 day.

1. Walls in Mass Work: 24 hours.
2. Thin Walls (12 inches or less): 48 hours.
3. Columns: 7 days.
4. Bottom Forms and Supports of Beams, Girders, and Slabs: 14 days.

C. Use methods of form removal that will not cause overstressing of the concrete. Remove supports to permit the concrete to uniformly and gradually take the stress due to its own weight. Do not use high impact methods to remove supports.

D. Break back ties after concrete has cured sufficiently to maintain unbroken bond with steel rod.

3.07 REUSE OF FORMS

A. Any reused form for exposed concrete work shall be reconditioned to “like new” condition. Any reused form shall be cleaned, repaired, and recoated before each reuse.

3.08 BLOCK OUTS

A. Where pipes, castings, or conduits pass through the walls, place such pipes or castings in the forms before pouring the concrete, or in special cases, with the express consent of the Engineer or as specified, build accepted boxes in the forms to make cored openings for subsequent insertion of such pipes, castings, or conduits. Provide boxes or cores with slight flare to facilitate grouting and the escape of entrapped air during grouting.

END OF SECTION

SECTION 031513 – WATERSTOPS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. PVC or Thermoplastic waterstops.

B. Hydrophilic (adhesive) waterstops.

C. Special purpose waterstops.

1.02 QUALITY ASSURANCE

A. Qualify each PVC weld by demonstrated on-site welding performance on straight and intersection welds. Test samples to 75 percent of tensile and shear stresses of original product. Testing by independent testing laboratory.

B. Design of PVC waterstop intersections where normal welding is not appropriate shall be by waterstop manufacturer.

C. Special Inspection of all waterstops required prior to concrete placement.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original container or packaging materials.

B. Store and handle in manner to prevent damage or contamination that would cause leaks or affect bond with concrete. Protect from heat or sunlight that may cause degradation.

PART 2 – PRODUCTS

2.01 PVC OR THERMOPLASTIC WATERSTOPS

A. Materials:

1. Extruded virgin polyvinyl chloride, minimum tensile strength 1,900 psi, and ultimate elongation 375 percent in accordance with ASTM D412.
2. Thermoplastic elastomeric rubber, meeting the same strength and elongation requirements as paragraph 1.

B. Configurations:

1. Hollow-center bulb waterstops as shown on Drawings.

   a. 6 inches overall dimension, 3/16-inch-minimum thickness.

      1) Greenstreak Style 704.
      2) JP Specialties Earthshield Part Number JP636.
      3) Durajoint Type 4.
      4) Approved equal.

   b. 4 inches overall dimension as shown on Drawings.

      1) Greenstreak Style 702.
      2) JP Specialties Earthshield Part Number JP436.
      3) Durajoint Type 3.
      4) Approved equal.

   c. Retrofit waterstops, with manufacturer-supplied adhesives and clamping bars.

      1) Greenstreak Style 609.
      2) JP Specialties Earthshield Part Number JP450T.
      3) Approved equal.

   d. Special waterstops, profiles as specified on the Drawings.

      1) Tear rib waterstops, for joints with large expected movement.
      2) Injectable waterstops, for base of tank walls as shown on Drawings.

2.02 HYDROPHILIC WATERSTOPS

1. Preformed expansive compound with virgin basic resins as manufactured by:

   a. Asahi Denka Kogyo (Adeka).
   b. Greenstreak (Hydrotight).
   c. Henry (Hydro-Flex and Synko-Flex).
   d. De neef (Swellseal).
   e. Approved equal.

2. Appropriate products shall be selected to conform to manufacturer's requirements of rebar confinement and cover distances to face of concrete surface.
3. Bentonite filled or other materials with expansive potential greater than 500 percent shall not be allowed.

PART 3 – EXECUTION

3.01 AREAS REQUIRED

A. Provide in all joints in liquid-containing structures (except joints within liquid-containing chambers not intended to be watertight) and in below-grade structures, where noted for the exclusion of groundwater. Waterstops shall also be provided in other locations as shown on Drawings.

3.02 SPLICES

A. Make splices and intersections in accordance with the manufacturer's instructions and with approved welding unit. Align splices as illustrated on approved detail drawing submittals.

3.03 INSTALLATION

A. Install in accordance with the manufacturer's installation instructions for continuous watertightness. Thoroughly vibrate or compact concrete under and around the waterstop to achieve concrete contact with all waterstop surfaces.

B. Prevent waterstops from being deformed or forced out of place where concrete is placed. Support with reinforcing steel or in conformance with the manufacturer's published recommendations. Hand placement of concrete around waterstops may be required.

C. Clip hog-rings through top of plastic waterstops used in wall to footing joints at maximum of 1 foot 0 inch spacing. Support rings from continuous horizontal reinforcement.

D. For hydrophilic waterstops using primer and/or adhesives, apply adhesives in a workmanlike manner, avoiding application to the concrete surface exceeding 1 inch beyond the edges of the waterstop strip. Areas beyond this 1 inch limit shall be cleaned or roughened to the inspector's satisfaction to ensure interlocking of the concrete across the joint.

E. For hydrophilic waterstops, prevent premature wetting of waterstop material. All materials swollen or damaged prior to concrete placement shall be replaced with new material.

F. Blow outs or cracking of concrete walls due to improper selection, placement, or lack of concrete cover on hydrophilic waterstop materials shall be repaired by Contractor at no additional cost to the Owner and to the satisfaction of the Engineer.

END OF SECTION

SECTION 031516 – EXPANSION, CONTRACTION, AND CONTROL JOINTS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Prepare and use in strict accordance with manufacturer's instructions. Discard materials after specified "shelf life."

B. Deliver products in manufacturer-labeled containers with complete preprinted instructions by manufacturer included.

C. Installers experienced in use of products.

1.02 SUBMITTALS

A. Sealant type and manufacturer.

B. Pre-molded composition board and backer rod samples.

C. Certification of conformance to Specifications.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Fiber expansion board ASTM D1751.

B. Joint Sealant:

1. Polyurethane material designated for bonding to concrete for sewage treatment plant service, which when cured, develops a high bond between surfaces and provides flexible watertight seal, non-sag, resistant to mild alkalis and acids, oils and meets all requirements for Federal Specifications TT-S-00230C, Type II. Prior to ordering the sealant, submit to the Engineer for review, sufficient data to show experience record of sealant and general compliance with the Specification requirements.
2. Joint primer supplied by the same manufacturer supplying the sealant.

C. Backer-Rod: Closed cell polyethylene backer-rod shall be used in sealant joints. The backer-rod shall be resilient and of a diameter at least 1/8 inch larger than the groove and shall be approved by the sealant manufacturer.

D. Control Joint on Flatwork: Form with grooving tool or embed control joint former such as Stress Cap by Vinylex or Zip Strip by Masco.

E. Building Paper: No. 15 asphalt felt.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Joints constructed and located as shown on the Drawings.

B. Sealant Surfaces: Clean, free of oil, grease, residue and other foreign materials, prior to application of sealant in accordance with manufacturer's recommendations. Prime all joints with joint primer.

C. Sealant Application:

1. Tape or otherwise protect surfaces adjacent to joints not intended to receive sealants. The backer-rod shall be accurately placed in the joint to provide the depth of sealant called for on the Drawings.
2. Neatly apply sealants to fill void required to level non-sag surface. Maintain uniform application procedures to continuously apply sealant. Complete joint system without intermediate stops and starts.
3. Sealant shall be applied according to manufacturer's recommendations in a manner so as to avoid entrainment of air in the joint.
4. Secure preformed board to surfaces with fasteners and procedures recommended by manufacturer.

END OF SECTION

SECTION 031519 – ANCHORS, INSERTS, AND EMBEDDED PRODUCTS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies the materials and installation requirements for metal embedment into concrete or grouted masonry.

B. Items Included:

1. Cast-in-place anchor bolts (anchor rods).
2. Manufactured cast-in-place inserts for suspended piping or electrical items.
3. Inserts for structural attachments.
4. Collars or sleeves for pipe penetrations.
5. Post-installed anchors.

1.02 SUBMITTALS

A. Shop drawings for all anchors, inserts, and embedded products (wall castings, pipes with seep rings, and special castings or fabrications).

B. Manufacturer's Data: Submit complete data for fasteners including materials, dimensions, resins, colors, and other information.

C. Current ICBO Evaluation Reports for all expansion and adhesive anchors.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Cast-in-place Anchor Bolts: ASTM F1554, Grade 36, hot dip galvanized steel unless otherwise noted. Configuration shall be as shown or noted on the Drawings.

B. Expansion (Wedge) Anchors: ICBO approved for use in cracked and uncracked concrete for all anchors used for wind or seismic anchorage applications.

1. All anchors to be Stainless Steel complying with the following:

a. Stud: Stainless steel bar conforming to ASTM A276 with chemical composition of AISI Type 316.
b. Wedge: Manufactured from either AISI Type 316 stainless steel.
c. Nut: Stainless steel conforming to ASTM F594 with chemical composition of AISI Type 316 and meeting dimensional requirements of ANSI B18.2.2.

d. Washer: AISI Type 316 stainless steel conforming to ASTM A240.

2. Products:

a. Hilti, Kwik-Bolt TZ SS 316.
b. Powers Fasteners, Power-Stud + SD6.
c. Simpson Strong Tie, Strong-Bolt 2, Type 316 stainless steel.
d. Other manufacturers upon approval of Engineer.

C. Adhesive Anchors:

1. Anchor rod material shall conform to ASTM A316 stainless steel.
2. Products:

a. Hilti, HIT-RE 500-V3.
b. Powers Fasteners, PE1000+.
c. Simpson Strong-Tie, SET-XP.
d. Other manufacturers upon approval of Engineer.

D. Stainless Steel Plates and Shapes: Conform to AISI Type 316 unless otherwise noted.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Coordinate the location and placement of all items to be embedded in concrete.

B. Coat any embedded aluminum with asphalt paint.

C. Adhesive and expansion anchors to be installed in holes drilled with carbide tipped drill bits. Anchors shall be installed per manufacturer's recommendations. Insert and tighten bolts in accordance with manufacturer's installation instructions. In case of interference with reinforcing bars or steel objects, notify the Engineer.

3.02 EMBEDDING

A. Set accurately and hold in position all embedded products during placement until the concrete is set.

3.03 INSPECTION

A. Anchors shall be inspected by Special Inspector as required by the Inspection Requirements described in the Structural General Notes contained on the Drawings or as required by the Building Official.

END OF SECTION

SECTION 032000 – CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Welded wire fabric reinforcing for exterior concrete slabs on grade.

C. Supports and accessories for steel reinforcement.

1.2 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories.

B. Section 033001 - Cast-In-Place Concrete – Sitework.

1.3 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete “Latest Edition”.

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary “Latest Addition”.

C. ACI SP-66 - ACI Detailing Manual “Latest Addition”.

D. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement “Latest Addition”.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement “Latest Addition”.

F. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement “Latest Addition”.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete “Latest Addition”.

H. CRSI (DA4) - Manual of Standard Practice “Latest Addition”.

I. CRSI (P1) - Placing Reinforcing Bars “Latest Addition”.

1.4 SUBMITTALS

A. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

B. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in Washington State.

D. Manufacturer's Data: Submit manufacturer's product data and installation instructions for proprietary materials.

E. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

B. Inspections: Covered hereinafter in this Section, and in Section 014300 Inspections and Tests. Should reinforcing placed under this Contract not meet specified requirements, remove and replace to assure compliance with Contract Documents.

C. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months and welders are WABO certified.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Material and Equipment: Transport, handle, store, and protect products.

B. All products to be stored in the Staging Area until day of use. All unused reinforcing steel and excess materials shall be immediately returned to the Staging Area after use.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:

1. Unless otherwise noted in Structural Notes, furnish deformed bars meeting requirements set forth in ASTM Standard A615, Grade 60 (Fy = 60,000 psi). Bars shall be unpainted, uncoated, and free from rust, dirt and loose scale.
2. Where reinforcing requires welded connections, furnish weldable reinforcing bars which meet the chemical requirements of ASTM A706 (Grade 60 ksi) with a minimum carbon equivalent of .55 percent.

B. Welded Steel Wire Fabric: Furnish welded wire fabric meeting requirements set forth in ASTM A1064, Fy=65 ksi; 6"x6" - W 1.4/W 1.4 size, unless otherwise noted.

C. Reinforcement Accessories:

1. Tie Wire: 16 gauge or heavier, double annealed wire.
2. Spacer Bars for Wall Reinforcing: 3-inch bars, "U" shaped. Stock items of equivalent function may be submitted for approval.
3. Mortar Blocks:

    a. Furnish as required for use as spacers in placing reinforcement; shall be two (2) inches square (maximum).
    b. Mortar blocks shall be constructed of mortar mixed with the same proportions of sand and cement used in concrete and develop a minimum compressive strength of 4,000 psi at 28 days.
    c. Mortar blocks shall have a tie wire embedded and the protruding ends to be tied to the reinforcing steel to hold the mortar blocks in place; mortar blocks with a grooved top may be used for supporting steel in slabs.
    d. Metal Chair Supports: In lieu of mortar blocks, furnish approved heavy-duty plastic-type chair supports, sized to support all slab steel to proper height and with cushioned pads to prevent vapor retarder membrane penetration.

4. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
5. Dowels shall comply with 9-07.5 Dowel Bars.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.

B. Locate reinforcing splices not indicated on drawings at point of minimum stress. Review locations of splices with Structural Engineer.

C. Hooks & Bends

1. Minimum Bend Diameter: The diameter of bend measured on the inside of the bar for standard hooks, other than stirrup and tie hooks, not less than:
2. Bar sizes #3 through #8: 6 bar diameters.

    a. Bar sizes #9 through #11: 8 bar diameters.

3. Bending: Bend cold, unless otherwise permitted by Structural Engineer; do not field bend partially embedded bars except as permitted by Structural Engineer. Conform to ACI 318, Section 26.6.3.

PART 3 - EXECUTION

3.1 PLACEMENT

A. General:

1. Conform to ACI 318, Section 26.6.2 for placing, supports, tolerances, and draped fabric, unless noted otherwise on Drawings.
2. Place, support, and secure reinforcement against displacement. Do not deviate from required position.
3. Do not displace or damage vapor barrier.
4. Prevent water from softening soil under reinforcing during steel placing.
5. Accommodate placement of formed openings.

B. Maintain concrete cover around reinforcing as set forth on Drawings, but not less than 2 inches.

C. Cleaning Reinforcement: Clean reinforcement, at time concrete is placed, free of mud, oil, or other materials that will reduce the bond. Conform to ACI 318, Section 26.6.1.2.

D. Placement:

1. Reinforcing steel shall be accurately placed in accordance with related drawings, schedules, and detailed shop drawings and be securely tied and supported in its precise location at all points where the bars cross so as to preclude shifting during the placing of formwork, construction, or concrete placement operations.
2. Provide sufficient number of supports and of strength to carry the reinforcement. Do not place reinforcing bars more than 2 inches beyond last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

    a. Bar reinforcing for concrete slabs on grade shall be securely supported in its proper position by means of mortar blocks or metal chairs as required; wood or foam supports are not acceptable.

        1) Use mortar blocks where placing reinforcing over vapor barrier or waterproof membranes at interior slabs on grade.

3. Metal chair supports may be used at exterior slabs.

    a. Bar reinforcing shall be continuous insofar as practical and shall carry around corners and through intersections in footings and walls. Provide elbow bars of size to develop required laps.
    b. Unless otherwise noted, reinforcing bar splices shall lap 40 bar diameters. Splices shall not be made at the points of maximum stress. Stagger all lap splices such that no more than 50% of horizontal or vertical bars shall splice at any location.

4. Fastening:

    a. Securely tie bars and bar supports together with 16-gauge wire to hold reinforcement accurately in position during concrete placement.
    b. Set wire so that ends are directed into the concrete.
    c. Wire tie stirrups and ties to main reinforcement.

E. Placing Welded Wire Fabric:

1. Install in new exterior paving slabs. Provide of size specified herein or otherwise indicated, and with minimum coverages indicated for concrete protection.
2. Install welded wire fabric in as long lengths as practicable. The mesh fabric shall be rolled out, straightened, cut to the required size, and be laid reasonably flat in place.
3. Lap adjoining pieces at least 12 inches or one full mesh spacing plus 2 inches, whichever is greater, and lace splices with 16-gauge wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
4. Do not carry through isolation/expansion joints.
5. Prior to concrete placement, the mesh reinforcing shall be supported at frequent intervals as required to insure proper location in the concrete.
6. Lifting mesh reinforcing during concrete placement is not allowed, unless approved in writing by the Structural Engineer.

3.2 FIELD QUALITY CONTROL

A. An independent testing agency will inspect installed reinforcement for conformance to Contract Documents before concrete placement.

END OF SECTION

SECTION 032000.1 – CONCRETE REINFORCING **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315.

B. *Manual of Standard Practice*, Concrete Reinforcing Steel Institute.

1.02 SUBMITTALS

A. Placing Drawings, Bending, and Cut-Sheet Schedules.

B. Mill test reports for each shipment of reinforcement shall be submitted to the Engineer for review.

C. All wall reinforcement to be shown in elevation on the shop drawings.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site in bundles marked to coordinate with placement drawings.

B. Handle and store to prevent contamination from dirt, oil, and other materials, which will affect bond.

C. Store a minimum of 6 inches above ground and in locations where the material will not be subject to abuse.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: Unless specified otherwise, all bars for concrete reinforcement shall be deformed bars meeting the requirements of ASTM A615, Grade 60, “Billet Steel Bars for Concrete Reinforcement.”

B. Welded Wire Fabric: Steel, conforming to ASTM A185, 65 ksi yield strength. Supply in sheets; rolls are not acceptable.

C. Tie Wire: Steel, black annealed, 16-gauge minimum.

D. Reinforcing Bar Supports: Per CRSI “*Manual of Standard Practice*,” Chapter 3, pregalvanized or plastic coated for chairs bearing on non-exposed surfaces, plastic or stainless steel for chairs or spacers in exposed work.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Placement and Tolerances: Conform to CRSI *Manual of Standard Practice*.

B. Splices:

1. Do not splice bars except at locations shown or noted on the Drawings or as otherwise approved.
2. Tie lap splices securely with wire to prevent displacement of splice during placement of concrete.

C. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that may reduce bond with concrete.

D. Protection during Concreting: Keep reinforcing in proper position during concrete placement.

E. Concrete Cover: Maintain minimum concrete cover over reinforcement as specified in ACI 318 or as noted. Bend tie wire away from concrete surfaces to maintain required clearances.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE – ARCHITECTURE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 033010 "Portland Cement Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
   1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301 (ACI 301M).
   2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Deformed-Steel Wire: ASTM A 1064/A 1064M.

D. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Zinc Repair Material: ASTM A 780/A 780M.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
   3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:
   1. Portland Cement: ASTM C 150/C 150M, **Type I gray**.
   2. Fly Ash: ASTM C 618, **Class F or C**.
   3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
   4. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33/C 33M coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: **1 inch (25 mm)** nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Water: ASTM C 94/C 94M **and potable**.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: **ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork**.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than **4100 psi (29 MPa)** at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than **5000 psi (34.5 MPa)** at 28 days when tested according to ASTM C 109/C 109M.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: **Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:**
   1. Fly Ash: 25 percent.
   2. Combined Fly Ash and Pozzolan: 25 percent.
   3. Slag Cement: 50 percent.
   4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
   5. Silica Fume: 10 percent.

6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to **0.06** percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use **water-reducing, high-range water-reducing or plasticizing** admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Foundations and Slabs-on-Grade: Normal-weight concrete.
1. Minimum Compressive Strength: **4000 psi (27.6 MPa)**] at 28 days.
2. Maximum W/C Ratio: 0.44.
3. Slump Limit: **8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture**, plus or minus 1 inch (25 mm).
4. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the work, indicating project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. **Class A, 1/8 inch (3.2 mm)** for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. **Chamfer** exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for **24** hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved **at least 70 percent of** its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least **one-fourth** of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces **not exposed to public view**

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces **exposed to public view**.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces **exposed to view**.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
      b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
      c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
      d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
   3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed **1/4 inch (6 mm)**.

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete basesas indicated in the structural drawings.
   3. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends

lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least **one** month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and

compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a **special inspector** to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; [**ASTM C 173/C 173M, volumetric method, for structural lightweight concrete;**]one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two (2) sets of two (2) standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within **24** hours of finishing.

END OF SECTION 03 3000

SECTION 033000.1 – CAST-IN-PLACE CONCRETE – SITEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Form liners.
3. Shoring, bracing, and anchoring.
4. Steel reinforcement bars.
5. Welded-wire reinforcement.
6. Cast-in-place concrete.
7. Concrete materials.
8. Mixture design.
9. Placement procedures.
10. Finishes.

B. Related Requirements:

1. Section 033543 – Polished Concrete Finishing.
2. Section 055000 – Metal Fabrications, for abrasive nosings.

C. Products Installed But Not Furnished Under This Section:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Self-Consolidating Concrete (SCC): Highly flowable, non-segregating concrete that can spread into place, fill formwork, and encapsulate reinforcement without any mechanical consolidation.

C. Water/Cement Ratio (w/cm): Ratio by weight of water to cementitious materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor.
    b. Contractor's superintendent.
    c. Owner.
    d. Architect.
    e. Structural engineer.
    f. Installer.
    g. Manufacturer representatives.
    h. Independent testing agency responsible for concrete design mixtures.
    i. Ready-mix concrete manufacturer.
    j. Concrete Subcontractor.
    k. Special concrete finish Subcontractor.

2. Review Project schedule, special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates.
8. Admixtures:

    a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

9. Fiber reinforcement.
10. Vapor retarders.
11. Liquid floor treatments.
12. Curing materials.
13. Joint fillers.
14. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28 day compressive strength.
3. Durability exposure class.
4. Maximum w/c ratios.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Synthetic micro-fiber content.
9. Indicate amounts of mixing water to be withheld for later addition at Project site.
10. Alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings: Prepared by or under supervision of a qualified professional engineer.

1. Formwork: Detail fabrication, assembly, and support of formwork.

    a. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

2. Concrete Forming and Accessories:

    a. For exposed vertical concrete walls, indicate dimensions and form tie locations.
    b. Indicate dimension and locations of construction and movement joints required to construct structure in accordance with ACI 301.

        1) Location of construction joints is subject to approval of Architect.

    c. Indicate location of waterstops.
    d. Indicate form liner layout and form line termination details.
    e. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.

3. Concrete Reinforcing: Comply with ACI SP-066, and include the following:

    a. Placing drawings that detail fabrication, bending, and placement.
    b. Bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

4. Cast-In-Place Concrete:

    a. Construction Joint Layout: Indicate proposed construction joints required to construct structure.

        1) Location of construction joints is subject to approval of Architect.

5. Submit Shop Drawings that have been prepared, signed, and sealed by a qualified professional engineer licensed in Washington State.

D. Samples:

1. Waterstops.
2. Vapor retarder.
3. Form Liners: 12 inch square Sample, indicating texture.

E. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Liquid floor treatment.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing and inspection agency.

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. For professional engineer indicating experience with providing delegated-design engineering services of the kind indicated.

a. Include documentation that engineer is licensed in Washington State.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Waterstops.
5. Liquid floor treatments.
6. Curing materials.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.
13. Form materials and form-release agents.
14. Steel reinforcement and accessories.

C. Welding Certificates.

1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706.

2. Mechanical splice couplers.
3. Portland cement.
4. Fly ash.
5. Slag cement.
6. Blended hydraulic cement.
7. Silica fume.
8. Aggregates.
9. Admixtures:

a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder, showing compliance with ICC AC380.

F. Preconstruction Test Reports: For each mix design.

G. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

H. Minutes of preinstallation meeting.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer with a minimum 3 years of experience who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Delegated-Design Engineer Qualifications: Professional engineer experienced in providing delegated-design engineering services of the kind indicated and is legally qualified to practice in Washington State.

C. Ready-Mixed Concrete Manufacturer Qualifications: A firm with a minimum 10 years of experience in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.

1. Manufacturer member of NRMCA and certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.4.
2. Use welders certified by AWS and State project is located for structural welding, and who have undergone recertification in the last 12 months.

E. Field Samples:

1. Build field samples approximately 200 sq. ft. for slabs-on-ground and 100 sq. ft. for formed surfaces. Field samples can remain part of finished work if approved.
2. Demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

    a. Demonstrate repair of blemished or damaged portion of exposed-face surface in presence of Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94 and ACI 301.

B. Form Liners: Store form liners under cover to protect from sunlight.

C. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage, and to avoid damaging coatings on steel reinforcement.

D. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows:

1. Protect concrete Work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for 3 successive days, maintain delivered concrete mixture temperature within temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1 and as follows:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.

    a. Contractor’s Option: Use of liquid nitrogen to cool concrete.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in Contract Documents:

1. ACI 301, Specification for Structural Concrete, Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 75 percent.

B. Reinforcing Bars: ASTM A615, Grade 60, except No. 3 may be Grade 40, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A706, Grade 60, deformed.

D. Galvanized Reinforcing Bars:

1. Steel Bars: ASTM A615, Grade 60, deformed.
2. Zinc Coating: ASTM A767, Class I zinc coated after fabrication and bending.

E. Deformed-Steel Wire: ASTM A1064, flat sheet.

F. Steel Bar Mats: ASTM A184, fabricated from ASTM A615, Grade 60, deformed bars, assembled with clips.

G. Welded-Wire Reinforcement:

1. Plain Steel: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.

a. Do not provide rolls of wire where scheduled for slabs.

2. Deformed-Steel: ASTM A1064, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI (DA4) of greater compressive strength than concrete and as follows:

    a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use all-plastic, CRSI Class 1 plastic-protected or hot-dip galvanized steel wire, or CRSI Class 2 stainless-steel bar supports.
    b. Where reinforcing steel is supported on ground, provide precast concrete blocks not less than 4 sq. in. with compressive strength matching surrounding concrete.

C. Galvanizing Repair Coating: Zinc-rich, cold galvanizing compound as specified in Section 055000 – Metal Fabrications.

2.4 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of same brand from same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement; ASTM C150; as follows:

    a. Interior Locations: Type I and Type II. Do not use air entrained concrete at interior slabs.
    b. Exterior Locations: Type I with specified air entrainment admixture, preferred to Type IA and Type IIA air-entrained concrete. Type IIIA acceptable for cold weather construction.

2. Fly Ash: ASTM C618, Class F or Class C pozzolan, loss on ignition not exceeding 1 percent. Account for lower calcium content of Class F where used.
3. Slag Cement: ASTM C989, Grade 120, ground, granulated blast-furnace slag.
4. Blended Hydraulic Cement: ASTM C595, Type IL, portland-limestone cement.

C. Aggregates: ASTM C33, Class 3S coarse aggregate or better. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: As follows:

    a. Slabs and Structural Concrete: Maximum 3/4 inch nominal.
    b. Footings: Maximum 1 inch nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. Gradation: Uniformly graded.

D. Self-Consolidating Concrete (SCC): Polycarboxolate based superplasticizers designed to consolidate concrete without need for vibrating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Co.: Plastol Series.
b. GCP Applied Technologies Inc.: ADVA Cast 530 or other ADVA Series product recommended by manufacturer.
c. Sika Corporation: Sika ViscoFlow-2020.
d. Approved substitution.

E. Self-Consolidating Concrete (SCC): Polycarboxolate based superplasticizers designed to consolidate concrete without need for vibrating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Co.: Plastol Series.
b. GCP Applied Technologies Inc.: ADVA Cast 530 or other ADVA Series product recommended by manufacturer.
c. Sika Corporation: Sika ViscoFlow-2020.
d. Approved substitution.

F. Water: ASTM C94; potable.

2.5 ADMIXTURES

A. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete.

1. Do not use calcium chloride or admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C260.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Co.: Eucon Dura-Plus.
b. Master Builders Solutions: MasterAir Series.
c. Sika Corporation: Sika Air Series.

2. Achieve 5 percent entrained air, plus or minus 1-1/2 percent to batch plant concrete mix, for exterior concrete exposed to earth, weather, or freezing temperatures after curing.
3. Applications:

a. Exterior concrete unless indicated otherwise
b. Do not use on interior slabs unless approved in writing by Architect.

C. Water-Reducing Admixture: ASTM C494,Type A: Low range and mid-range.

1. Products, Water Reducer: Subject to compliance with requirements, provide one of the following:

    a. Euclid Chemical Co.: Eucon WR.
    b. Master Builders Solutions: MasterPozzolith Series.
    c. Sika Corporation: Plastocrete 161.

2. Products, Mid-Range: Subject to compliance with requirements, provide one of the following:

    a. Euclid Chemical Co.: Eucon MR.
    b. Master Builders Solutions: MasterPolyheed Series.
    c. Sika Corporation: SikaPlaast-200.

3. Applications: General use concrete unless another type is indicated.

D. High-Range, Water-Reducing Admixture: ASTM C494, Type F: High range.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Euclid Chemical Co.: Eucon 37.
    b. Master Builders Solutions: MasterGlenium Series.
    c. Sika Corporation: Sikament Series.

2. Applications: Self-consolidating and pumped concrete.

E. Permeability-Reducing Admixture: ASTM C494, Type S, hydrophilic, permeability-reducing crystalline admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).

1. Products: Subject to compliance with requirements, provide one of the following:

    a. AQUAFIN, Inc.: AQUAFIN IC ADMIX- Powder.
    b. Barrier One, Inc.: Barrier One WPX.
    c. Euclid Chemical Co.: Vandex AM-10
    d. ISE Logik Industries: CWPA 800.
    e. Kryton International Inc.: Krystol Internal Membrane (KIM).
    f. Master Builders Solutions: MasterLife 300 Series
    g. Penetron International: Penetron Admix.
    h. Sika Corporation: Sika WT-215 P or Sika WT-240 P.
    i. Specialty Products Group: Vapor Lock 20/20
    j. Xypex Chemical Corporation: Admix C-500/C-500 NF

2. Performance Requirements:

    a. Permeability: U.S. Army Corps of Engineers CRD C48; no leakage at hydraulic pressure of 200 psi for 14 days.
    b. Complies with ACI 212.3R.
    c. NSF/ANSI Standard 61 certified for use with potable water.
    d. Compressive Strength: ASTM C39; increase 28 day strength by at least 8 percent when compared to untreated concrete

e. Crack Sealing: Capable of self-sealing static cracks with widths up to 0.02 inch.

3. Applications: Concrete requiring integral waterproofing.

F. Moisture Vapor Reduction Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission, with no adverse effect on concrete properties.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Barrier One, Inc.: Barrier One MVRA-CPS.
b. Hycrete, Inc.: Hycrete W1000
c. ISE Logik Industries: MVRA 900.
d. Approved substitutions.

2. Performance Requirements:

a. NSF/ANSI Standard 61 certified for use with potable water.
b. Certified by admixture manufacturer to not interfere with bonding of floor coverings.

3. Applications: Interior slabs scheduled to receive adhesively applied flooring.

2.6 FIBER REINFORCEMENT

A. Synthetic Monofilament Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116, Type III.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Co.: PSI Fiberstrand 100 or PSI Fiberstrand 150.
b. Fibermesh; a Sika Brand: Fibermesh 150e3.
c. FORTA Corporation: FORTA Econo-Mono.
d. GCP Applied Technologies Inc.: Sinta M3019.
e. Master Builders Solutions: MasterFiber M35 or MasterFiber M70.
f. Nycon Corp.: ProCon-M.
g. Sika Corporation: SikaFiber HP.
h. Approved substitution.

2. Length: Minimum 3/4 inch.
3. Applications: Interior exposed slabs.

a. Not for use at composite slabs or as replacement for welded-wire fabric.

B. Synthetic Fibrillated Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C1116, Type III.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Co.: PSI Fiberstrand F.

b. Fibermesh; a Sika Brand: Fibermesh 300.
c. FORTA Corporation: FORTA Econo-Net.
d. GCP Applied Technologies Inc.: Sinta F19.
e. Master Builders Solutions: MasterFiber F100.
f. Nycon Corp.: ProCon-F.
g. Sika Corporation: SikaFiber PPF.
h. Approved substitution.

2. Length: Minimum 3/4 inch.
3. Applications: Interior slabs schedules for floor coverings, exterior slabs.

a. Not for use at composite slabs or as replacement for welded-wire fabric.

2.7 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc.: MiraSTOP.
b. CETCO – Building Materials Group: Waterstop-RX-101.
c. Concrete Sealants Inc.: Conseal CS-231.
d. GCP Applied Technologies Inc.: Adcor ES.
e. Henry Company: Hydro-Flex.
f. JP Specialties, Inc.: Earth Shield Type 20.
g. Sika Corporation: Swellstop.
h. Tremco Incorporated: Superstop.
i. W. R. Meadows, Inc.: Waterstop EC Plus.

2. Size: 1 x 3/4 inches.
3. Shape: Rectangular or trapezoidal.
4. Physical Properties:

a. Hydrostatic-Head Resistance: 200 feet; ASTM D5385, modified.

5. Configurations: As indicated on Drawings. Do not use for expansion joints.

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fortifiber Building Systems Group: Moistop Ultra 15.
b. GCP Applied Technologies Inc.: Florprufe 120.
c. Insulation Solutions, Inc.: Viper Vaporcheck II 15-mil.

d. Raven Engineered Films.: VaporBlock 15.
e. Reef Industries, Inc.: Griffolyn 15 mil Green. Stego Industries, LLC: Stego Wrap Vapor Barrier (15-Mil).
g. W.R. Meadows, Inc.: Perminator 15 mil.
h. Approved substitution.

2.9 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment (Type-1): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, seals, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Curecrete Distribution Inc.: Ashford Formula.
b. Dayton Superior: Sure Hard Densifier J17.
c. Nox-Crete Inc.: Duro-Nox.
d. Laticrete International, Inc.: Seal Hard.
e. Master Builders Solutions: MasterKure HD 200WB.
f. SpecChem, LLC: SpecHard.
g. W.R. Meadows, Inc.: LIQUI-HARD.

B. Penetrating Liquid Floor Treatment (Type-2): Spray-applied, clear, odorless, non-toxic, non-flammable, penetrating colloidal silica concrete treatment designed to harden, densify, and seal concrete surfaces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. AQURON Corporation International: Aquron 2000 Cure & Sea.
b. Solomon Colors, Inc.: Lythic Densifier.
c. Spray-Lock Concrete Protection, LLC: SCP 327 – Time of Placement SCP 327.
d. Approved substitution.

2.10 CURING MATERIALS

A. Curing Materials, General:

1. Verify products comply with requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete to reduce rapid surface moisture evaporation.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior: AquaFilm J74RTU or AuqaFilm Concentrate J74.
b. Euclid Chemical Co.: Eucobar.

c. Kaufman Products, Inc.: VaporAid.
d. Lambert Corporation: LAMBCO Skin.
e. Laticrete International, Inc.: E-CON.
f. Master Builders Solutions: MasterKure ER 50.
g. Nox-Crete Inc.: Monofilm.
h. Vexcon Chemicals, Inc.: Starseal Assist.
i. W.R. Meadows, Inc.: Evapre or Evapre-RTU.

2. Concentrated versions of specified products are acceptable subject to concentrates being used according to manufacturers' written instructions.
3. Applications: Apply to exterior concrete surfaces immediately after concrete placement and awaiting finishing in hot, dry, and windy conditions.

C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

D. Moisture-Retaining Cover: Provide one of the following that complies with ASTM C171:

1. Impervious paper consisting of 2 sheets of kraft paper cemented together by a bituminous adhesive with fiber reinforcement.
2. Polyethylene film, clear or white, minimum nominal thickness of 0.0040 inch.
3. White-burlap-polyethylene sheet, 40 inches wide, weighing not less than 10 oz./lin. yd.
4. Color: Comply with the following color restrictions for ambient temperatures:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

E. Curing Paper: Nonstaining, waterproof, 8 foot wide paper, consisting of 2 layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C171.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fortifiber Building Systems Group: Sisalkraft SK-10.
b. Approved substitution.

F. Curing Compound: ASTM C309, clear, waterborne, membrane-forming, dissipating, Type 1, Class A and B.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior: Clear Resin Cure J11W.
b. Euclid Chemical Co.: Kurez DR-100.
c. Kaufman Products, Inc.: Thinfilm 420.
d. Nox-Crete Inc.: Clear Cure DH 100.
e. Laticrete International, Inc.: L&M Cure.
f. W.R. Meadows, Inc.: 1100.
g. Approved substitution.

2. Certified by curing compound manufacturer to not interfere with bonding of floor coverings.

G. Curing and Sealing Compound: ASTM C1315, clear, waterborne, membrane-forming, Type 1, Class A. Product contains acrylic copolymers.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior: Cure & Seal 1315 J22WB.
b. Euclid Chemical Co.: Super Diamond Clear VOX.
c. Kaufman Products, Inc.: Krystal 25 Emulsion.
d. Laticrete International, Inc.: L&M Dress & Seal WB 25.
e. Master Builders Solutions: MasterKure CC 1315WB.
f. Nox-Crete Inc.: Cure & Seal 250 E.
g. W.R. Meadows, Inc.: Vocomp-25.
h. Approved substitution.

H. Water: Potable or complying with ASTM C1602.

2.11 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022 inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

1. Sizes: As indicated on Drawings.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Masco Masons Supply Company: Reflex Rubber Joint.
b. Right Pointe Company: Right-Joint Fibre Expansion Joint.
c. SpecChem: SpecFlex Fiber Expansion Joint.
d. W. R. Meadows: FIBRE Expansion Joint.
e. Western Louisville Fiberboard: WLF Expansion Joint.
f. Approved substitution.

2. Thickness: 3/4 inch unless indicated otherwise.

D. Removable, Plastic, Expansion-Joint Cap: Rigid, recycled PVC joint cap with removable top strip.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BoMetals, inc.: Expansion Board Cap.
b. Superior Profiles: VoidCap.
c. W. R. Meadows: SNAP-CAP Expansion Joint Cap.
d. Approved substitution.

2. Size: 1/2 inch wide by 1/2 inch deep.

E. Semi-Rigid Joint Filler (SR.JNT-1): 2-component, semi rigid, 100 percent solids, aromatic polyurea.

1. Polyurea Products: Subject to compliance with requirements, provide one of the following:

   a. Adhesives Technology Corp.: Crackbond JF-82 Fast.
   b. ARDEX Americas: Ardiseal Rapid Plus.
   c. Curecrete Distribution Inc.: CreteFill Pro 85.
   d. Euclid Chemical Company (The): Euco Qwikjoint UVR.
   e. Laticrete International, Inc.: L&M Joint Tite 750.
   f. MAPEI Corporation: Planiseal RapidJoint 15.
   a. Master Builders Solutions: MasterSeal CR 100.
   b. Sika Corporation: Sika Loadflex-524 EZ.
   c. Approved substitution.

2. Colors: Standard gray unless selected otherwise by Architect from manufacturer's full color range.
3. Shore A Durometer Hardness: ASTM D2240; 85 to 95 minimum.
4. Tensile Strength: When tested according to:

   a. ASTM D412; minimum 600 psi.
   b. ASTM D638; minimum 920 percent.

5. Elongation: When tested according to:

   a. ASTM D412; minimum 200 percent.
   b. ASTM D638; minimum 180 percent.
   c. ASTM C321, minimum 250 percent

6. Locations:

   a. Joints in interior concrete slabs scheduled to receive concrete polishing systems.
   b. Where indicated.

F. Keyed Control Joint Devices: Keyed control joint system with tongue and groove profile, removable top plastic cap sealant trough, knockout holes on 6 inch centers for dowels, and ribbed steel spikes with tongue to fit top screed edge.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. BoMetals, inc.: Pro-Key.
   b. Form-A-Key Products a div. of Cardinal Manufacturing Co.: Key-Loc Joint System.
   c. Approved substitution.

2. Materials:

   a. Keyed Joint Form: ASTM A653, nominal 0.028 inch thick galvanized steel with G90 or thicker coating.
   b. Stakes: ASTM A1011, minimum 0.064 inch nominal thickness, ribbed.
   c. Removable Cap: Joint device manufacturer’s standard 3/8 x 3/8 inch PVC cap.

G. Bonding Agent: ASTM C1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

H. Floor Slab Protective Covering: 8 foot wide cellulose fabric.

1. Application: Used to protect concrete floors schedule for polished concrete finishing.
2. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. McTech Group, Inc.: EZ Cover.
b. Approved substitution.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150 portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4,100 psi at 28 days when tested in accordance with ASTM C109.
5. Applications: At floor slab areas scheduled to receive floor coverings.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150, portland cement as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5,000 psi at 28 day strength of concrete being repaired when tested according to ASTM C109.
5. Applications: At floor slab areas scheduled to remain exposed coverings.

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows unless indicated otherwise on structural Drawings:

1. Fly Ash or Other Pozzolans: 35 percent maximum by mass.
2. Slag Cement: 50 percent maximum by mass.
3. Silica Fume: 5 percent maximum by mass.
4. Combined Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, and plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion concrete mixes in accordance with requirements indicated in structural Drawing. The following requirements are a minimum standard.

B. Class A: Normal-weight concrete.

1. Minimum Compressive Strength: As indicated on structural Drawings.
2. Maximum w/c Ratio: As indicated in structural Drawings.
3. Slump Limit: As indicated on structural Drawings.
4. Air Content: At point of delivery for concrete containing: Not required for interior slabs on ground.

    a. 5 percent, plus or minus 1.5 percent for 3/4 inch nominal maximum aggregate size.
    b. 4.5 percent, plus or minus 1.5 percent for 1 inch nominal maximum aggregate size.

5. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent by weight of cement.
6. Applications:

    a. Footings, stem walls, grade beams, tie beams, and interior slabs on ground.

C. Exterior Concrete: Normal-weight concrete.

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Maximum w/c Ratio: 0.42 to 0.5 unless indicated otherwise in civil Drawings.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd.
4. Slump Limit: 3 inches, plus or minus 1 inch.
5. Air Content: 4-1/2 to 7-1/2 percent, according to ASTM C231.
6. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd.
7. Applications:

    a. Exterior stoop slabs, exterior sidewalks, mechanical equipment pads, and other similar conditions.

D. Class J: Normal-weight concrete used for exterior retaining walls.

1. Minimum Compressive Strength: 4,000 psi at 28 days.

E. Self-Consolidating Concrete (SCC) Range of Slump Flow Values: Concrete free of rock pockets and honeycombs.

1. Slabs: 18 to 28 inch.
2. Architectural Members: 24 to 30 inch.
3. Walls, Normal Reinforcement: 18 to 28 inch.
4. Walls and Columns, Heavy Reinforcement: 24 to 28 inch.
5. Others: As indicated in structural Documents.

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI (DA4).

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94 and ASTM C1116. Furnish batch certificates for each batch discharged and used in Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes.
2. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
3. Monitor concrete in truck and reject if temperature rises to 89 deg F or 5 deg F in 10 minutes, indicating that concrete is setting up prior to discharge.

B. Project-Site Mixing: Not permitted without Architect's written approval. If approved by Architect, measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes, after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added.
4. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with Surface Finish designations specified in this Section for as-cast finishes.

C. Limit concrete surface irregularities as follows:

1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

D. Construct forms tight enough to prevent loss of concrete mortar and to minimize joints.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips
2. Use strike-off templates or compacting-type screeds.

H. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

I. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
4. Locate joints for beams, slabs, joists, and girders in middle third of spans.

    a. Offset joints in girders a minimum distance of twice beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings.

    a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI (DA4) for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Accurately position, support, and secure reinforcement against displacement.

1. Maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than 1 bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on structural Drawings.

1. Lap bars indicated to be continuous and vertical bars not less than 48 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
4. Weld reinforcing bars in accordance with AWS D1.4, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI (DA4).

a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least 1 wire spacing plus 2 inches, or 12 inches, whichever is greater, for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

H. Zinc-Coated Reinforcement:

1. Repair cut and damaged zinc coatings with galvanizing repair coating.

I. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete, prior to placing concrete.

3.4 REMOVING AND REUSING FORMS

A. Clean and repair surfaces of forms to be reused in Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
2. Apply new form-release agent.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 SHORING AND RESHORING

A. Comply with ACI 301 and ACI 318 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.6 INSTALLATION OF VAPOR-RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.7 JOINTS

A. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Terminate reinforcement at construction joints and provide smooth dowel across joint as indicated in structural Drawings.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders in middle third of spans. Offset joints in girders a minimum distance of twice beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against non-structural hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated on Drawings and approved Shop Drawings. Construct control joints for a depth equal to at least 1/4 of concrete thickness, but not less than 1-1/4 inch, as follows:

1. Early-Entry Sawed Joints: Form control joints on both interior and exterior slabs using early-entry dry-cut saws and methods in accordance with ACI 302.1R, Chapter 8. Acceptable alternatives include the following:

    a. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
    b. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Verify control joint forming methods and locations with Architect before proceeding.

D. Expansion and Isolation Joints in Slabs-on-Ground: After removing formwork, install expansion- and isolation-joint-filler strips at slab junctions with vertical surfaces, such as foundation walls and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

2. Install joint-filler strips in lengths as long as practicable. Where more than 1 length is required, lace or clip sections together.
3. Where joint sealants, specified in Section 079200 – Joint Sealants, are indicated, place removable, plastic, expansion-joint cap over top of expansion- and isolation-joint material prior to placing of concrete to form a level, clean void for self-leveling joint sealant once concrete hardens.

    a. Joint Sealant Depth: Not less than 1/2 inch or more than 1 inch below finished concrete surface

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated.
2. Lubricate or asphalt coat 1/2 of dowel length to prevent concrete bonding to 1 side of joint.

3.8 INSTALLATION OF WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Protect exposed waterstops during progress of Work.

3.9 CONCRETE PLACEMENT

A. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

B. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in 1 layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.10 FINISHING FORMED SURFACES

A. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.

2. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Locations:

    a. Surfaces to receive trowel finish.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete that has a total air content greater than 3 percent.
6. Locations:

    a. Surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic tile set over a cleavage membrane, liquid floor treatments, and polished concrete finished floors.

E. Trowel and Fine-Broom Finish:

1. While concrete is still plastic, slightly scarify surface with a fine broom.
2. Coordinate required final finish with Architect before application.
3. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
4. Locations:

    a. Surfaces indicated on Drawings and where ceramic tile is to be installed by either thickset or thinset method.

F. Broom Finish:

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.
3. Locations:

    a. Exterior concrete platforms, steps, ramps, and where indicated on Drawings.

3.12 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Interior Curbs:

1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases as indicated on Drawings, and extend base not less than 6 inches in each direction beyond maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4,000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch centers around full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold-weather protection.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
4. Apply evaporation retarder immediately after placing concrete if necessary to maintain maximum moisture loss.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within 3 hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1:

1. Begin curing immediately after finishing concrete by one or a combination of the following methods:

    a. Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

        1) Lap edges and ends of absorptive cover not less than 12 inches.
        2) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than 7 days.

    b. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

        1) Immediately repair holes or tears during curing period, using cover material and waterproof tape.
        2) Cure for not less than 7 days.

    c. Ponding or Continuous Sprinkling of Water:

        1) Maintain concrete surfaces continuously wet for not less than 7 days utilizing water or continuous water-fog spray.

    d. Applications:

        1) Surfaces to receive floor coverings specified in other Sections.
        2) Surfaces to receive penetrating liquid floor treatments.

3) Surfaces to receive polished finish.

a) Do not use moisture-retaining-cover curing for surfaces to receive polished finish.

2. Floors to Receive Curing Compound:

a. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions.
b. Recoat areas subjected to heavy rainfall within 3 hours after initial application.
c. Maintain continuity of coating and repair damage during curing period.
d. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
e. Applications:

1) Interior surfaces schedule to receive floor covering adhesives.
2) Do not apply to slabs scheduled to receive polished concrete finishing.

3. Floors to Receive Curing and Sealing Compound:

a. Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions.
b. Recoat areas subjected to heavy rainfall within 3 hours after initial application.
c. Repeat process 24 hours later and apply a second coat.

1) Maintain continuity of coating and repair damage during curing period.

d. Applications:

1) Exposed exterior surfaces including sidewalks and equipment pads.
2) Do not use on interior slabs unless indicated otherwise.
3) Do not apply to slabs scheduled to receive polished concrete finishing.

3.14 TOLERANCES

A. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

1. Slabs on Ground, Floor Areas Less Than 10,000 Sq. Ft.:

a. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10 ft. long straightedge resting on 2 high spots and placed anywhere on surface does not exceed 1/4 inch, or 1/16 inch in 2 feet where gauged porcelain tile is scheduled.

2. Slabs on Ground, Floor Areas Greater Than 10,000 Sq. Ft.:

a. Slabs Scheduled to Receive Carpeting: Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
b. Slabs Scheduled to Polished Concrete Finishing: Specified Overall Value (SOV): F_F 50 and F_L 25 with minimum local value (MLV): F_F 40 and F_L 17.

3. Suspended Slabs, Floor Areas Less Than 10,000 Sq. Ft.:

a. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10 ft long straightedge resting on 2 high spots and placed anywhere on surface does not exceed 1/4 inch, or 1/16 inch in 2 feet where gauged porcelain tile is scheduled.

4. Suspended Slabs, Floor Areas Greater Than 10,000 Sq. Ft.:

a. Slabs Scheduled to Receive Carpeting: Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.

B. Floor Levelness Exceptions:

1. May be waived by Architect if not practical at specific locations.
2. Floor levelness requirements are not applicable at slabs sloped to drain.

3.15 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment (Type-1): Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs using a fully automatic floor scrubber with 100 grit sanding screens.
2. Do not apply to concrete that is less than 28 days old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.
6. Applications:

a. Type-1: Interior slabs on ground that are scheduled to remain exposed.
b. Type-2: Interior slabs on ground that are scheduled to receive adhered flooring materials.

3.16 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged as follows:

a. Semi-Rigid Joint Fillers: Minimum 1 month.
b. Joint Sealants Specified in Section 079200: Minimum 6 months.

2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint and trim joint filler flush with top of joint after hardening.

3.17 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar:

1. Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

a. Limit cut depth to 3/4 inch.
b. Make edges of cuts perpendicular to concrete surface.
c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Fill and compact with patching mortar before bonding agent has dried.
e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color.

a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing defects. including spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with a repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4 inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

1. Repair materials and installation not specified above may be used, subject to Architect's written approval.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports shall include reporting requirements of ASTM C31, ASTM C39, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit 3 copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Inspect formwork for shape, location, and dimensions of concrete member being formed.

2. Steel-reinforcement placement.
3. Steel-reinforcement mechanical splice couplers.
4. Steel-reinforcement welding.
5. Headed bolts and studs.
6. Verification of use of required design mixture.
7. Concrete placement, including conveying and depositing.
8. Curing procedures and maintenance of curing temperature.
9. Verification of concrete strength before removal of shores and forms from beams and slabs.
10. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Testing: Perform testing of composite samples of fresh concrete obtained in accordance with ASTM C172 according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 150 cu. yd. or fraction thereof of each concrete mixture placed each day.
2. Testing Frequency: Obtain 1 composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus 1 set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than 5 compressive-strength tests for each concrete mixture, testing shall be conducted from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

3. Slump: ASTM C143:

    a. 1 test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

4. Slump Flow: ASTM C1611:

    a. 1 test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

5. Air Content: ASTM C231, pressure method, for normal-weight concrete:

    a. 1 test for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.

6. Concrete Temperature: ASTM C1064:

    a. 1 test hourly when air temperature is 40 deg F and below or 80 deg F and above, and 1 test for each composite sample.

7. Compression Test Specimens: ASTM C31.

    a. Cast and laboratory cure 2 sets of 3 standard cylinder specimens for each composite sample.

b. Cast, initial cure, and field cure 2 sets of 3 standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39:

   a. Test 1 set of 2 laboratory-cured specimens at 7 days and 1 set of 2 specimens at 28 days or 56 days, depending on mix strength and curing requirements indicated on structural Drawings.
   b. Test 1 set of 3 field-cured specimens at 7 days and 1 set of 2 specimens at 28 days or 56 days, depending on mix strength and curing requirements indicated on structural Drawings.
   c. A compressive-strength test shall be the average compressive strength from a set of 3 specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5,000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5,000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.

       1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional Work with specified requirements.
14. Correct deficiencies in Work that test reports and inspections indicate do not comply with Contract Documents.

F. Measure floor and slab flatness and levelness according to ASTM E1155 within 48 hours of finishing and promptly report test results to Architect.

3.19 PROTECTION

A. Protect concrete surfaces scheduled to remain exposed until Substantial Completion.

B. Protect concrete surfaces scheduled to receive finished flooring until installation of floor coverings.

C. Protect concrete surfaces as follows:

1. Petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Liquid floor treatment from damage and wear during remainder of construction period.

    a. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments applicator.

4. Concrete surfaces scheduled to receive surface hardener and polished concrete finish using Floor Slab Protective Covering.

D. Prohibit the following:

1. Vehicles from interior concrete slabs.
2. Use of pipe-cutting machinery over concrete surfaces.
3. Placement of steel items on concrete surfaces.
4. Use of acids or acidic detergents over concrete surfaces.

END OF SECTION

SECTION 033000.2 – CAST-IN-PLACE CONCRETE **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Materials and work shall conform to the requirements of standards and recommended practices required in this section. In conflicts between industry standards, required standards and this specification, or this specification and the local building code, the more stringent requirement shall govern.

B. Standards:

1. Concrete is designed and controlled by the latest edition of the following:

   a. ACI 318, "Building Code Requirements for Structural Concrete."
   b. ACI 301, "Specifications for Structural Concrete for Buildings."
   c. Field Reference Manual (ACI Publication SP-15).
   d. WSDOT M 41-10, Section 5-05, Cement Concrete Pavement.

2. Contractor shall have available in the field office a copy of the ACI Field Reference Manual SP 15. This field reference manual is a compilation of ACI 301 and selected ACI and ASTM references listed in that specification.

C. Evaluation and Acceptance: Strength level of concrete will be satisfactory if 90 percent of strength test results and averages of all sets of three consecutive strength test results equal or exceed specified strength and not more than 1 test result in 100 is below specified strength by more than 500 psi.

D. Concrete Test Cylinders:

1. Owner will retain and pay for the services of an independent testing laboratory. Contractor shall coordinate and cooperate with testing service and the Engineer to perform the following:

   a. Prepare a minimum of three test cylinders for each location (slab, wall, etc.) for each day's placement or every 50 cubic yards, whichever is less.

2. Test set of three cylinders as follows:

   a. One at 7 days.
   b. Two at 28 days.

3. Prepare and test cylinders per ASTM C31 and C39.

E. Prior to placement, have available at placement location all tools, cylinder molds, slump cone, rod, curing containers, and all other apparatus required for sampling and testing.

F. Air Entrained: One test for each pour.

1.02 SUBMITTALS

A. Submit two copies of trial mix designs proposed and one copy each of 30 consecutive test results and the mix design used from a record of past performance in accordance with ACI 301.

B. Submit manufacturer's certification of meeting these Specifications for materials proposed including names, sources, descriptions, and warranties for cement, fly-ash, grouts, water-reducing admixtures, epoxy bonding materials, and curing compounds.

C. Submit a sample ready-mixed concrete delivery ticket.

1.03 STORAGE OF MATERIALS

A. Maintain in continuous clean environment and in manner required to maintain homogeneity.

B. Cements, grouts, and mortar containerized and kept in dry humidity environment. Engineer shall reject materials, which have hardened or show any evidence of initial hydration.

1.04 PRODUCT WARRANTY

A. The material manufacturer's standard warranty shall not contain any disclaimer limiting their responsibility to just the purchase price of the material. The manufacturer shall be willing to participate with the Contractor in replacing or repairing any area found to be defective due to faulty materials as determined by accepted test methods.

B. The technical data sheet of the manufacturer shall not have any statement of warranty that would be more limited than this warranty or contain any disclaimer.

PART 2 – PRODUCTS

2.01 CONCRETE

A. ASTM C94 and mix design approved by Engineer.

B. Strength:

1. Schedule (except as noted):

Type of Structure	Minimum Compressive Strength	Maximum Water/ Cement Ratio
Concrete Tanks and water-containing structures	5,000 psi at 28 days	0.40
Building Structures (foundations, slabs)	4,000 psi at 28 days	0.45
Miscellaneous Structures (equipment pads, etc.)	4,000 psi at 28 days	0.50
Duct bank or pipe encasement	2,500 psi at 28 days	Per supplier mix design

2. Cementitious content:

   a. for 5,000 psi concrete shall not be less than 610 pounds per cubic yard.
   b. for 4,000 psi concrete shall not be less than 520 pounds per cubic yard.

3. Entrained air 5-1/2 plus or minus 1 percent, for tanks and exterior concrete. Not required for interior slabs.
4. Maximum slump 3 inches; 4 inches for walls (without use of water-reducing admixtures). Where water-reducing admixtures are required to increase workability necessary to facilitate placement of low water, cement ratio concretes, slump range may be 6 to 11 inches in strict accordance with manufacturer's recommendations.

C. Cement ASTM C150: Type I or Type II for all structures.

D. Aggregates:

1. Maximum aggregate size 3/4 inch conforming to ASTM C33, grading No. 67.
2. Maximum wear 50 percent at 500 revolutions, AASHTO 96.

E. Water: Clear, free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

F. Admixtures:

1. Shall be subject to approval of the Engineer.

   a. General:

      1) Use only those specified in approved mix design.
      2) Apply in strict accordance with manufacturer's printed instructions.
      3) No chloride content permitted.
      4) Must be compatible with other admixtures.

2. Air-Entraining Agent: Air entrainment admixtures shall conform to ASTM C260.
3. Water-Reducing Admixture: Water-reducing admixture shall conform to ASTM C494, Type A.
4. High-Range Water-Reducing Admixture: High-range water-reducing admixture (superplasticizer) shall conform to ASTM C494, Type G.
5. Accelerating Admixture: Accelerating admixture, when used, shall conform to ASTM C494, Type E.
6. Retarding Admixture: Retarding admixture, when used, shall conform to ASTM C494, Type D.

2.02 CURING MATERIALS

A. Polyethylene Sheeting: 0.004-inch thick.

B. Waterproof Paper: Polyethylene-coated, Federal Specification UU-B-790 Type I, Grades A, B, C, Style 4. Define lap control lines clearly by printed markings.

C. Membrane Forming Compound: Conform to ASTM C309.

2.03 HOT WEATHER FINISHING AID

A. Evaporation retardant used to retard rapid evaporation of water from exposed concrete. “Confilm” by BASF.

2.04 BONDING AGENT

A. Bonding Agent: A multi-component compound, high strength, extended working time, suitable for use on dry or damp surfaces. Provide manufacturer’s specific instructions for application.

2.05 CONTROLLED DENSITY FILL (CDF)

A. Controlled Density Fill (CDF) or Controlled Low-Strength Material (CLSM) – a self-compacting, cementitious, flowable material requiring no subsequent- vibration or tamping to achieve consolidation. The Contractor shall provide a mix design in writing to the Engineer and utilize ACI 229 as a guide to develop the CDF mix design. CDF shall be designed to have a minimum 28-day strength of 50 psi and a maximum 28-day strength not to exceed 150 psi. The CDF consistency shall be flowable (approximate slump 3 to 10 inches).

B. The following testing methods shall be used by the Contractor to develop the CDF mix design:

1. 28-day compressive strength – ASTM D4832.
2. Unit weight, yield, and air content – ASTM D6023.
3. Slump – FOP for AASHTO T 119.

2.06 MISCELLANEOUS CEMENTITIOUS MATERIALS

A. For Fill (Manhole or Basin Bottom Fill): 400 pounds of cement, 120 pounds of fly ash per cubic yard of concrete, 3/8-inch-maximum aggregate, W/C = 0.45.

PART 3 – EXECUTION

3.01 MIXING AND TRANSPORTATION

A. Ready-Mixed Concrete: Conform to ASTM C94, concrete mixing shall be in accordance with ACI 301.

3.02 PLACING

A. Deliver only in sufficient quantities required for specified time interval use and placement. Discard concrete having initial set before placement. No remixing with water or supplementing with other materials will be permitted once initial set has occurred. Initial set as evidenced by typical hydration characteristics to be determined by Engineer.

B. Place as nearly as possible to final position to avoid segregation of the materials and displacement of reinforcement. Placement shall be completed within 60 minutes after water is first added to the mix. However, at the Engineer's discretion if climatic and temperature conditions are suitable and when the concrete is continually agitated, the time may be extended to 1-1/2 hours.

C. Do not change consistency (slump) for a given placement without the Engineer's written permission.

D. Keep open trough and chutes of steel or steel lined clean and free from coatings of hardened concrete.

E. Do not drop concrete a distance of more than 4 feet or through a cage of reinforcing steel unless concrete is designed flowable with the specified superplasticizer included in the mix, then concrete can free fall up to 10 feet.

F. Layout and sequence of placing of concrete in monolithic structures as shown on the Drawings or approved by the Engineer.

G. Within a placement, deposit concrete in horizontal layers not to exceed 24 inches in depth. Place at rate such that:

1. No concrete surface shall obtain initial set before additional concrete is placed on it.
2. Yielding of forms is not so great as to cause the concrete surfaces to exceed the tolerances specified.

H. Unless specified otherwise, place all slabs and finished floors to finish elevation in one continuous operation, except that the Contractor may place a separate finish topping if prior approval is received from the Engineer. Floor and roof slab sectional thicknesses shown are minimum thicknesses. Slopes on floors or roofs increase, rather than decrease, slab thicknesses.

I. Construction Joints:

1. Limit size of each slab or wall pour as shown on the Drawings, or as approved by the Engineer.
2. Locate construction joints so as not to impair the strength of the structure, and only at locations shown on the shop drawings or approved by the Engineer.
3. Construct bulkheads to neatly fit reinforcement and water stops and prevent concrete leakage.
4. Provide water stops or sealants in construction joints where required.
5. Continue reinforcement through construction joint unless otherwise shown or noted.
6. When noted, alternate pour at each side of construction joints with specified minimum curing time between pours.
7. Before placing concrete against previously placed concrete, thoroughly roughen and clean by wet sandblasting or green cutting with an air-water jet.

    a. Use air-water cutting at the proper time after the initial set. Use a high-pressure air-water jet to expose clean, sound aggregate without undercutting the edges of the larger aggregate. Protect adjacent subgrade when cutting is used on slab edges.
    b. After cutting or sandblasting, rinse the surface until wash water contains no cloudiness. Dispose of wastes from cutting, washing, and rinsing so wastes do not stain or abrade exposed surfaces.

8. Place concrete continuously to a predetermined construction joint.

J. Care shall be taken in placing concrete through reinforcements so that no segregation of the coarse aggregate occurs. In any placement where segregation may occur, the concrete shall be designed flowable and placed at 6 inches plus slump. Vibrators shall be inserted no farther than 3 feet from the point of placement of concrete into forms, as concrete is being placed.

K. Special care shall be taken to prevent splashing forms or reinforcement with concrete. Any hardened concrete or partially hardened concrete on the forms or reinforcements above the level of the concrete already in place shall be removed before proceeding with the work.

L. Cold Weather Placement:

1. Concrete shall be placed only when the temperature is at least 40 degrees F, and rising, unless permission to pour is obtained from the Engineer.
2. Material shall be heated and otherwise prepared so that batching and mixing can proceed in full accord with the provisions of this specification.
3. Suitable means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for a period of at least the first 5 days and at a temperature above freezing for the remainder of the specified curing period, except that where high early strength cement is used, this period may be reduced to 72 hours. The methods proposed for heating the materials and protecting the concrete shall be approved by the Engineer.
4. Salts, chemicals, or other materials shall not be mixed with concrete for the purpose of preventing freezing.

M. Hot Weather Placement:

1. The temperature of fresh concrete at the time of placement during hot weather shall be a maximum of 90 degrees F, to prevent an accelerated setting of the concrete.
2. A retarding densifier admixture shall be used when the high expected atmospheric temperature for the day is 85 degrees F or above. Admixture shall be used in accordance with the manufacturer's recommendations.

N. Placing Concrete Against Earth:

1. Unless otherwise called for on the Drawings, earth cuts shall not be used as forms for vertical surfaces without the prior approval of the Engineer.
2. Concrete placed on or against earth shall be placed only upon or against firm, damp surfaces free from frost, ice, and standing or running water. Concrete shall not be placed upon mud or upon fills until the required compaction has been obtained.

3.03 COMPACTING

A. Compact all concrete with high-frequency internal vibrators immediately after placing.

B. Use external vibrators for compacting concrete where the concrete is inaccessible for adequate compaction by internal vibrators; construct forms sufficiently rigid to resist displacement or damage from external vibration.

C. Use mechanical vibrating equipment, always keeping the vibrator within 3 feet of the discharge point into the form. For exposed concrete surfaces and architectural concrete, keep the vibrator on the unexposed side of the reinforcing steel or at least 2-1/2 inches from the form surface. Vibrate the concrete as the concrete is being placed to prevent honeycomb, rock pockets, and voids. Do not insert vibrators into lower layers of concrete that have begun to set. Vibration required on flowable concrete is about one-fourth that needed for 4-inch-slump concrete.

3.04 CURING AND PROTECTION

A. General:

1. Maintain at site, ready to install, before actual concrete placing begins, all equipment and materials needed for optimum concrete curing and protection; maintain extra vibrators on standby in case of malfunction of any unit.
2. Protect finished surfaces or edges from stains, abrasions, and breakage during the entire construction period.
3. Protect all concrete from accelerated drying and excessive heat at all times. Close all conduits and other formed openings through the concrete during the entire curing period and as long thereafter as practicable to prevent drying of concrete by air circulation.
4. Install slab-curing covers immediately after initial set or as soon as free water has disappeared from the surface of the concrete after finishing or surfacing.

B. Water Curing (use water curing specified herein for all walls and slabs where watertight construction is required):

1. Keep continuously wet by covering with an approved material or by a system of perforated pipes or mechanical sprinklers or other approved methods.
2. Keep forms wet at all times to prevent opening of joints and the drying out of the concrete.
3. Water for curing shall be clean and free from any elements, which might cause objectionable staining or discoloration of the concrete.
4. Cover surfaces completely with sheeting. Where a single sheet does not cover the entire surface, lap ends and edges at least 4 inches, and continuously seal with tape or other suitable means recommended by the manufacturer.
5. Continue waterproof sheet curing for 7 days. Maintain sheeting and edge and end seals intact for entire period. Repair immediately any breaks in the sheeting envelope.

C. Curing Compounds (use only when specifically approved and for optimum climatic conditions):

1. Do not use curing compounds unless this use is authorized in writing by the Engineer. Curing compounds are unacceptable where concrete is exposed to the direct rays of the sun or in accelerated drying conditions.
2. All interior slabs shall have membrane-forming compounds that meet the moisture retention required by ASTM C309 when applied at a normal single coat.
3. Prior to applying curing compounds to formed surfaces, the surfaces shall be moistened with a spray of water immediately after forms are removed. Moistening shall be continued until the surfaces will not readily absorb more water. The compound shall be applied as soon as the moisture film has disappeared and while the surface is still damp.

4. On slabs, the compounds shall be applied immediately after finishing and after bleeding water and "shine" has disappeared.
5. Curing compounds shall not be used on surfaces where future bonding, painting, or protective coating is required. In cold weather, curing compounds shall not be used on concrete surfaces, which are kept at curing temperature, by the use of steam.

3.05 REPAIRING CONCRETE

A. Immediately after removal of forms, break back all form ties and inspect concrete surfaces for defects. Complete repair of defects within 48 hours after removal of forms. No repairs shall be made until the defects have been reviewed and method of repair approved by the Engineer.

B. Remove all defective or damaged concrete, including honeycombed, sand streaked, or fractured material from the area to be repaired. Chip out areas to 1-inch-minimum depth. Edge shall be squared with the surface to eliminate feather edges.

C. Before placing the repair material, obtain Engineer inspection. Clean area free of chipping dust, dried mortar, and all other foreign material.

D. Keep surfaces to be repaired continuously wet for at least 3 hours prior to placing new concrete or mortar. No free water on the surface when the repair material is placed.

E. Apply a bonding agent to the area to be repaired before placing repair material. Apply the bonding agent per manufacturer's published instructions attached to container.

F. For all repair surfaces permanently exposed to atmosphere use white cement in proportions found by trial to be effective in producing a color which, in the hardened patch, will match the surrounding concrete surface.

G. Make repairs by: (1) dry-packing, (2) filling with concrete, or (3) plastering with mortar or a combination of all three in conformance with the following:

   1. Use the dry-pack method for holes at least 1 inch deep where the depth is equal to, or greater than the smallest surface dimension of the defect, such as cone-bolt or form tie holes, and for narrow slots cut for the repair of cracks. Do not use the dry-pack method where lateral restraint cannot be obtained. Place and pack dry-pack mortar in layers having a compacted thickness of approximately 3/8 inch. Solidly compact each layer over its entire surface by use of a hardwood stick and hammer. Do not use metal tools for compacting. Compact surface just flush with adjacent area. Do not use steel finishing tools or water to facilitate finishing. Color match.
   2. Use concrete replacement for (1) holes extending entirely through concrete sections; (2) for holes larger than 1 square foot and deeper than 4 inches in which no reinforcement is encountered; (3) for holes larger than 1/2 of 1 square foot where reinforcement is exposed. Concrete used for replacement shall be of the same strength and mixture as used in the structure.
   3. Use mortar replacement for holes too wide to dry-pack and too shallow for concrete replacement and when approved by the Engineer for other conditions not covered by Items (1) and (2) above.

H. Cure all repairs with the same methods as new concrete.

3.06 CONCRETE FINISHES AND TOLERANCE

A. Schedule of Concrete Finishes:

1. Area and Type:

a. Walls:

1) Exposed Interior and Exterior: W-1.

b. Slabs:

1) Interior: S-1.
2) Exterior and Top of Walls: S-3.
3) Underside: S-4.
4) Sidewalks: S-5.
5) Reinforced Concrete Pavement: S-3.

B. Concrete Wall Finishes:

1. Type W-1:

a. Fill snap-tie holes with nonshrink, nonmetallic grout.
b. Knock off projections.
c. Patch honeycomb areas and rock pockets. Small air holes do not require patching.

C. Concrete Slab Finishes:

1. General:

a. Do not excessively use “jitterbugs” or other special tools designed for the purpose of forcing coarse aggregate away from the surface and allowing a layer of mortar to accumulate.
b. Do not dust surfaces with dry materials, except where floor hardener is to be applied.
c. Thoroughly compact slabs and floors by vibration.
d. Round off all edges of slabs and tops of walls with a steel-edging tool, except where a cove finish is shown. Steel edging tool radius shall be 1/4 inch for all slabs subject to wheeled traffic.
e. After applying the final floor finish and after curing cover slabs with Visqueen or other material, keep floor clean and protect it from material and damage due to other construction work.

2. Type S-1 – Concrete Slab Finish Steel Troweled Finish:

a. Finish by screeding and floating with straight edges to bring surfaces to required finish elevation shown.
b. While concrete is still green, but sufficiently hardened to bear a person’s weight without deep imprint, float to true, even plane with no coarse aggregate visible.
c. Use sufficient pressure on floats to bring moisture to surface.
d. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.

e. Burnish surface with an additional troweling. Final troweling shall produce a ringing sound from trowel.
f. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.

3. Type S-2 – Not Used.
4. Type S-3 – Broomed Finish:

   a. Finish as specified for Type S-1 floor finish, except omit final troweling and finish surface by drawing a fine-hair broom lightly across the surface.
   b. Brooming: Sloped slabs, perpendicular to slope.

5. Type S-4 – Underside: When forming is removed, grind off projections on underside of slab, repair rock pockets and honeycomb area defects, including small shallow air pockets.
6. Type S-5 – Sidewalk Finish:

   a. Slope walks down 1/4 inch per foot away from structures, unless otherwise shown.
   b. Strike off surface by means of strike board and float with wood or cork float to a true plane, then flat steel trowel before brooming.
   c. Broom surface at right angles to direction of traffic.
   d. Lay out sidewalk surfaces in blocks with an approved grooving tool as shown or as directed by the Engineer.

D. Tolerances:

1. Unless otherwise required, allowable tolerances for concrete surfaces shall be in accordance with those shown in the table below. Surface irregularities are classified as either "abrupt" or "gradual." Offsets caused by displaced or misplaced form sheathing, lining, or form section or by defective form lumber shall be considered as abrupt irregularities. All others are classed as gradual irregularities. Gradual irregularities shall be measured with a template consisting of a straight edge for plane surfaces and its equivalent for curved surfaces.
2. The length of the template for testing formed surfaces is 5 feet. The length of the template for unformed surfaces is 10 feet. Maintain a 5-foot-long and a 10-foot-long steel template on the job site.
3. Maximum Allowable Irregularities in Concrete:

	Irregularity in Inches	
Location	Gradual	Abrupt
Walls	1/4	3/16
Slabs	1/4	1/4

3.07 UNSATISFACTORY CONCRETE

A. Any concrete placed which fails to meet or exceed the specified strength requirements as determined from molded cylinders, or cores, or to meet the density or surface requirements, or which has been frozen during placing or curing, shall be removed and replaced with satisfactory materials at the Contractor's expense.

B. Method of Determining Unsatisfactory Concrete: Visual appearance characteristic of rain or freeze damage to concrete which is apparent to the Engineer.

3.08 BONDING TO OLD CONCRETE

A. Clean existing concrete surfaces by using wet sandblast or high-pressure water jet to remove the surface film and contaminants. Roughen to 1/4-inch amplitude or as shown on the Drawings.

B. Coat the contact surfaces with bonding agent specified in paragraph 2.04. Apply the bonding agent in conformance with the manufacturer's instruction.

C. As concrete is placed, thoroughly vibrate against the contact surface.

END OF SECTION

SECTION - 033010 – PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work described in this section applies to Cement Concrete Pavement A, and B. Contractor shall deploy skilled, experienced, and artistic concrete labor and supervision personnel to achieve intended outcomes. Furnish materials, labor, transportation, services, and equipment necessary to furnish and install the work as indicated on drawings and specified herein.

1.2 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Section 031000 – Concrete Forming and Accessories
2. Section 032000 – Concrete Reinforcing
3. Section 033001 – Cast-in-Place Concrete – Sitework
4. Section 312000 – Earth Moving
5. Section 321500 – Crushed Rock Surfacing

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Federal, State and local laws and regulations governing this Work are hereby incorporated into and made part of this Section. When this Section calls for certain materials, workmanship, or a level of construction that exceeds the level of Federal, State, or local requirements, provisions of this Section take precedence.

1.4 REFERENCES

A. Specifications and recommended practices of American Concrete Institute (ACI), American Society for Testing and Materials (ASTM), The Uniform Building Code, referred to in this Specification with their individual designations are to be considered part of this Specification.

B. Design and Control of Concrete Mixtures – Thirteenth Edition; Portland Cement Association.

1.5 QUALITY ASSURANCE

A. All concrete work shall be done with extreme care by a company specializing in cast-in-place concrete with a minimum of 10 years of documented experience. Any work which does not conform to the construction documents shall be rejected, removed, and redone.

B. Engage experienced personnel who have completed at least three (3) completed installations of similar scope and complexity using this application, material, design, and extent indicated for this Project.

C. Submit resumes of Concrete Foreman and two installers/finishers that will be performing the installation.

D. Single Source Responsibility: Obtain each color, type, and variety of materials from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying work.

E. Testing:

1. The Owner's testing firm will take cylinders and perform slump, compression strength, and air entrainment tests in accordance with ACI 301. Provide Testing Lab with 24 hours' notice.

F. Contractor is informed that only the highest quality workmanship will be accepted.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 013500 – Project Meetings.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.
e. Installer and manufacturer's representative for sealer/hardener/densifier.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes, and finishing, cold- and hot-weather concreting procedures, curing procedures, construction expansion and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, steel reinforcement installation, concrete repair procedures, finishes, and concrete protection.

1.6 SITE INSPECTION

A. Verify conditions at site that affect work of this Section.

B. Take field measurements as required.

C. Report major discrepancies between Drawings and field dimensions to Owner's Authorized Representative prior to commencing work.

1.7 SUBMITTALS

A. Product Data: Submit product data as required and as specified in Section 013300 Submittal Procedures. Include joint filler data, admixtures, and curing compound information. Submit a list of products specified in this section, no later than 10 days after contract award.

B. Submit Design Mix: Low slump as specified. Batch history provided for each mix.

C. Mock-Ups: Prepare mock-ups per section 013300 Submittal Procedures. Prepare the following mock-ups illustrating specified textured finish and color admixture as required. Approved Mock-up may remain in place as finished product. Rejected Mock-ups shall be removed.

1. Natural Color Portland Cement, Cement Concrete Pavement A and B with one saw cut joint, one expansion joint, and with Medium Broom Finish.
2. Mock-ups shall remain as sample to match throughout project and shall be a minimum of 12’ wide and 12’ long with one expansion joint at center. Make up to two mock-ups to meet Landscape Architect’s requirements.

D. Shop Drawings: Submit shop drawings for reinforcing steel and accessories in accordance with ACI standards.

1. Paving Jointing and Pour Sequence Plan - submit electronic file indicating the following:

   a. Proposed layout of expansion and control joints. Clearly delineate the different joint types.
   b. Layout of paving types as indicated on Drawing Paving Schedule. Give overall dimensions of each paving type.
   c. Concrete pour sequence. Indicated sequence of paving pour installation.

E. Statement of Mix Design: Submit (1) copy of Statement of Mix Design prepared by batch plant servicing Project for each load delivered to Project. Statement of Mix Design to contain following information:

1. Name, address, and telephone number of batch plant preparing statement of mix design.
2. Date of mix design.
3. Project location.
4. Contractor requesting load delivery.
5. Mix design number.
6. Integral color used.
7. Gradations for sand and aggregate.
8. Material weights, specific gravity, and absolute volumes.
9. Basis of testing, i.e., UBC 2605 D4 and Title 24 2604 D4.
10. Water/cement ratio.
11. PSI rating.
12. Signature of testing laboratory manager.
13. Signed stamp from registered Project structural engineer or architect.

1.8 REFERENCE STANDARDS

A. All work shall comply with Jurisdiction’s Standard Drawings and Washington State Department of Transportation Standard Specifications (WSDOTSS).

B. All exterior cement concrete pavement surfacing shall comply with ADA Standards for Accessible Design, Ground and Floor Surfaces per latest addition of Code of Regulations by the Department of Justice.

1.9 TESTING

A. A testing agency will be designated by Owner. Contractor shall provide Testing Agency with 120 hours' notice of testing.

1.10 PROJECT CONDITIONS

A. Keep Work area clean, and in a safe and workmanlike condition so that rubbish, waste and debris do not interfere with work of other trades.

1.11 PRODUCT HANDLING

A. Store materials in a dry and protected location. Protect reinforcing steel from rusting, deformation, staining, and moisture damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: Conform to "Specifications for Portland Cement" ASTM C150-68, Type I or Type II, Class 4000. Do not use different cements or different brands of cement interchangeably in the same element or portion of the work; use one brand and color of cement for all exposed concrete.

B. Aggregates: Conform to "Specifications for Concrete Aggregates" ASTM C 33-69. Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall conform to the grading requirements of the appropriate ASTM specifications.

C. Water: Mixing water shall be clean and free from injurious amounts of oil, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or steel.

2.2 PROPORTIONING

A. General: Concrete for all parts of the work shall be homogeneous and when hardened, shall have the required strength, resistance to abrasion, watertightness, appearance, resistance to deterioration, durability, and other properties specified herein.

B. Slump: Slump for concrete as determined by "Method of Test for Slump of Portland Cement Concrete" ASTM C 143-69, shall be 2-4 inches.

Make one test for each batch of concrete and at least one test per hour during a continuous pour.

C. Aggregate Size: Maximum size of the aggregate is 3/4" but not larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, or three-fourths of the minimum clear distance between reinforcing bars and side forms. See structural drawings for other requirements.

D. Admixtures:

1. Air-Entraining Admixtures, Pozzolanic Materials, and Proprietary Chemical Admixtures: Use in accordance with manufacturer's recommendations. All admixtures must be compatible with one another.
2. Rheocrete 222+ or other Owner-approved corrosion-inhibiting admixture will be used in all concrete with reinforcing steel. Admixture must provide both passive and active protection of reinforcing steel. Rheocrete 222+ shall be used at a dosage rate of one gallon/cubic yard of concrete.
3. Air-entraining admixture will comply with ASTM C260 and be certified by manufacturer to be compatible with other required admixtures.
4. Water-reducing admixture will comply with ASTM C494, Type A, and be certified.

E. Proportion of Ingredients: Proportion ingredients to produce the proper playability, durability, and strength. Proportion ingredients to produce a mixture which will work readily into the corners and angles of the forms, and around reinforcement by the methods of placing and consolidation employed on the work, but without permitting the materials to segregate, or excessive free water to collect on the surface.

Strength (psi)	Min. Cement Content Minimum Sacks per Cu. Yd.
4,000	6-Paving

The minimum cement contents above may be reduced by 1/2 sack per cubic yard when an approved water reducing additive is used.

F. Fly Ash: Use one sack Fly Ash per cubic yard, must comply with ASTM C618, Type F.

2.3 MIXING

A. Standards: Mix and transport ready-mixed concrete in accordance with "Specifications for Ready-Mixed Concrete" ASTM C 94-69.

B. Slump: Mix concrete only in quantities for immediate use. Do not make indiscriminate addition of water to increase slump. When concrete arrives at the project with slump below that suitable for placing, water may be added only if the maximum permissible water-cement ratio or the maximum slump is not exceeded, and only at the direction of the Owner.

C. Temperatures: The as-mixed concrete temperature shall not be less than 55 degrees F when the ambient temperature falls below 40 degrees F. If water or aggregate has been heated, combine water with the aggregate in the mixer before cement is added when the temperature of the mixture is greater than 100 degrees F.

2.4 EXPANSION JOINT & MATERIALS

A. Joint Filler: ASTM D1752, Type I; closed cell isometric polymeric foam, resilient recovery of 95 percent if not compressed more than 50 percent of original thickness; 1/2" thick "Ceramar", manufactured by W.R. Meadows or approved equal.

B. Expansion Joint Cap: Removable, high-impact extruded polystyrene, placed on joint filler during concrete placement; removed after curing to expose 1/2" deep sealant trough of covered dimensions; "Joint Cap" by the Burke Company or approved equal.

C. Premilled expansion joint filler shall be of sufficient size to cover the full depth of the concrete section. Joints shall be 1/2" thick. Provide removable plastic cap (zip-strip) to hold joint filler below concrete surface. Refer to locations shown on the drawings.

D. Joint Sealant w/ Sand Topping: ASTM D5893/D5893M-16 Cold-Applied, Single Component, Chemically Curing Silicone Joint Sealant; product shall be Pourthane SL Self-Leveling Polyurethane Joint Sealant, manufactured by W.R. Meadows.

1. Sand topping for the joint sealant shall comply with ASTM-C144

2.5 REINFORCEMENT

A. Per Section 032000 – Concrete Reinforcing.

PART 3 - EXECUTION

3.1 SUBGRADE

A. Subgrade to meet requirements of project's Earthwork section.

B. Ensure that subbase and subgrade is compacted to 95 percent prior to placing concrete.

C. Ensure that utilities, including irrigation lines and sleeves are buried and compacted below bottom of subbase.

D. Keep subbase damp prior to placing concrete. Compact subgrade to 95% of maximum density as determined by ASTM D-1557-M.

3.2 FORMWORK

A. General: Reference Section 031000 – Concrete Forming and Accessories. Landscape Architect and Contractor shall verify all formwork grades prior to pouring. Obtain Landscape Architect's approval of formwork before placing concrete. All curves shall have a consistent radii and vertical grade, straight tangents shall unwavering in the horizontal and vertical alignment.

B. Contractor is required to measure all formwork to laser level accuracy and shall provide a laser level on site for the O.R. to use to check grades.

3.3 TOLERANCES

A. The top of the finished concrete shall not deviate more than one-eighth inch (1/8") in ten feet (10'), or the alignment one-fourth inch (1/4") in ten feet (10').

3.4 CONCRETE FINISHES

A. Concrete Thickness: 4 or 6 inches, as indicated in Drawings, except at thickened edge.

B. Medium Broom Finish: Pull broom across freshly floated concrete to produce rough texture perpendicular to direction of travel of the concrete panels. Texture created shall be 1/32-inch to 3/64-inch in depth.

C. Edge all concretes with 1/2" radius edger.

D. Cement Concrete Pavement A, and B

Finish for Cement Concrete Pavement A and B shall be a medium broom finish with brush strokes perpendicular to longitudinal slope.

3.5 CLEAN UP

A. Contractor shall clean up and remove all concrete spatters and spray evidence on other site improvements immediately. All evidence of excess concrete disposed on site shall be removed from project site within 48 hours of pour.

B. Clean up entire area of all excess materials, debris, etc., and leave project in a neat, orderly condition.

END OF SECTION

SECTION 033130 – CEMENTITIOUS WATERPROOFING **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SUMMARY

A. Section describes cementitious waterproofing of water containing concrete structures.

B. Areas to be waterproofed:

1. Headworks channels and distribution box.
2. The walls of the MBR tanks.
3. MLR Channel.
4. RAS channel and RAS Distribution Structure.
5. Roof of the Pipe Gallery between the MBR Tanks.

C. Waterproofing may also be used in lieu of damp proofing of below-grade building walls.

D. Repair of cracks in water-containing structures as noted below.

1.02 QUALITY ASSURANCE

A. All material from one supplier.

1.03 SUBMITTALS

A. Certification of quality of all waterproofing materials to be used.

B. Description of materials supplied and description of proposed method of application.

C. Description of application method at pipe penetrations.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered and stored in their original unopened containers.

B. All material shall be handled and stored in such a manner as to prevent contamination or deterioration from weather or humidity.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Waterproofing Material: Concrete crystalline waterproofing admixture, Xypex Admix C-1000.

B. Water: Clear and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

C. Supplier: Xypex as manufactured by Xypex Chemicals, Ltd. of Canada, or approved equal.

D. Storage: Xypex products shall be stored at 50 degrees F or greater. Shelf life is less than one year.

PART 3 – EXECUTION

3.01 ADDING TO CONCRETE (ADMIX)

A. Xypex Admix C-1000 must be added to the concrete at the time of batching. The sequence of procedures for addition will vary according to the type of batch plant operation and equipment.

1. Mix ratio shall be 12.2 lbs/cy or 2 percent of cement weight excluding fly ash.

B. Ready Mix Plant – Dry Batch Operation: Add Xypex Admix in powder form to the drum of the ready-mix truck, per manufacturer's recommendations.

C. Ready Mix Plant – Central Mix Operation:

1. Mix Xypex Admix with water to form a very thin slurry (e.g., 15–20 lb/6.75–9 kg of powder mixed with 3 gallons/13.6 liters of water). Pour the required amount of material into the drum of the ready-mix truck. The aggregate, cement and water should be batched and mixed in the plant in accordance with standard practices (taking into account the quantity of water that has already been placed in the ready-mix truck). Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of the Xypex Admix throughout the concrete.
2. Contractor to provide documentation tickets from concrete supplier that admix was added to concrete per manufacturer's instructions. If documentation is not supplied, Contractor shall provide Xypex "Concentrate" coating as specified below.

3.02 SURFACE PREPARATION ("CONCENTRATE") – FOR CRACK REPAIR ONLY

A. Construction Joint or Crack Repair:

1. Prepare cracks or joints as recommended by the manufacturer. This will include chipping or grinding a slot over the joint or crack as required to insert the dry pack mixture.
2. Apply one slurry coat of Xypex "Concentrate" at a coverage of 1-1/2 pounds per square yard to slot and to 6-inch strip on either side of slot. Application may be performed by brush or by hand.

3. While slurry coat is still tacky, fill slot to surface with Xypex "Concentrate" mixed by adding one part clean water to six parts "Concentrate." Blend by trowel for 10 to 15 seconds only. Lumps SHOULD be present in the mixture. Apply the Dry-Pac by hand, followed by compressing tightly using a pneumatic packing device or a hammer and block.
4. Wet Dry-Pac surface lightly with water and then apply a slurry coat of Xypex "Concentrate" at a coverage of 1-1/2 pounds per square yard over the repaired area.
5. For curing, fog spray periodically with water for 2 days or apply Xypex "Gamma Cure" immediately after the slurry coat has set.
6. Repeat Steps 1 through 5 if leaks re-occur.

END OF SECTION

SECTION 033301 – HYDRAULIC STRUCTURE WATER LEAKAGE TESTING **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. Except as otherwise provided, all hydraulic structures shall be tested. The Contractor shall furnish all equipment, labor, and materials required for testing hydraulic structures.

B. Structures to be tested include:

1. Headworks.
2. Wall between Anoxic and Aeration basins.
3. Each chamber of the MBR Tank Structure.
4. Channels leading to and from the MBR Tanks.

1.02 SUBMITTALS

A. Submit detailed testing plan for each structure listed in Paragraph 1.01B at least 14 days prior to execution of test.

PART 2 – MATERIALS

2.01 WATER

A. Water used for testing shall be clear, free from injurious amount of oil, acid, salt, alkali, organic matter, or other deleterious substances.

B. Owner will provide water required for one leak test on each structure listed in Paragraph 1.01B. If first leak test fails, all water required for additional testing shall be provided and paid for by the Contractor.

2.02 TEST PLUGS

A. Contractor shall be responsible for provision of plugs to seal tank openings to allow testing to full depth of tank.

PART 3 – EXECUTION

3.01 PROCEDURES

A. Prior to testing, all hydraulic structures shall be cleaned by thoroughly hosing down all surfaces with a high-pressure hose.

B. Testing shall be performed prior to backfilling, except where noted or otherwise permitted by the Owner. Testing shall not be performed sooner than 28 days after all portions of structure walls have been completed. The test shall consist of filling the structure with water to the maximum operating water surface. After the structure has been kept full for 48 hours, it will be assumed for the purposes of the test, that the absorption of moisture by the concrete in the basin is complete.

C. Testing of multi-chamber tanks shall be done sequentially to verify leak-tightness of all tank compartments.

D. If protective coatings are to be applied to the surfaces of the hydraulic structure, such coatings shall be applied after all testing operations have been completed.

E. Release of water from structures, after testing has been completed, shall be as directed by the Owner.

3.02 LEAKAGE TEST AND REPAIRS

A. After the structure has been filled, the leakage test shall be performed as follows: An initial water level reading shall be made. Seven days following the initial reading, a second reading shall be made. The structure shall be considered passing if water loss during the 7-day period, as computed from the two water level readings, does not exceed 0.7 percent of the total volume of water in the structure, after allowance is made for evaporation and precipitation. Should the structure fail the test, it shall be repeated for up to three additional 7-day test periods. If, at the end of 28 days, the structure still fails, the Contractor shall empty the structure as directed by the Owner and examine the interior for evidence of cracking or other conditions responsible for leakage. Any source of leakage shall be repaired to the satisfaction of the Owner. Following these operations, the Contractor shall again test the hydraulic structure.

B. If the 7-day reading exceeds the allowable, it may be taken as the initial reading, with the second reading taken after another 7 days.

C. Two open-top watertight containers shall be partially filled and floated on the water surface. The water surface shall be measured from the top of the level containers as a method of determining volume change due to precipitation and evaporation during the test.

D. Readings shall be taken by the Contractor in the presence of the Owner.

END OF SECTION

SECTION 033543 – POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polished concrete finishing.

B. Related Requirements:

1. Section 033000 – Cast-in-Place Concrete – Architecture, for concrete related to polished concrete, including concrete materials, mixture design, placement procedures, initial finishing, and curing.

1.2 DEFINITIONS

A. Terminology and Finish Gloss as defined by Concrete Polishing Council (CPC).

B. Bonded Abrasive Polished Concrete: Multi-step operation of mechanically grinding, honing, and polishing of a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to maximum potential to achieve a specified level of finished gloss as defined by the CPC.

C. CPC: Concrete Polishing Council. An organization that supports concrete floor polishing industry through position statements, specifications, seminars, webinars, and online training, and that offers consensus-based definitions, procedures, and best practices to suit every polished concrete surface.

D. Design Reference Sample: Sample designated by Architect in Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

E. Finished Gloss: Processing a concrete floor surface to achieve a specified level of finished gloss prior to application of protective treatments.

1. Reflective Clarity: DOI (distinction of image) value of degree of sharpness and crispness of reflection of overhead objects when measured by a device in accordance to ASTM D5767. Value indicated is prior to application of sealer.
2. Reflective Sheen: Specular gloss value of degree of gloss reflected from a surface, at specified angles of illumination, when measured by a device in accordance to ASTM D523. Value indicated is prior to application of sealer.

F. Grout: Thin mortar used to fill surface imperfections including holes, surface damage, small and micro cracks, air holes, pop-outs, and voids to eliminate micro pitting in finished Work.

G. Polished Concrete: The act of changing a concrete floor surface to achieve a specified level of gloss.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Schedule Work and coordinate troweling of concrete finish and curing of concrete slab with Work of Section 033000.
2. Do not permit use of curing compounds on slabs receiving Work of this Section.
3. Do not permit use of fiber reinforcing in slabs receiving Work of this Section.

B. Preinstallation Meeting: Conduct meeting at Project site.

1. Meeting Time: Schedule meeting a minimum of 2 weeks prior to beginning Work of this Section and related Work.
2. Attendees: Owner, Architect, Contractor, Contractor's superintendent, independent testing agency responsible for concrete design mixtures, ready-mix concrete manufacturer, cast-in-place concrete Subcontractor, polished concrete finishing Subcontractor, polished concrete system manufacturer’s trained technical representative, and other entities as requested to attend.
3. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials.
4. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete finishing, and protection of polished concrete.
5. Discuss floor protection plan.
6. Discuss procedures for cleaning up slab spills, including use of and availability of cleaning chemicals and absorptive materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include for each grinding machine, including types of grinding heads, dust extraction system, joint fillers, concrete densifying impregnators, penetrating sealer, and other chemicals used in the process.

B. Polishing Schedule: Submit plan layout showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples for Verification: For each type of exposed finish.

D. Manufacturer's Instructions: Application instruction, special procedures, and conditions requiring special attention.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Include certification of Installer’s experience.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Repair materials.
2. Stain materials.
3. Liquid floor treatments.

1.6 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with not less than 3 years of experience in grinding and polishing of concrete flooring similar in complexity to Work required for this Project, including specific requirements indicated.

1. Successfully completed not less than 5 comparable scale projects using this equipment.
2. Factory trained or approved by system manufacturer for concrete preparation, toppings, grinding, and polishing work, with factory-trained supervisor on site during concrete floor polishing operations.

B. Supervisor Qualifications: Current certification from Concrete Polishing Council (CPC) stating that technicians are certified as Craftsmen Level II or higher.

C. Field Samples:

1. Build field samples approximately 50 sq. ft. for each concrete finish and sheen specified.

a. Field sample may be built at an area of slab that will subsequently be covered by carpet, provided that slab area is from same concrete mix and pour as areas scheduled for polished concrete finish.
b. Build field samples before casting concrete.
c. Build field samples in conjunction with concrete slab field samples specified Section 033000.

2. Use specular gloss meter and coefficient of friction testing equipment as required to verify accepted gloss level and coefficient of friction.
3. Demonstrate curing, finishing, and protecting of polished concrete. Approval of system will be based on aesthetic compliance for the following:

a. Approved submittals.
b. Specified finished gloss level.

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for pedestrian traffic as required for other construction activities.

B. Ambient Conditions:

1. Maintain temperatures recommended by polished flooring manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in factory sealed containers, clearly labeled and marked with manufacturer's name, address, batch number, and date of manufacture.

B. Store materials per manufacturer's printed instructions. Store materials to be used in conjunction with application of system indoors, protect from damage, and maintain at temperatures no lower than 40 deg F.

1.9 FIELD CONDITIONS

A. Ambient Conditions:

1. Proceed with installation only when existing and forecasted weather conditions permit polished concrete Work to be performed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Provide Installer's "single source" warranty to repair or replace concrete finish damaged due to Installers' neglect, poor workmanship, or other warranted failures.

1. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Floor Surface Profile: Prior to beginning concrete polishing Work, test floor surfaces according to ASTM E1155 to verify flatness and levelness requirements as specified in Section 033000 for concrete floor slab flatness and levelness.

1. Floor levelness requirements may be waived by Architect if not practical at specific locations.
2. Floor levelness requirements are not applicable at slabs sloped to drain.

B. Design Criteria: The following gloss levels are based on CPC Polished Concrete Appearance Chart:

1. Level 2, Satin (Honed): Images of objects being reflected have a matte appearance.

a. Image Clarity Value, Percent: 10-39.

2.2 POLISHED FLOOR FINISHING SYSTEMS

A. Polished concrete finishing systems that include hardener-densifiers and stain and wear protection finish coats.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ARDEX Americas:

1) Sealer and Densifier: ARDEX PC 50 Lithium Densifier.
2) Finish Sealer: ARDEX PC Finish.

b. Advanced Floor Products, Inc.: Retro-Plate 99.

1) Sealer and Densifier: Retro-Plate 99.
2) Finish Sealer: RetroGuard.

c. Laticrete International, Inc.: FGS Permashine.

1) Sealer and Densifier: FGS Hardener Plus.
2) Finish Sealer: Permaguard SPS.

d. Sika Corporation: Scofield Formula One.

1) Sealer and Densifier: Scofield Formula One Lithium Densifier MP.
2) Finish Sealer: Scofield Formula One Guard-W.

e. W.R. Meadows, Inc.: Induroshine.

1) Sealer and Densifier: Liqui-Hard Ultra.
2) Finish Sealer: Bellatrix.

2.3 ACCESSORIES

A. Stain Protection Sealer: Ready to use, low odor, VOC compliant, stain and food resistant penetrating concrete sealer that meets slip-resistance according to ASTM D2407 and stain-resistance according to ASTM D1308.

1. Product: Subject to compliance with requirements, provide stain protection sealer that is acceptable to polished concrete finish manufacturer and applicator.

B. Floor Protection Cover: Heavy-Duty, impact-resistant, vapor-permeable, flexible, multi-ply, textured membrane laminated with a non-woven polypropylene film acceptable to polished concrete finish product manufacturer and Installer.

1. Seaming Tape: Acceptable to floor protection product manufacturer.

C. Joint Sealants: Acceptable to polished floor system manufacturer and applicator. Comply with requirements of Section 079200.

D. Semi-Rigid Joint Filler (SR.JNT-1): 2-component, semi rigid, 100 percent solids, aromatic polyurea.

1. Polyurea Products: Subject to compliance with requirements, provide one of the following:

a. ARDEX Americas: Ardiseal Rapid Plus.
b. Curecrete Distribution Inc.: CreteFill Pro 85.
c. Euclid Chemical Company (The): Euco Qwikjoint UVR.
d. Laticrete International, Inc.: L&M Joint Tite 750.
e. MAPEI Corporation: Planiseal RapidJoint 15.
f. Master Builders Solutions: MasterSeal CR 100.
g. Sika Corporation: Sika Loadflex-524 EZ.
h. Approved substitution.

E. Grout: A thin mortar consisting of epoxy, urethane, poluyrea, or polyaspartic resins or latex, acrylic, and silicate binders mixed with cement dust from previous grinding steps.

F. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Close areas to traffic during and after polished concrete application for a period of time recommended by polished flooring system manufacturer.

B. Install barriers at adjacent building areas and cover adjacent construction to limit air-borne dust from settling on surfaces and entering adjacent areas.

C. Mask adjoining surfaces not receiving polished finishing to prevent overspray, spillage, leaking, and migration of sealers.

D. Remove protective coverings from concrete slab and thoroughly clean concrete surfaces to remove dirt, form oil, plaster, stains, oil, grease, adhesives, water repellants, compounds, and other substances that may deter penetration.

E. Fill cracks, holes, and depressions in substrates with patching mortar and remove bumps and ridges to produce a uniform and smooth substrate prior to starting of grinding operations.

3.2 INITIAL GRINDING AND POLISHING APPLICATION

A. Perform grinding, honing, and polishing procedures for dry grinding and honing according to recommendations from CPC.

B. Scrub and rinse slab surface with clean water and vacuum with auto-scrubber between and after final passes.

C. Perform sequential progression of diamond tooling steps and limit to no more than double the grit value of previous diamonds used.

D. Overlap adjacent passes by 25 percent.

E. Perform each pass perpendicular to subsequent pass; multiple passes may be needed.

F. Progressively grind, hone, and polish slab surface utilizing approved diamond segments as necessary to produce finishing requirements, stopping at 1 polish level less that that specified for finished surface or as recommended by polished flooring applicator.

1. Where necessary to fill gaps, voids, and pop-outs during grinding operation, apply patching mortar or grout coat according to manufacturer's recommendations.

3.3 CONCRETE SURFACE REPAIRS

A. Mix patching mortar or grout material with dust created by grinding operations.

B. Fill surface imperfections including holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with patching mortar to eliminate micro pitting in finished Work.

C. Using grinding equipment with appropriate grinding pad, work patching mortar and treatment into concrete surface and fill surfaces to eliminate imperfections.

1. Repaired surface will be acceptable when there is no noticeable difference between existing and repaired surfaces when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Edges: In areas inaccessible to grinding equipment, use special hand-held or walk-behind edge grinding tool to perform polished finishing operations immediately following grinding equipment operations.

1. Follow same steps and procedures as required for grinding equipment to match adjacent slab finish.

3.4 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Apply undiluted liquid floor treatment material to slab to point of rejection using low-pressure spray keeping concrete surface wet for 5 to 15 minute period without producing puddles. Remove excess liquid and dispose in proper manner.

B. Allow liquid floor treatment to gel and dry, then continue progressively polishing floor surface with resin diamonds as necessary to produce desired final finish.

3.5 POLISHING

A. Polish Finish:

1. Sheen LevelLevel 2; Low sheen, 400 grit or as indicated on Drawings.
2. Class: Class B – Fine Aggregate (Salt and Pepper Finish).

B. Polishing, General:

1. Process: Use dry grinding and polishing techniques.
    a. Wet grinding and polishing is not acceptable.
2. Grinding Equipment: Use of electric machines required.
    a. Propane-fueled equipment is not acceptable.
3. Apply polished concrete finish to ramps and vertical stair risers adjacent to and contiguous with slabs receiving polished concrete finishing.

C. Apply polished concrete finish system to cured and prepared slabs to match accepted field sample.

1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved field sample.
2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved field sample.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

3.6 SEALING

A. After final polishing of surface, apply sealer at rates recommended by sealer manufacturer.

1. Apply to clean, dry slab at completion of mechanically polishing no higher than 800-grit. Ensure scratch pattern is not visible before application.
2. Lightly wet a lint free short nap paint roller with interior high performance sealer and remove excess, leaving primed paint roller.
3. Roll out sealer using minimal downward force. Evenly roll sealer without leaving overlap lines. Work from 1 control joint to another.
4. Maintain a thin, even coating and wet edge. Do not over apply.
5. If additional sealer is required to meet sheen approved in field sample, allow 4 to 6 hours of dry time before applying a second sealer coat.
6. To increase gloss, wait at least 12 to 24 hours after final coat is applied, then use a high- speed burnisher fitted with a burnishing pad. Burnish at a slow walking pace.

3.7 CLEANING

A. Immediately clean up spills on slab. Provide cleaning chemicals and absorptive materials approved or recommended by polished concrete finishing products manufacturer and applicator.

3.8 PROTECTION

A. Protect finished floors with temporary floor protection product to prevent damage including grinding and scratching by construction traffic and activities until Substantial Completion.

B. Do not drag or drop equipment or material across slab that will cause damage to floor slab.

C. Inspect tires for debris prior to use on slab. Remove embedded items that may cause damage to floor slab.

D. Provide a clean slab surface using concrete maintenance cleaner within an auto scrubber, equipped with soft nylon brushes, in accordance with manufacturer's published recommendations.

END OF SECTION

SECTION 034810 – PRECAST CONCRETE VAULTS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section covers furnishing and installation of special purpose precast concrete vaults with ladder and safety post, as applicable.

1.02 ADAPTATION OF PRODUCT

A. Furnish product readily adaptable for installation and operation in the manner shown on the Drawings.

1.03 SUBMITTALS

A. Shop drawings showing detailed dimensions, block outs, floor doors, and specifications for materials used, parts, devices, and other accessories forming part of the vault, ladder, and safety post.

PART 2 – PRODUCTS

2.01 GENERAL

A. The vaults shall be precast as manufactured by Oldcastle Precast, or equivalent, with tops, walls, and bases modified as shown on the Drawings.

2.02 DESIGN

A. Conform to ASTM C913.

B. Design for 16,000-pound wheel load, AASHTO HS20-44.

2.03 FABRICATION

A. Precast elements shall provide for watertight sealing of mating surfaces using epoxy grout, field applied.

B. Openings shall be located and sized as dimensioned on the Drawings. Where drains are connected to piping below the base of the precast unit, provide adequate opening with keyway to facilitate a field installation and grouting of base drains and trap units as shown on the Drawings. Standard products may be used where provision exists for achieving the configuration shown on the Drawings.

1. For vaults with drains, installing Contractor shall add concrete fill to slope the floor towards the drain.

C. Embedded items shall be provided in the tops, walls, and bases where indicated on the Drawings.

1. Furnish access hatches with frames cast integrally with the concrete top unit and in accordance with the notes on the Drawings.

2.04 LADDER RUNGS

A. Conform to applicable requirements of ASTM C478.

B. Conform to OSHA.

C. Designed so that foot cannot slide off the ends.

D. Space rungs at 12 inches and locate as shown on the Drawings.

E. Project uniformly inside wall.

F. Be deformed bar conforming to ASTM A615, intermediate or standard grade, hot bent and galvanized after bending. For bending, the temperature shall be at least 1,600 degrees F. Galvanizing shall conform to ASTM A123.

G. Design utilizing other materials or shapes that conform to the requirements of this specification may be used upon written approval of the Owner.

2.05 SAFETY POST

1. Provide vaults with ladder safety posts where shown on the Drawings.
2. Safety post shall be OSHA 1910.27 compliant and extend 42 inches above platform to provide safe ladder access through floor door. Must support minimum 200-pound load.
3. Material of Construction:

    a. 1-1/2 inch by 1-1/2 inch by 1/8 inch high strength square stainless steel type 304.
    b. Finish: mill
    c. Balance Spring: Stainless steel constant force spring shall be provided to provide smooth, easy controlled operation when raising and lower the safety post.
    d. Hardware: Type 316 stainless steel.

4. Safety post shall have a pull up loop provided at the upper end to facilitate raising of post.
5. Acceptable Manufacturer:

    a. Nystrom.
    b. Bilco.
    c. Or Equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The bottom of the excavation for the vaults shall be fine graded to a plane surface on firm undisturbed subgrade material. Loose subgrade soils shall be compacted.

B. Granular pipe bedding material shall be uniformly spread to a depth of 4 inches over the bottom of the excavated area to provide uniform bearing for the vault. Foundation bedding material shall be brought to precise elevations called for on the Drawings and leveled.

C. Install vault and accessories in conformance with Drawings, Specifications, and recommendations of vault manufacturer unless otherwise instructed in writing by the Engineer. Vault location and orientation shall conform to the Drawings.

D. The vault joints, pipeline, and conduit penetrations through walls, as shown on the plans, shall be sealed watertight using epoxy cement grout. No leakage will be allowed into the vault.

E. Concrete fill for sloping vault bottoms to the vault drain shall be placed by the Contractor in the field.

F. Follow Manufacturer's instruction for installing safety post.

END OF SECTION

SECTION 034820 – WET WELL **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide and install wet well base, riser(s) and top slab as shown on the Contract Drawings and described herein.

1.02 QUALITY ASSURANCE

A. Testing by Manufacturer:

1. Submit two copies of all test results which shall include a certification that material to be delivered is represented by the samples tested and that such delivered materials meet or exceeds the Specifications requirements.
2. The Owner shall have free access to all testing and records pertaining to material to be delivered to the jobsite.

1.03 ADAPTATION OF PRODUCT

A. Furnish product readily adaptable for installation and operation in the manner shown on the Drawings.

1.04 SUBMITTALS

A. Shop drawings showing detailed dimensions, block outs, floor doors, and specifications for materials used, parts, devices, and other accessories forming part of the wet well.

PART 2 – PRODUCTS

2.01 PRECAST WET WELLS

A. Precast concrete wet wells shall conform to the requirements of ASTM C478 except as specifically modified herein.

B. Joints between precast elements designed to accommodate a rubber gasket joint with the existing riser section similar to pipe joints conforming to ASTM C443. Design of joints shall be approved by the Owner before manufacture. Shop drawings shall be submitted for review. Variations in joint dimensions shall meet the gasket design requirements but shall in no case be more than the minimum requirement of ASTM C478.

C. Openings to receive pipes shall be circular and shall be sized to equal the outside diameter of the pipe to be inserted in the joint plus the wet well wall thickness.

D. Resilient connectors conforming to ASTM C923 may be used at the Contractor's option.

2.02 FLOOR DOORS

A. Openings using Floor Doors shall be as shown on the Drawings.

PART 3 – EXECUTION

3.01 WET WELL INSTALLATION

A. Wet well shall be constructed of precast units.

B. Precast Sections:

1. Placed and aligned to provide vertical sides and vertical alignment of the ladder rungs, if applicable.
2. The completed wet well shall be true to dimensions and watertight.
3. Lift holes shall be thoroughly wetted and then be completely filled with mortar and smoothed and pointed both inside and out to ensure water tightness.
4. Steel loops must be removed and be covered with mortar, smoothed, and pointed.

C. Backfill:

1. Extend around wet well and at least one pipe length into each trench.
2. Hand place and tamp with selected native material up to an elevation of 6 inches above the crown of all entering pipes.

END OF SECTION

SECTION 036000 – GROUTING **(FOR SCHEDULE B ONLY)**

1.01 SUMMARY

A. This section specifies nonshrink grout and epoxy grout for use in applications including but not limited to grouts for leveling machine bases to equipment pads, manhole masonry units, joints between precast concrete sections, and grouting under base plates. Epoxy adhesives for concrete applications including, but not limited to pressure injection of cracks and doweling of anchor bolts, threaded rod anchors and reinforcing bar dowels.

1.02 QUALITY CONTROL

A. Referenced Standards: This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM C33	Concrete Aggregates
ASTM C40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
ASTM C136	Test Method for Sieve Analysis of Fine and Course Aggregates
ASTM C150	Portland Cement
ASTM C289	Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C881	Standard for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C1017	Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM E329	Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
CRD-C-621	Corps of Engineers Specification for Nonshrink Grout

1.03 SUBMITTALS

A. Procedures: Section 013300.

B. Manufacturer's Data for the following:

1. Nonshrink cementitious grout.
2. Epoxy grout.
3. Admixtures for cement grout.
4. Adhesive for pressure injection of cracks.
5. Adhesive for doweling.
6. Retardants.
7. Bonding compounds.

C. Certified Test Reports: Before delivery of materials or grout, submit certified reports of the tests specified herein. Accompany the certified reports on previously tested materials with the manufacturer's certified statement that the previously tested material is of the same type, quality, manufacture, and make as that proposed for use in this Contract. Certified test reports are required for all cement grout constituents, including cement and aggregates.

PART 2 – PRODUCTS

2.01 GENERAL

A. Grout mixes and admixtures shall not contain more than 0.05% chloride ions.

B. Water for washing aggregate, for mixing, and for curing:

1. Shall be free from oil and deleterious amounts of acids, alkalis, and organic materials.
2. Shall not contain more than 1,000 mg/L of chlorides as Cl, nor more than 1,300 mg/L of sulfates as SO4.
3. Shall not contain an amount of impurities that may cause a change of more than 25% in the setting time of the cement nor a reduction of more than 5% in the compressive strength of the grout at 14 days when compared with the result obtained with distilled water.
4. Water used for curing shall not contain an amount of impurities sufficient to discolor the grout.

2.02 GROUT

A. Use grout specified on the Contract Plans or as specified in the equipment recommendations.

B. Nonshrink cementitious grout:

1. Cementitious grout that conforms to ASTM C1107, CRD-C-621, "Corps of Engineers Specification for Non-Shrink Grout," and the following requirements:

a. Nonmetallic aggregate.

b. Acceptable manufacturers:

1) Euclid Chemical Co., "Euco NS."
2) BASF, "Masterflow 713 Plus."
3) Five Star Grout Co., "Five-Star Grout."
4) Or approved equal.

C. Epoxy Grout:

1. Multi-component, 100% solids compound conforming to the following requirements:

a. Suitable for use on dry or damp surfaces.
b. Comply with ASTM C881.
c. Acceptable manufacturer:

1) Euclid Chemical Co., "DuralBond."
2) Sika Chemical Co, "Sikadur 35 Hi-Mod LV."
3) BASF, "SCB Concresive 1380."
4) Or approved equal.

D. Cement grout:

1. A mixture of 1 part Portland cement, 1 to 2 parts fine aggregate, and with sufficient water to impart workability but not such that the grout will flow:

a. Cement shall be Portland cement, ASTM C150 Type II or Type V, and shall be low alkali cement, containing less than 0.60% alkalis.
b. Fine aggregate shall conform to ASTM C33 and to the following requirements:

1) Nonreactive and washed before use.
2) When sources of aggregate are changed, provide test reports for the new material. Perform the tests specified prior to commencing grout work.
3) Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine.
4) When tested in accordance with ASTM C136, gradation of fine aggregate shall be such that 100% by weight will pass a standard No. 8 mesh sieve and no less than 45% by weight will pass a standard No. 40 mesh sieve.
5) Variation from the specified gradations in individual tests of fine aggregates will be accepted if the average of three consecutive tests is within the specified limits and the variation is within the permissible variation listed below.
6) Comply with ASTM C33 as modified herein.

U.S. Standard Sieve Size	Permissible Variation, Percent
30 or coarser	2
50 or finer	0.5

7) Other tests shall be in accordance with the following specifications:

Test Method	Test	Requirements
ASTM C40	Organic Impurities	Color lighter than standard
ASTM C117	Passing 200 sieve	3% maximum
ASTM C88	Soundness	10% max loss with sodium sulfate
ASTM C289	Reactivity	Innocuous aggregate
ASTM D2419	Sand Equivalent	Minimum 80

E. Admixtures:

1. Admixtures shall be compatible with the grout and shall conform to the following requirements:

   a. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.
   b. Use admixtures in accordance with the manufacturer's recommendations and add separately to the grout mix.
   c. Chemical admixtures for flowing concrete grout shall comply with ASTM C1017.
   d. Water reducing, retarding admixture:

      1) The admixture shall comply with ASTM C494 Type D requirements and not contain more chloride ions than are present in municipal drinking water.
      2) Acceptable manufacturers:

         a) Euclid Chemical Co., "Eucon Retarder-75."
         b) BASF, "Pozzolith 100 XR."
         c) Sika Corporation, "Plastiment."
         d) Or approved equal.

2.03 ADHESIVES

A. Adhesive for pressure injection of cracks in concrete:

1. A two-component, moisture tolerant, low viscosity, liquid epoxy adhesive conforming to ASTM C881 for load-bearing applications.
2. Acceptable manufacturers:

   a. BASF, "SCB Concresive 1350 or 1360."
   b. Sika Chemical Co, "Sikadur 35 Hi-Mod LV."
   c. Euclid Chemical Co., "Eucopoxy Injection Resin."
   d. Or approved equal.

B. Adhesive for doweling of anchors and reinforcing bars in concrete:

1. A two-component, moisture tolerant, epoxy gel conforming to ASTM C881 for load-bearing applications.
2. Acceptable manufacturers:

a. Euclid Chemical Co., "Euco #452."
b. Sika Corporation, "Sikadur Anchor Fix-4."
c. Simpson Strong Tie., "Set XP."
d. Hilti, "HIT RE 500SD."
e. BASF, "SCB Concresive 1380."
f. Or approved equal.

PART 3 – EXECUTION

3.01 GENERAL

A. Mix, place and cure in accordance with the manufacturer's instructions.

B. For grouting of equipment base plates, refer to manufacturer's instructions for appropriate procedures.

3.02 EXAMINATION

A. Inspect concrete surfaces to receive grout or mortar and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints, impregnations, and all loose material or foreign matter likely to affect the bond or performance of grout or mortar.

B. Inspect base plate and anchor systems for rust, oil, and other deleterious substances that may affect the bond or performance of grout.

C. Confirm that newly placed concrete has been cured sufficiently to attain its design strength and limit further shrinkage.

D. Verify that temperature of cementitious or epoxy grout does not exceed manufacturer's recommendations.

3.03 PREPARATION

A. Surface Preparation:

1. Roughen all concrete surfaces by heavy sandblasting, chipping, or other mechanical means to ensure bond. Loose or broken concrete shall be removed.
2. All grease, oil, dirt, curing compounds, laitance, and other deleterious materials that may affect bond that were identified in the inspection process shall be completely removed from concrete and bottoms of base plates. All metal surfaces should have a 2- to 3-mil peak-to-valley profile for epoxy grouts.
3. For cementitious mortars and grouts, concrete shall be saturated surface damp. Any standing water shall be removed prior to placing grouts.
4. For epoxy grouts, do not wet concrete surfaces with water. Instead, where required, wet surfaces with epoxy for horizontal work or epoxy gel for vertical or overhead work prior to placing epoxy grouts.

B. Forms and Headboxes for Cementitious or Epoxy Grouts:

1. Forms for grouts shall be built of material with adequate strength to withstand the placement of grouts.
2. Forms must be rigid and liquid tight. All cracks and joints shall be caulked with an elastomeric sealant. All forms shall be lined with polyethylene for easy grout release. Forms carefully waxed with two coats of heavy-duty paste wax shall also be acceptable.
3. Forms shall be 4 to 6 inches higher than the base plate on one side of the base plate configuration when using head pressure for placement.
4. A sufficient number of headboxes shall be built to facilitate placement of grouts.
5. Air relief holes a minimum 1/8 inch in diameter shall be provided when required by a base plate configuration to avoid entrapping air underneath.

3.04 NONSHRINK CEMENTITIOUS GROUT

A. Prepare concrete surfaces in accordance with the grout manufacturer's instructions.

B. Do not retemper grout by adding more water after stiffening.

3.05 EPOXY GROUT

A. Prime concrete in accordance with the grout manufacturer's instructions.

B. Epoxy grouts shall be mixed in complete units. Do not vary the ratio of components or add solvent to change the consistency of the mix.

C. Mix until aggregate is uniformly wetted. Over mixing will cause air entrapment in the mix.

3.06 PRESSURE INJECTION OF CRACKS

A. Design system to permit injection of adhesive resin at pressures up to 50 psi.

B. Injection Equipment:

1. Include a mixer and holdover agitator tanks.
2. Provide gauges to indicate pressure used.
3. Provide a meter capable of indicating the volume of grout used to 1/10 of a cubic foot.

3.07 DOWEL INSTALLATION

A. Install per adhesive manufacturer's instructions.

B. Obstructions in Drill Path:

1. Locate holes in existing concrete to miss existing reinforcing. Prior to drilling holes, field verify and mark the location of existing reinforcing using a pachometer or other approved locating equipment.

2. When reinforcing steel is encountered in the drill path, slant drill to clear obstruction. Drill shall not be slanted more than 10 degrees. Where slanting the drill does not resolve the conflict the Contractor shall stop and notify the Owner Representative and resolve the conflict to the satisfaction of the Owner Representative.
3. Abandoned dowel or anchor holes shall be completely filled with nonshrink grout and struck off flush with the adjacent surface.

3.08 CURING

A. Cementitious Grouts:

1. Clean equipment and tools as recommended by the grout manufacturer.
2. Cure Grouts in accordance with manufacturer's specifications and recommendations. Keep grout moist for a minimum of 3 days. The method needed to protect grouts will depend on temperature, humidity, and wind. Wet burlap, a soaker hose, sun shading, ponding, and, in extreme conditions, a combination of methods shall be employed.
3. Grouts shall be maintained above 40 degrees Fahrenheit until they have attained a compressive strength of 3,000 pounds per square inch, or above 70 degrees Fahrenheit for a minimum of 24 hours to avoid damage from subsequent freezing.

B. Epoxy Grouts:

1. Cure grouts in accordance with manufacturer's specifications and recommendations. Do not wet cure epoxy grouts.
2. Consult the manufacturer for appropriate cure schedule. In no case should any surface in contact with epoxy grout be allowed to fall below 50 degrees Fahrenheit for a minimum of 48 hours after placement.

3.09 TESTING

A. To ensure compliance with the specified requirements for grout, provide the services of an independent testing laboratory that complies with the requirements of ASTM E329, ASTM C109, and ASTM C579, Method B.

B. The testing laboratory will sample and test grout materials and submit results to the Owner Representative.

C. During the course of construction, the Owner Representative may take separate field samples of the following materials for confirming tests:

1. Cement.
2. Aggregates.
3. Cement grout mixture.
4. Commercially manufactured grout products.

END OF SECTION

SECTION 042200 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

A. Section Includes:
   1. Concrete masonry units.
   2. Mortar and grout.
   3. Steel reinforcing bars.
   4. Miscellaneous masonry accessories.

B. Related Requirements:
   1. Section 076500 – Flexible Flashing.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project site.
   1. Attendance: Owner, Architect, Contractor, and Installers, and other entities directly affecting Work of this Section.
   2. Time: Minimum of 2 months prior to starting Work of this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars.
      a. Comply with ACI 315.
   3. Show elevations of reinforced walls.

C. Samples: For each type and color of the following:
   1. Exposed CMUs.
   2. Colored mortar.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include data on material properties, and if required by AHJ, material test reports substantiating compliance with requirements.
   2. Integral water repellant used in CMUs.
   3. Cementitious materials. Include name of manufacturer, brand name, and type.
   4. Mortar admixtures.
   5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   6. Grout mixes. Include description of type and proportions of ingredients.
   7. Reinforcing bars.
   8. Joint reinforcement.
   9. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

A. Sample Panels: Comply with requirements in Section 014339 – Mockups.
   1. For each color scheme.
   2. For each type of exposed unit masonry construction, including typical exterior and interior walls in sizes approximately 60 inches long by 48 inches high by full thickness.
   3. Facing south.

B. Sample Panels: Comply with Section 014339 – Mockups.
   1. Protect approved sample panels from elements with weather-resistant membrane.
   2. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
      a. Approval of sample panels does not constitute approval of deviations from Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's Work. Cover partially completed masonry when construction is not in progress.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
1. Basalite Concrete Products, LLC.
2. Central Pre-Mix Concrete Products Co.
3. Eastside Masonry Products.
4. Mutual Materials Co.
5. Western Materials.
6. Willamette Graystone, Inc.
7. Approved substitutions.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide standard CMU with 2 cell or open end configuration.
3. Provide smooth-faced, natural gray colored, unscored units where fully concealed behind other wall finishes and for exposed surfaces to receive elastomeric coatings.
4. Provide bullnose units for outside vertical corners at exposed outside corners, door openings, and where indicated, except as follows:
5. Provide square-edged units for remaining conditions unless otherwise indicated.

6. Provide bond beam units for continuous bond beam courses as shown unless indicated otherwise.
7. Provide CMU sill units at exterior windows and where indicated unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514 as wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) ACM Chemistries: RainBloc.
      2) Euclid Chemical Company (The): Eucon Blocktite.
      3) GCP Applied Technologies Inc.: Dry-Block.
      4) Master Builders Solutions: MasterPel 240 or MasterPel 200HD.
      5) Moxie International: Moxie Shield 1800 Admixture.
2. Application: Masonry units in exterior wall structures that will be exposed in completed Work.

C. CMUs: ASTM C90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,000 psi.
2. Density Classification: Medium weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching range represented by Architect's sample.
5. Concealed Faces: Provide smooth-faced, natural gray colored, unscored units where scheduled to be concealed by other wall finishes and exterior exposed faces scheduled to receive elastomeric coatings.

2.4 CONCRETE LINTELS

A. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: Not allowed.

E. Mortar Cement: ASTM C1329.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Holcim US: Mortar Cement.
   b. SPEC MIX, Inc.: Mortar Cement & Sand.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979. Use only pigments with a record of satisfactory performance in masonry mortar.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Davis Colors: True Tone Mortar Colors.
      b. Euclid Chemical Company (The): Increte Color-Crete.
      c. Solomon Colors, Inc.: SGS Concentrated A, H, and X Series Mortar Colors.
      d. Approved substitution.

G. Colored Portland Cement-Lime Mix: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
   1. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
      1) Holcim US.
      2) Lehigh Hanson; HeidelbergCement Group.
      3) SPEC MIX, Inc.
      4) Approved substitution.
   2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
   3. Limit pigments to maximum of 10 percent of Portland cement by weight.
   4. Limit pigments to maximum of 5 percent of mortar cement by weight.

H. Aggregate: ASTM C144 and as follows:
   1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
   2. White Aggregates: Natural white sand or ground white stone.
   3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
      a. Match Architect's sample.

I. Aggregate for Grout: ASTM C404.

J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Addiment Incorporated: Mortar Kick.
      b. Euclid Chemical Company (The): Accelguard 80.
      c. GCP Applied Technologies Inc.: Morset.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ACM Chemistries: RainBloc for Mortar.
      b. GCP Applied Technologies Inc..: Dry-Block Mortar Admixture.
      c. Master Builders Solutions: MasterPel 240MA.
      d. SPEC MIX, Inc.: Preblended Integral Water Repellent (IWR) Masonry Mortar.

L. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148 inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Heckmann Building Products Inc.: #376 Rebar Positioner.
      b. Hohmann & Barnard, Inc.: #RB or #RB-Twin Rebar Positioner.
      c. Wire-Bond: O-Ring or Double O-Ring Rebar Positioner.

C. Masonry Joint Reinforcement, General: ASTM A951.
   1. Interior Walls: Hot-dip galvanized, carbon steel.
   2. Exterior Walls: Stainless steel.
   3. Wire Size for Side Rods: 0.187 inch diameter.
   4. Wire Size for Cross Rods: 0.187 inch diameter.
   5. Wire Size for Veneer Ties: 0.187 inch diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches on center.
   7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this Article that are made from materials that comply with the following unless otherwise indicated:
   1. Stainless Steel Wire: ASTM A580, Type 304.
   2. Galvanized-Steel Sheet: ASTM A653, Commercial Steel, G60 zinc coating.
   3. Steel Sheet, Galvanized after Fabrication: ASTM A1008, Commercial Steel, with ASTM A153, Class B coating.
   4. Stainless Steel Sheet: ASTM A240 or ASTM A666, Type 304.
   5. Steel Plates, Shapes, and Bars: ASTM A36.

B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Anchor Section for Welding to Steel Frame: Crimped 1/4 inch diameter, stainless steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
   2. Tie Section: Triangular-shaped wire tie made from 0.187 inch diameter, stainless steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.109 inch thick, stainless steel sheet.
      a. 0.108 inch thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
   2. Tie Section: Triangular-shaped wire tie made from 0.187 inch diameter, stainless steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

D. Partition Top Anchors: 0.105 inch thick metal plate with a 3/8 inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless indicated otherwise.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual," Section 076200 – Sheet Metal Flashing and Trim, and as follows:
   1. Stainless Steel: ASTM A240 or ASTM A666, Type 316 [Type 304], 0.0188 inch thick; solder metal flashing at corners.
   2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet.
      a. Provide splice plates at joints of formed, smooth metal flashing.
   3. Fabricate metal drip edges from stainless steel.
      a. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
   4. Fabricate metal sealant stop from stainless steel.
      a. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 3/8 inch to form a stop for retaining sealant backer rod.
   5. Locations: Where flashing is exposed to view and the following:
      a. Where flashing is indicated to receive counterflashing, use metal flashing.
      b. Where flashing is indicated to be turned down at or beyond wall face, use metal flashing.
      c. Where flashing is partly exposed and is indicated to terminate at wall face, use metal flashing with a sealant stop with a drip edge.

B. Flexible Flashing: Specified in Section 076500 – Flexible Flashing, for the following types:Stainless Steel-Laminated Metal Flashing: LM.FLSHG-1.
   2. Aluminum-Faced, Modified Bituminous Flashing: LM.FLSHG-3.
   3. Rubberized-Asphalt Sheet Flashing: SA.FLSHG-3, for thru-wall flashing.
   4. Butyl Rubber Sheet Flashing: SA.FLSHG-4.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 – Sheet Metal Flashing and Trim.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Termination Bars for Flexible Flashing: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded, closed cell neoprene filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Blok-Lok; a Hohmann & Barnard company: NS Neoprene Sponge.
      b. Hohmann & Barnard, Inc.: NS – Closed Cell Neoprene Sponge.
      c. NMW, Inc.: Foamtech "N".
      d. Williams Products, Inc.: Everlastic EVA-200G 1056 Joint Filler.
      e. Wire-Bond: #3300 Expansion Joint.

B. Preformed Control-Joint Gaskets: Semirigid, preformed, extruded gaskets designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Products: Subject to compliance with requirements, provide 1 of the following:
   a. BoMetals, Inc.: BCJ-3 PVC Control Joint.
   b. Hohmann & Barnard, Inc.: VS-678 PVC Control Joint.
   c. Wire-Bond: #2902 PVC Control Joint.
2. Material: ASTM D2000, ASTM D2287, Type PVC-65406; polyvinyl chloride
3. Size: 1/4 inch thick by 6-7/8 inches long.
4. Shore A Durometer Hardness: ASTM D2240; 85 minimum.
5. Tensile Strength: ASTM D412; minimum 1,500 psi.
6. Elongation: ASTM D412; minimum 350 percent.
7. Recycled Content: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 50 percent
8. Locations: Masonry construction joints at pilasters, columns, intersections, or other joints, and at maximum of 30 feet intervals.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Diedrich Technologies, Inc.; a division of Hohmann & Barnard, Inc.: 202 New Masonry Detergent.
      b. EaCo Chem, Inc.: NMD 80.
      c. ProSoCo, Inc.: Sure Klean 600.
      d. Approved substitution.

2.11 MORTAR AND GROUT MIXES

A. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.
   3. For reinforced masonry, use portland cement-lime mortar mortar.
   4. Add cold-weather admixture (if used) at same rate for mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. Type M: 2,500 psi; for masonry in contact with earth and walls below grade.
   2. Type S: 1,800 psi; for exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls and for other applications where another type is not indicated.
   3. Type N: 750 psi; for interior non-load-bearing walls. Type O may be used instead of Type N.

C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required.
   1. Do not add pigments to colored cement products.
   2. Limit pigments to maximum of 10 percent of Portland cement by weight.

3. Limit pigments to maximum of 5 percent of mortar cement by weight.
4. Mix to match Architect's sample.
5. Application: Use pigmented mortar for exposed mortar joints in decorative CMUs.

D. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2,000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond. Do not use units with less-than-nominal 4 inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Joint Tooling:
1. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
2. Cut joints flush for masonry walls to be concealed or scheduled to receive direct-applied finishes (other than paint) unless otherwise indicated.
3. Cut joints flush where indicated to [receive waterproofing] [and] [air barriers] [epoxy coating] unless otherwise indicated.

3.5 MASONRY-JOINT REINFORCEMENT

A. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches on center.
2. Space reinforcement not more than 8 inches on center in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
   1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches on center vertically and 36 inches on center horizontally.

3.7 EMBEDDED FLASHING

A. Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
   4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

3.8 INSTALLATION OF REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 48 inches.

3.9 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests

and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: 1 set of tests for each 5,000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

3.10 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.11 POINTING

A. Pointing: During tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

3.12 CLEANING

A. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Test cleaning methods on sample wall panel; leave 1/2 of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry Work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section for Earth Moving.
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

Section 042200.1 – Concrete Unit Masonry **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Mortar and grout.
3. Reinforcing steel.
4. Masonry joint reinforcement.
5. Miscellaneous masonry accessories.
6. Masonry wall cavity insulation.

B. Products installed, but not furnished, under this section include:

1. Hollow-metal frames in unit masonry openings.
2. Anchor bolts and other structural connections.

1.02 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following net-area compressive strengths (f′m) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to 2018 IBC, Chapter 21 which references TMS 402/602-16. Determine f′m per one of the methods specified in TMS 602 1.4B.

1. For Concrete Unit Masonry: f′m = 1,500 psi (10.3 MPa).

1.04 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Shop Drawings:

1. Show fabrication and installation details for the following:

a. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, “Details and Detailing of Concrete Reinforcement.”

C. Samples for initial selection for the following: Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.

D. Material Test Reports: Provided by masonry supplier for each type of masonry unit required.

1. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
2. From an independent qualified testing agency paid for by the Contractor indicating and interpreting test results of the following for compliance with requirements indicated:

a. Mortar complying with property requirements of IBC Section 2103.2. Verify compliance with ASTM C270 by one of the following procedures:

1) Proportion Specification Method: Verify compliance with the proportions specified in ASTM C270 for the specified compressive strength f'm.
2) Property Specification Method: Provide laboratory testing of the mortar to demonstrate compliance with the specified minimum compressive strength, minimum water retention, and maximum air content.

b. Grout mixes complying with compressive strength requirements noted in the Drawings and with IBC Section 2103.3. Include description of type and proportions of grout ingredients.

1) At the start of grouting operations, take one test per day for the first three days. The tests shall consist of three specimens that are made in accordance with ASTM C1019 Test Method of Sampling and Testing Grout.
2) After the first three tests, specimens for continuing quality control shall be taken once a week or for every 25 cubic yards of grout or for every 2,500 square feet of wall, whichever comes first.
3) For minimum grout strength required, the compressive strength shall be at least 1,000 psi after 7 days and the strength specified in the Drawings after 28 days.

1.05 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07 PROJECT CONDITIONS

A. Protection of Masonry:

1. During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
2. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls.

C. Stain Prevention:

1. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed. Immediately remove grout, mortar, and soil that come in contact with such masonry.
2. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
3. Protect sills, ledges, and projections from mortar droppings.
4. Protect surfaces of doorframes, as well as similar products with painted and integral finishes, from mortar droppings.
5. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in Section 2104.3 of the Uniform Building Code.

E. Cold Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F (4 degrees C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

F. Hot Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

PART 2 – PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. General:

1. Provide shapes indicated and as follows:

a. Provide special shapes for lintels, corners, jambs, sills, control joints, headers, bonding, and other special conditions.
b. Provide split faced units where noted.

B. Concrete Masonry Units:

1. ASTM C90 and as follows:

a. Weight Classification: Medium weight.
b. Provide Type I, moisture-controlled units.
c. Size (Width): Manufactured to 8 inches nominal, 7-5/8 inches actual.

2.02 MORTAR AND GROUT MIXES

A. Mortar: ASTM C270, Type S.

B. Grout: ASTM C476.

C. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

D. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

E. Do not use calcium chloride in mortar or grout.

2.03 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A615; ASTM A616, including Supplement 1; or ASTM A617, Grade 60.

2.04 MASONRY JOINT REINFORCEMENT

A. General:

1. ASTM A951 and as follows:

a. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.

b. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
c. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
d. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.

B. For single-wythe masonry, provide ladder type with single pair of side rods and cross rods spaced not more than 16 inches on center.

2.05 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this article, unless otherwise indicated.

B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A82; with ASTM A153, Class B-2 coating.

C. Steel Sheet, Galvanized after Fabrication: ASTM A366 cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A153.

D. Plate and Bent Bar Anchors: ASTM A36.

2.06 MISCELLANEOUS MASONRY ACCESSORIES

A. Reinforcing Bar Positioners:

1. Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.

a. Provide units with either two loops or four loops as needed for number of bars indicated.

B. Available Products:

1. Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:

a. Reinforcing Bar Positioners.
b. Dur-O-Wal, Inc.
c. Heckman Building Products, Inc.
d. Hohmann and Barnard, Inc.
e. Masonry Reinforcing Corporation of America.

2.07 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2 cup dry measure tetrasodium polyphosphate and 1/2 cup dry measure laundry detergent dissolved in 1 gallon of water.

2.08 WALL CAVITY INSULATION

A. Provide perlite loose-fill insulation, produced by member of the Perlite Institute, Inc.

B. Comply with ASTM C549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and limited dust generation during application), with a maximum thermal conductivity of 0.44 Btu-in/h·ft^2·degrees F.

C. Alternative: Resinous insulating foam upon approval of submittal.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Verify that foundations are within tolerances specified.
2. Verify that reinforcing dowels are properly placed.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.02 INSTALLATION, GENERAL

A. Thickness: Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this section and in other sections of the Specifications.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

3.03 CONSTRUCTION TOLERANCES

A. Comply with tolerances in TMS 602 3.3 F and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet.
3. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Masonry:

1. Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

a. One-half running bond with vertical joint in each course centered on units in courses above and below.

C. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond; do not tooth. Clean exposed surfaces of set masonry, and remove loose masonry units and mortar before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified under this and other sections of the Specifications. Fill in solidly with masonry around built-in items.

E. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

G. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and where adjacent to cells to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

3.06 MASONRY JOINT REINFORCEMENT

A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcement as indicated.

B. Provide continuity at corners and wall intersections by using prefabricated “L” and “T” sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, and other special conditions.

3.07 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown.

1. Provide built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.08 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Metal reinforcement shall be located in accordance with the Plans and Specifications. Reinforcement shall be secured against displacement prior to grouting by wire positioners or other suitable devices at intervals not exceeding 200 bar diameters.

C. Grouting:

1. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

2. Cleanouts shall be provided for all grout pours exceeding 5 feet in height. Provide in the bottom course of each vertical bar. Cleanouts shall remain open until inspected and then sealed before grouting.
3. Cleanouts may be omitted if special provisions are made to keep the grout spaces open and clean to the satisfaction of the inspector.
4. Comply with requirements of TMS 602, Section 3.5 and Table 6 for grout placement, including minimum grout space.

3.09 INSTALLATION OF CAVITY WALL AND MASONRY CELL INSULATION

A. Pour granular insulation into cavities indicated to receive insulation, taking care to fill voids completely. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close ports after confirming complete coverage. Limit fall of insulation to one story in height, but not exceeding 20 feet.

3.10 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning:

1. After mortar is thoroughly set and cured, clean exposed masonry as follows:

    a. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
    b. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
    c. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
    d. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

END OF SECTION

SECTION 051220 – STRUCTURAL STEEL **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Materials, Fabrication, and Erection: Conform to the latest edition of AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

B. Welding: By operators qualified by tests as prescribed by the AWS in Standard Qualification Procedure for performance of the type of work required. Structural welding shall be performed by welders certified by ICBO or local building department jurisdiction.

1.02 SUBMITTAL

A. Shop Drawings: All fabricated metals illustrating dimensions, erection details, cuts, copes, connections, holes, threaded fasteners, and welds. Base dimensional data on actual field measurements where connections interface with other materials required.

B. Mill Test Reports: Submit mill test reports for each shipment of materials or products.

1.03 PRODUCT HANDLING

A. Delivery of Materials Installed Under Other Sections:

1. Deliver anchor bolts, anchorage devices, sleeves, and other steel to be embedded in cast-in-place concrete or masonry prior to start of concrete or masonry work.
2. Provide setting drawings, templates, and direction for installation of anchor bolts and other devices.

B. Store above grade. Protect from corrosive elements.

C. Handle and store during construction to prevent overstressing any elements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Structural Steel – All new material, clean and free from damage:

1. Rolled Shapes: ASTM A992.
2. American Standard Shapes, Channels, Angles, Bars, and Plates: ASTM A36.
3. Steel pipe: ASTM A53 Grade B.
4. Tubes (HSS): ASTM A500 Grade B or C.

B. Bolts:

1. Standard Bolts and Nuts: ASTM A307.
2. High Strength Bolts and Nuts: ASTM A325-N.

C. Welded Studs: TRW Nelson Headed anchor studs or approved equal.

2.02 FABRICATION

A. Fabricate structural and architectural steel in accordance with the appropriate AISC Specifications with the modifications and additional requirements specified in this section.

B. Weld all shop connections unless otherwise noted.

1. Conform to AWS Code for "Arc Welding in Building Construction."
2. Remove all weld spatter from exposed surfaces.

C. Straightness of Structural Members: Straightness of structural members and fabricated assemblies shall conform to AISC Specifications.

D. Shop Assembly:

1. Fabricate units in as large parts and sections as practicable.
2. Holes in members: Punch or drill as necessary to receive bolts and similar items. Do not cut holes with a torch.
3. Provide holes as required for venting closed members that are to be galvanized.

PART 3 – EXECUTION

3.01 ERECTION

A. Set and secure structural steel members and appurtenant connections accurately to the required lines and levels shown on Drawings.

B. All procedures and tolerances per AISC Standards and Specifications.

C. Bolts, Anchors and Other Accessories: Install as necessary and as required for erection of structural steel.

D. Bearing Plates:

1. Provide under all steel, such as ends of beams bearing on concrete.
2. Shim with metal only.

E. Columns:

1. Set on leveling nuts or on metal shims to accurate elevations and grout solid.
2. Shim with metal only. Do not use wood wedges.

F. Anchor Bolts and Anchors: Locate and build into connecting work. Preset anchor bolts and anchors using templates of configuration required for fastening to structural members.

G. Grouting: After all structural members have been properly positioned and all bolts and anchor bolts tightened, place grout between concrete and steel. Finish exposed surfaces or grout flush and smooth.

END OF SECTION

SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel framing and supports for:
      a. Mechanical and electrical equipment.
      b. Framing and supports are not specified in other Sections

B. Products Furnished But Not Installed Under This Section:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.
   3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Coordination:
   1. Coordinate selection of shop primers with topcoats to be applied over them.
      a. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
   2. Coordinate installation of metal fabrications that are anchored to or that receive other Work.
      a. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete.
      b. Deliver such items to Project site in time for installation.

1.2 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
   1. Steel framing and supports for:
      a. Mechanical and electrical equipment.
      b. Applications where framing and supports are not specified in other Sections.
   2. Loose steel lintels.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

C. Steel Primer Certification: From steel fabricator for specific surface preparation procedures and primers used for fabricated steel items to verify compliance with Specifications and compatibility of finish coat materials.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1.AWS D1.2.AWS D1.6.Use welders certified by AWS and State project is located for structural welding, and who have undergone recertification in the last 12 months.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. W-Shapes and Channels 8 Inches and Larger: ASTM A992.

C. Steel Angles: ASTM A572, Grade 50.

D. Steel Plates, Channels Smaller Than 8 Inches, and Bars: ASTM A36.

E. Stainless-Steel Sheet, Strip, and Plate: ASTM A240 or ASTM A666, Type 304.

F. Stainless-Steel Bars and Shapes: ASTM A276, Type 304.

G. Steel Tubing: ASTM A500, cold-formed steel tubing.

H. Steel Pipe: ASTM A53, Standard Weight (Schedule 40) unless otherwise indicated.

I. Zinc-Coated Steel Wire Rope: ASTM A741.
   1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

J. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

K. Nickel Silver Extrusions: ASTM B151, Alloy UNS No. C74500.

L. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

A. Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls.
   1. Select fasteners for type, grade, and class required.
   2. Provide stainless-steel fasteners for fastening stainless steel and nickel silver.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
   1. Provide hot-dip galvanized or mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to 4 times load imposed when installed in concrete, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: ASTM F593, Alloy Group 1 stainless steel bolts, and ASTM F594, Alloy Group 1 or 2 stainless steel nuts.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches on center.
   1. Provide with temporary filler and tee-head bolts, complete with washers and nuts, zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Steel Primers:
   1. Provide primers that comply with Section 099000 – Painting and Coating.

B. Galvanizing Repair Coating: Zinc-rich, cold galvanizing compound complying with SSPC-Paint 20 or ASTM A780, and compatible with paints and coatings scheduled to be used over it.
   1. Products: Subject to compliance, provide one of the following:
      a. Alvin Products; a div. of Dampney Co., Inc.: Galvax.
      b. Rust-Oleum: 7000 System Cold Galvanizing Compound.
      c. ITW Professional Brands; LPS: Cold Galvanize Corrosion INHIBITOR.
      d. ZRC Worldwide: Galvilite.
      e. Approved substitution.
   2. Zinc Content: Minimum 93 percent by weight.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

D. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107; recommended in writing by manufacturer, for exterior applications.

E. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

F. Concrete: Comply with requirements in Section 033000 – Cast-in-Place Concrete – Architecture, for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3,000 psi or as indicated on structural Drawings.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible.
1. Disassemble units only as necessary for shipping and handling limitations.
2. Use connections that maintain structural value of joined pieces.
3. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately.
1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.

D. Form exposed Work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated. Coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6 inch embedment and 2 inch hook, not less than 8 inches from ends and corners of units and 24 inches on center, unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide steel framing and supports not specified in other Sections as needed to complete Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated or as recommended by partition manufacturer, with attached bearing plates, anchors, and braces as indicated or as recommended by partition manufacturer.
   1. Drill or punch bottom flanges of beams to receive partition track hanger rods.
   2. Locate holes where indicated on operable partition Shop Drawings.

D. Countertop Supports: Concealed, flush-mounted counter brackets.
   1. Products: Subject to compliance with requirements, provide the following:
      a. A&M Hardware, Inc.: C Series Concealed Bracket.
      b. Rangine Corporation: Rakks EH Series In-Wall Counter Support Brackets.
      c. U.S. Futaba: 72531 Series Concealed Brackets.
      d. Approved substitution.
   2. Material: Steel.
   3. Construction: Fabricated from horizontal T section and vertical L section.
   4. Size: 18 inches high, up to 24 inches deep.
   5. Load Capacity: Minimum 300 lbs. per bracket.

E. Vanity Supports: Concealed, flush-mounted, ADA-compliant vanity brackets.
   1. Products: Subject to compliance with requirements, provide the following:
      a. A&M Hardware, Inc.: ADA Vanity Bracket.
      b. Rangine Corporation: Rakks EHV Vanity Support Brackets.
      c. U.S. Futaba: 72531 Series.
      d. Approved substitution.
   2. Material: Steel.
   3. Construction: Fabricated from horizontal T section and vertical L section.
   4. Size: 18 inches high, up to 21 inches deep.
   5. Load Capacity: Minimum 450 lbs. per bracket.

F. Galvanize miscellaneous framing and supports where indicated.

G. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and 24 inches on center, unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete, if not specified in Section 033000.

2.8 METAL BOLLARDS

A. Bollard Type 1:
1. Material: Schedule 40, 0.322 inch wall thickness steel pipe.
2. Size: 8 inch diameter or as indicated.
3. Length: As indicated on Drawings.
4. Location: Enclosure gate openings.

B. Galvanize steel pipe bollards inside and out after fabrication.

2.9 ENCLOSURE GATES

A. ASTM F900 for gate posts and swing gate types.
1. Gate Leaf Width: 48 inches unless indicated otherwise.

B. Pipe and Tubing:
1. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; manufacturer's standard protective coating and finish.
2. Gate Posts: 2 inch diameter round tubular steel.
3. Gate Frames and Bracing: 2 inch square rectangular tubular steel.

C. Frame Corner Construction: Welded, except where bolted connections are indicated, complete with required mounting hardware.

D. Metal Facing Panels: Tapered-rib profile metal panels formed with raised, trapezoidal major ribs and flat pan between major ribs.
1. Product: Subject to compliance with requirements, provide the following:
a. AEP Span: HR-36 Roof and Wall.
b. Bridger Steel, Inc.: 7.2 Structural Box Rib Panel.
c. Petersen Aluminum Corp.: 7.2 Panel.
d. Taylor Metal Inc.: HR-34.
e. Approved substitution.
2. Material: Zinc-coated (galvanized) steel sheet complying with ASTM A653, G90 coating designation, prepainted by coil-coating process to comply with ASTM A755.
a. Nominal Thickness: 0.0.028 inch.
b. Exterior Finish: 3-coat fluoropolymer.
c. Color: Dura Tech 5000 Cool Matte Black.

E. Hardware:
1. Hinges: 180 degree outward swing as detailed.
2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
3. Gate keepers provided for leaves wider than 60 inches to hold gate in open position.
4. Miscellaneous Hardware: Cane bolts, steel pipe receiver, and other accessories required and detailed.

F. Fabrication:
1. Refer to appropriate details on Drawings.
2. Drill holes of sizes and in locations required for bolted connections including hardware and facing panels.

3. Secure panels to gate frame and picket members with oval head self-drilling, self-tapping stainless steel screw fasteners, complete with neoprene washers, located at frame corners and spaced not more than 24 inches on center each way.

G. Finish: Powder coat members after fabrication; color Black.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings at locations indicated.
1. Fabricate in single lengths for each opening unless otherwise indicated.
2. Weld adjoining members together to form a single unit where indicated.

B. Galvanize loose steel lintels located in exterior walls.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete Work. Provide each unit with no fewer than 2 integrally welded steel strap anchors for embedding in concrete.

2.12 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or unless otherwise indicated.
1. Shop prime with universal shop primer unless primers specified in Section 099000 – Painting and Coating are indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
1. SSPC-SP 3: Interior Steel.
2. SSPC-SP 6/NACE No. 3: Exterior steel; steel indicated to receive high-performance coatings.

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions, overhead doors, and overhead grilles securely to, and rigidly brace from, building structure.

C. Countertop Supports: Install support brackets in accordance with approved Shop Drawings and manufacturer's written instructions using fasteners of type, size, and quantity as furnished or recommended by bracket manufacturer for type of application and substrate.
   1. Install support brackets at locations and heights indicated on Drawings or where field-verified with Architect.
   2. Anchor support brackets to blocking, studs, or supporting substrate indicated.
      a. Secure with appropriate fasteners.
      b. Install support brackets level, plumb, true, and aligned with other countertop supports.
   3. Set countertops on support brackets and fasten in place.

D. Anchor shelf angles securely with expansion anchors or anchor bolts.

3.3 INSTALLATION OF METAL BOLLARDS

A. Anchor bollards in place with concrete footings.
   1. Center and align bollards in holes 3 inches above bottom of excavation.

2. Place concrete and vibrate or tamp for consolidation.
3. Support and brace bollards in position until concrete has cured.
4. Fill bollards solidly with concrete, mounding top surface to shed water.

B. Fill standard bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLATION OF ENCLOSURE GATES

A. Install Type 2 bollards as indicated above and as detailed.
1. Install gate posts in concrete as detailed, properly aligned with cane bolt assemblies.
2. Secure gate frames to Type 2 bollards with hinges as detailed, properly aligned.
3. Install remaining hardware components as detailed.
4. Leave gates in proper operating condition, free of dents and other surface or structural damage.

3.5 REPAIRS

A. Touchup Painting:
1. Immediately after erection, clean field welds, bolted connections, and abraded areas.
a. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
b. Apply by brush or spray to provide a minimum 2.0 mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair with galvanizing repair coating.

END OF SECTION

SECTION 055000.1 – METAL FABRICATIONS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Materials, Fabrication, and Erection: Conform to the latest edition of AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings" (steel assemblies) and the Aluminum Association's Aluminum Construction Manual (aluminum assemblies).

B. Welding: By operators qualified by tests as prescribed by the AWS in "Standard Qualification Procedure" for performance of the type of work required. Structural welding will require all welders to be certified by ICBO or local building department jurisdiction.

C. Comply with OSHA/WISHA and Building Code requirements.

1.02 SUBMITTALS

A. Shop Drawings: All fabricated metals illustrating dimensions, erection details, cuts, copes, connections, holes, threaded fasteners, and welds. Base dimensional data on actual field measurements where connections interface with other materials required.

B. Mill Test Reports: Submit mill test reports for each shipment of materials or products.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials in such a manner as to prevent damage to finished surfaces.

B. Store above grade in clean and dry locations. Protect from corrosive elements.

PART 2 – PRODUCTS

2.01 STRUCTURAL STEEL

A. Conform to Section 051220, "Structural Steel."

B. All structural steel shall be galvanized unless otherwise specified.

C. Bolts: As specified in Section 051220, "Structural Steel," hot dip galvanized.

2.02 STAINLESS STEEL

A. Bars and Shapes: ASTM A276, Type 304.

B. Plates: ASTM A240, Type 316, except where indicated as Type 304 on the Drawings.

C. Bolts: ASTM A193, Type 316.

D. Nuts: ASTM A194, Type 316.

2.03 PIPE RAILING

A. Posts and rails shall be fabricated of aluminum, designed to meet the load requirements of International Building Code Section 1607.8.

1. Railing shall be as manufactured by Golden Railings, Inc., 520 Burbank Street Unit A, Broomfield, CO 80020 (www.goldenrailings.com), or equal.
2. Railing shall be constructed of 1-1/2-inch diameter Schedule 40 aluminum pipe (1.90 inches outside diameter, 1.51 inches inside diameter). Aluminum material for rail, posts, and fittings shall be 6061-T6 alloy.
3. Finish shall be clear satin anodizing.
4. Fasteners for railing connections shall be Type 304 stainless steel.

B. All connections shall be mechanically joined using special connection pieces fabricated specifically for this use.

C. Pipe rails (used as “guards” as defined in the IBC) shall be provided as shown on the Drawings. Note that railing dimensions and configurations shall be as shown on the Drawings to fit existing conditions.

D. Maximum spacing of posts shall be 6 feet. Note that shorter post spacings are shown on the Drawings in order to fit existing conditions.

E. Fastenings to concrete shall be made with 316 stainless steel epoxy anchors in accordance with Section 031519. Coat surfaces of aluminum fittings in contact with concrete per manufacturer’s recommendations.

F. Toe boards consisting of a 1/4-inch-thick by 4-inch-high plate or extrusion shall be provided on all exposed sides where indicated on the Drawings. Not more than 1/4-inch clearance shall be permitted between toe board and floor level. Toe boards shall not be required on concrete curb mountings, as shown on the Drawings.

G. At openings in handrail, provide OSHA/WISHA approved safety gates or safety chains, as shown on the Drawings.

PART 3 – EXECUTION

3.01 FABRICATION

A. Fabricate in accordance with the Drawings and additional requirements specified in this section.

B. Shop Assembly:

1. Holes in Members: Punch or drill as necessary to receive bolts and similar items. Do not cut holes with a torch.
2. Close all ends of pipe railing or hand rail with post terminal or cap with hemispherical caps of approved design.

C. Galvanize all carbon steel bolts, fastenings, and hardware unless otherwise noted.

3.02 ERECTION

A. Set and secure accurately to the required lines and levels.

B. Protect the finish from scratches, nicks, and dents during erection.

C. Handrail: Install true to line and grade. Remove all burrs at cut ends of rail.

D. Repairing galvanizing as specified in Section 055116 - Galvanizing.

END OF SECTION

SECTION 055116 – GALVANIZING **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 DEFINITIONS

A. Hot-Dip Galvanizing: The dipping of steel members and assemblies into molten zinc for lasting (or long-term) corrosion protection. The resultant zinc coating fuses permanently with the base steel material.

B. Passivating: The mechanical treatment of freshly galvanized steel materials to prevent humid storage stain (white rust or white corrosion). This treatment (passivation) consists of quenching freshly galvanized steel in water to which a chromate or a chromic-acid solution, or other proprietary solution, has been added.

1.02 QUALITY ASSURANCE

A. Reference Standards: American Hot-Dip Galvanizers Association, Inc. (AHDGA): Publication, “Inspection Manual for Hot-Dip Galvanized Products.”

B. Certification: Furnish Certificates of Compliance with ASTM Specifications, and Standards specified herein. Each certificate to be signed by Contractor and galvanizer certifying that steel materials, bolts, nuts, washers, and items of iron and steel hardware conform to specified requirements.

1.03 DELIVERY, STORAGE AND HANDLING

A. Packaging: Of type to prevent damage to galvanized surfaces and distortion of steel materials and components.

B. Handling and Storage: Handle and protect galvanized materials from damage to zinc coating. To avoid humid storage stain, space surfaces of galvanized materials to permit free circulation of air.

C. Damaged Material: Repair material showing evidence of damage to zinc coating. If not repairable, material with damaged coating will be subject to rejection.

PART 2 – PRODUCTS

2.01 STEEL MATERIALS

A. Material for galvanizing to be geometrically suitable for galvanizing as specified in ASTM A384 and A385. Steel materials suitable for galvanizing include structural shapes, pipe, sheet, fabrications, and assemblies.

B. Material to be chemically suitable for galvanizing.

C. Coordinate with Steel Fabricator to ensure adequate vent holes for closed sections. Drawings indicate suggested vent hole locations for appearance and weather tightness considerations. Notify Engineer if these are not compatible with galvanizing processes.

2.02 IRON AND STEEL HARDWARE

A. Bolts, nuts, washers, and items of iron and steel hardware furnished for galvanizing to be suitable for hot-dip galvanizing.

B. Inspect iron and steel hardware before galvanizing and ascertain whether suitable for galvanizing. Replace items that are not suitable for galvanizing.

2.03 ZINC FOR GALVANIZING

A. Conform with ASTM B6, and as specified in ASTM A123.

2.04 GALVANIZING

A. Steel members, fabrications, and assemblies to be galvanized after fabrication, by hot-dip process in accordance with ASTM A123. Weight of zinc coating to conform to requirements specified under “Weight of Coating” in ASTM A123.

B. Safeguard against steel embrittlement in conformance with ASTM A123.

C. Safeguard against warpage or distortion of steel members to conform to ASTM A384. Notify Engineer of potential warpage problems that may require modification in design, before proceeding with steel fabrications.

D. Finish and uniformity of zinc coating and adherence of coating to conform to ASTM A123, A153, or A386, as applicable.

E. Bolts, nuts, and washers, and iron and steel hardware components to be galvanized in accordance with ASTM A153. Weight of zinc coating to conform to requirements specified under “Weight of

Coating" in ASTM A153. Nuts to be tapped after galvanizing to minimum diametral amounts specified in ASTM A563. Coat nuts with waterproof lubricant, clean and dry to touch. High strength bolts for structural steel joints to be galvanized in accordance with ASTM A325.

2.05 PASSIVATING

A. Galvanized materials subject to extended periods of storage in open, exterior locations to be given passivating treatment or light oiling to prevent humid storage stain. Treatment, solution, and process subject to review and acceptance by Engineer.

PART 3 – EXECUTION

3.01 INSTALLATION OF STEEL MATERIALS

A. Steel materials, fabrications, and assemblies are to be installed as shown on the Drawings or specified.

3.02 FIELD INSPECTION

A. Inspect installed galvanized materials, fabrications, and assemblies in accordance with the applicable requirements of AHDGA "Inspection Manual for Hot-Dip Galvanized Products," for visual inspection.

3.03 TOUCH UP AND REPAIR

A. Repair damaged galvanized surfaces with hot melt repair materials in accordance with ASTM A780. Galvanizing repair paints will not be accepted.

B. Dry film thickness of applied repair materials to be not less than galvanized coating thickness required by ASTM A120, A123, A153, as applicable.

END OF SECTION

SECTION 055119 – METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal grating stairs.
   2. Steel railings and guards.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
   2. Coordinate installation of anchorages for metal stairs**, railings, and guards**.
      a. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, **blocking for attachment of wall-mounted handrails,** and items with integral anchors, that are to be embedded in concrete or masonry.
      b. Deliver such items to Project site in time for installation.
   3. Coordinate locations of hanger rods and struts with other Work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
   4. Schedule installation of railings so wall attachments are made only to completed walls.
      a. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:
   1. Gratings.
   2. Shop primer products.
   3. Grout.

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachment to other Work.
   2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
   3. Include plan at each level.
   4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
   5. Submit Shop Drawings that have been engineered and certified by professional engineer licensed in the State in which Project is located.
      a. Include seal and signature of professional engineer on Shop Drawings.

C. Delegated-Design Submittal: For stairs, **railings, and guards,** indicating compliance with performance and design criteria.
   1. Include analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer indicating experience providing delegated-design engineering services of the kind indicated.
   1. Include documentation that engineer is licensed in state in which Project is located

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Delegated-Design Engineer Qualifications: Professional engineer experienced in providing delegated-design engineering services of the kind indicated and is legally qualified to practice in state where Project is located.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1.AWS D1.2.Use welders certified by AWS and the State in which Project is located for structural welding, and who have undergone recertification in the last 12 months.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.
   1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
   2. Protect steel members and packaged materials from corrosion and deterioration.
   3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
      a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Delegated-Design: Engage a qualified professional engineer, as defined in Section 013573 – Delegated-Design Procedures, to design stairs**, railings, and guards**, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs shall withstand effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform Load: 100 lbf/sq. ft.
   2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
      b. Infill load and other loads need not be assumed to act concurrently.
   3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Seismic Performance of Stairs: Metal stairs shall withstand effects of earthquake motions determined according to ASCE/SEI 7.
   1. Component Importance Factor: 1.5.

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content
   1. Steel Components: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 50 percent.

C. Steel Plates, Shapes, and Bars: ASTM A36.

D. Rolled-Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.

E. Steel Bars for Grating Treads: ASTM A36 or steel strip, ASTM A1011 or ASTM A1018.

F. Wire Rod for Bar Grating Crossbars: ASTM A510.

G. Aluminum Bars for Grating Treads: ASTM B221, extruded aluminum, alloys as follows:
   1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
   2. 6061-T1, for grating crossbars.

H. **Steel Tubing for Railings and Guard Rails: ASTM A500 (cold formed) or ASTM A513 unless indicated otherwise**.
   1. Provide galvanized finish for exterior installations and where indicated.

I. Cast Iron: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

J. Cast-Abrasive Nosings: Cast iron, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. **Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads**.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 4 times load imposed when installed in concrete as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Steel Primer:
1. Comply with Section 099000 – Painting and Coatings.
2. Universal Shop Primer: Fabricator's standard fast-curing, lead- and chromate-free, nonasphaltic, rust-inhibiting, primer complying with MPI #79 and compatible with topcoat.
a. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
3. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI #107 and compatible with topcoat.

C. Galvanized Steel Primer:
1. Vinyl wash primer complying with MPI #80.
2. Water-based galvanized metal primer complying with MPI #134**.**
3. Etching Cleaner: MPI #25 for galvanized metal as specified in Section 099000.

D. Galvanizing Repair Coating: Zinc-rich, cold galvanizing compound as specified in Section 055000 – Metal Fabrications.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

F. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior and exterior applications; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30 minute working time.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, **railings and guards,** clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Shop-assemble stairs **and railings** to greatest extent possible to minimize field splicing and assembly.
1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.
3. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.
1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.

E. Form exposed Work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. **Weld exposed corners and seams continuously unless otherwise indicated.**
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for the following:
   a. Finish #3; partially dressed weld with spatter removed.
      1) Application: Service class stairs.
   b. Finish #4; good quality, uniform undressed weld with minimal splatter.
      1) Application: Industrial class stairs.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that are exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:
1. Fabricate stringers of steel plates or steel channels.
   a. Stringer Size: As indicated on Drawings.
   b. Provide closures for exposed ends of channel and rectangular tube stringers.
   c. Finish: Shop primed.
2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with Performance Criteria Article unless indicated otherwise.
   a. Provide closures for exposed ends of channel and rectangular tube framing.

b. Finish: Shop primed.

3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board and shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below.
   a. Locate hanger rods and struts where they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
1. Fabricate treads and platforms from **welded steel or pressure-locked steel** grating with openings in gratings no more than **5/16 inch** in least dimension.
   a. Surface: **Serrated**.
   b. Finish: **Galvanized**
2. Fabricate grating treads with **rolled-steel floor plate** nosing and with steel angle or steel plate carrier at each end for stringer connections.
   a. Secure treads to stringers with bolts.
3. Fabricate grating platforms with nosing matching that on grating treads.
   a. Secure grating to platform framing **by welding**.

D. Risers: **Solid**.

E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.
1. Material and Finish: Steel plate to match finish of other steel items.
2. Fabricate to dimensions and details indicated.

2.7 FABRICATION OF STAIR RAILINGS

A. Comply with applicable requirements in Section 055213 – Pipe and Tube Railings.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153M for steel and iron hardware and with ASTM A123 for other steel and iron products.
1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC surface preparation specifications indicated below and environmental exposure conditions of installed products:
1. SSPC-SP 3: Interior stairs to receive universal shop primer.
2. SSPC-SP 6 (WAB)/NACE WAB-3: Exterior stairs and interior stairs scheduled to receive zinc-rich primers, and stairs indicated to receive primers specified in Section 099000 – Painting and Coatings.

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with

SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
   1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
   1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
   1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.
      a. Clean bottom surface of baseplates.
      b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
      c. After stairs have been positioned and aligned, tighten anchor bolts.
      d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
      e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
         1) Neatly finish exposed surfaces; protect grout and allow to cure.
         2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.
   1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
   2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
   3. Comply with requirements for welding in "Fabrication, General" Article.

3.3 INSTALLATION OF RAILINGS AND GUARDS

A. Comply with applicable requirements in Section 055213 – Pipe and Tube Railings.

B. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts and rail ends to building construction as follows:
   a. Anchor posts to steel by **welding or bolting** to steel supporting members.
   b. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.

C. Attach handrails to wall with wall brackets.
1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as **required to comply with performance requirements.**
   a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   b. For hollow masonry anchorage, use toggle bolts.
   c. **For wood stud partitions, use lag bolts set into wood backing between studs. Coordinate with carpentry Work to locate backing members**.
   d. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
   e. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.4 REPAIR

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099000 – Painting and Coating.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair with galvanizing repair coating.

END OF SECTION

SECTION 055213 – PIPE AND TUBING RAILS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel railings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection of shop primers with topcoats to be applied over them.
      a. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
   2. Coordinate installation of anchorages for railings.
      a. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
      b. Deliver such items to Project site in time for installation.

B. Scheduling:
   1. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Fasteners.
   3. Post-installed anchors.
   4. Handrail brackets.
   5. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
   1. Submit Shop Drawings that have been engineered and certified by professional engineer licensed in the State in which Project is located.
      a. Include seal and signature of professional engineer on Shop Drawings.

C. Samples: For each type of exposed finish required.
   1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
   2. Fittings and brackets.
   3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
      a. Show method of connecting and finishing members at intersections.

D. Delegated-Design Submittal: For railings and guardrails, indicating compliance with performance and design criteria.
   1. Include analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer indicating experience providing delegated-design engineering services of the kind indicated.
   1. Include documentation that engineer is licensed in state in which Project is located.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

D. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

E. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Delegated-Design Engineer: Professional engineer experienced in providing delegated-design engineering services of type indicated and is legally qualified to practice in state where Project is located.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1.AWS D1.2.AWS D1.6.Use welders certified by AWS and the State in which Project is located for structural welding, and who have undergone recertification in the last 12 months.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Engage metal fabricating firm acceptable to Owner and Architect that meets requirements of these Specifications.
   1. Do not engage metal fabricating firm without written approval from Owner and Architect.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Steel Pipe and Tube Railings:
      a. American Stair, Inc.: Ametco Manufacturing Corporation. R&B Wagner, Inc. VIVA Railings, LLC.

C. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Delegated-Design: Engage a qualified professional engineer, as defined in Section 013573 – Delegated-Design Procedures, to design railings and guardrails, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
      b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.4 STEEL RAILINGS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Tubing: ASTM A500 (cold formed) or ASTM A513, Type 5.

C. Pipe: ASTM A53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A36.

E. Cast Iron Fittings: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.

2.5 GUARDRAILS

A. Square Tubing: ASTM A500 (cold formed) or ASTM A513, Type 5.

B. Pipe: ASTM A53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A36.

2.6 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM F1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153 or ASTM F2329 for zinc coating.
3. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
1. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable or are standard fastening method for railings indicated.
3. Provide tamper-resistant square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.7 MISCELLANEOUS MATERIALS

A. Guardrails:
1. Posts and Horizontal Rails: 2 in. sq. steel tubing.
2. Post Caps: 1/4 inch thick steel plate.
3. Mounting Flanges: Steel plate matching post material.
   a. Top (Deck) Mounted: 4-1/4 in. sq. by 3/8 in. thick.
   b. Side (Facia) Mounted: 6 in. by 4 in. by 3/8 in. thick.
4. Vertical Infill: 1/2 in. sq. steel bars.

B. Handrail Brackets, Wall-Mounted:
1. Material: 3/4 in. OD round steel bar, radiused as indicated, welded to 3 in. dia., 3/8 in. thick steel mounting flange.
   a. Predrill center of mounting flange with 13/16 in. hole for anchoring.
   b. Fully weld bracket to underside of handrails where indicated, and grind welds smooth.
2. Projection: Minimum 1-1/2 in. clearance from inside face of handrail and face of finished wall surface.

C. Handrail Brackets, Masonry-Mounted:
1. Material: 3/4 in. OD round steel bar, radiused as indicated, welded to 4-1/4 in. sq., 3/8 in. thick steel mounting flange.
   a. Predrill 9/16 in. holes in mounting flange for anchoring. Locate holes 3/4 in. in from each corner of mounting flange.
   b. Fully weld bracket to underside of handrails where indicated, and grind welds smooth.

2. Projection: Minimum 1-1/2 in. clearance from inside face of handrail and face of finished wall surface.

D. Handrail Brackets, Surface-Mounted:
1. Product: Subject to compliance with requirements, provide one of the following:
   a. Julius Blum & Co., Inc.: Model 381 Wagner Companies: 1766: Approved substitution.
2. Description:
   a. Material: Cast ductile iron.
   b. Saddle: 2-3/4 in. dia. with single predrilled hole for exposed bolt anchorage.
   c. Projection: Minimum 1-1/2 in. clearance from inside face of handrail and face of railing or finished wall surface.

E. Handrail Brackets, Interior Stair Railings:
1. Product: Subject to compliance with requirements, provide one of the following:
   a. Wagner Companies: Model No. 3474 Style C with Style H Adapter: Approved substitution.
2. Description:
   a. Material: Cast ductile iron.
   b. Saddle: 2-3/4 in. dia. with single predrilled hole for exposed bolt anchorage.
   c. Projection: Minimum 2-1/2 in. clearance from center of handrail and face of wall surface.

F. Handrail Brackets: Cast iron center of handrail 2-1/2 inches from face of railing or wall.
1. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
   a. C. L. Laurence Co., Inc.:
   b. Julius Blum & Co., Inc.: Model 382
   c. Morse Industries.
   d. RailPro Architectural Aluminum.
   e. Richelieu:
   f. Wagner Companies:
   g. Approved substitution.
2. Description: 2-3/4 in. dia. saddle with single predrilled hole for exposed bolt anchorage.

G. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

H. Etching Cleaner: MPI #25 for galvanized metal.

I. Galvanizing Repair Coating: High-zinc-rich, cold galvanizing compound as specified in Section 055000 – Metal Fabrications.

J. Shop-Applied Steel Primers:
1. Provide primers that comply with Section 099600 – High-Performance Coatings.

K. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior and exterior applications; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

L. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated on Drawings, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.8 FABRICATION

A. NAAMM Pipe Railing Standard: Comply with " NAAMM AMP 521, "Pipe Railing Systems Manual," unless more stringent requirements are indicated.

B. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

C. Shop-assemble railings to greatest extent possible to minimize field splicing and assembly.
   1. Disassemble units only as necessary for shipping and handling limitations.
   2. Clearly mark units for reassembly and coordinated installation.
   3. Use connections that maintain structural value of joined pieces.

D. Cut, drill, and punch metals cleanly and accurately.
   1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
   2. Remove sharp or rough areas on exposed surfaces.

E. Form Work true to line and level with accurate angles and surfaces.

F. Fabricate connections that are exposed to weather in a manner that excludes water.
   1. Provide weep holes where water may accumulate.
   2. Locate weep holes in inconspicuous locations.

G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

H. Connections: Fabricate railings and guardrails with welded connections unless otherwise indicated.

I. Guardrails:
   1. Posts and Horizontal Rails:
      a. Extend tops of posts beyond top rail as indicated on Drawings.
      b. Weld post caps to top of posts.
      c. Weld ends of horizontal rails to posts at dimensions indicated on Drawings.
   2. Mounting Flanges:
      a. Predrill 9/16 in. holes in flange for anchoring. Locate holes 3/4 in. in from each corner of flange.
         1) Provide flanges without predrilled holes where indicated to be welded to metal surfaces.
      b. Weld flanges to bottom of posts for top (deck) and to side of posts where indicated for side (facia) mounting.
   3. Vertical Infill: Weld ends of rods to horizontal rails at dimensions indicated on Drawings.

J. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings, and grind welds smooth.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.

4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" as follows:
   a. Finish #2; completely sanded joint, some undercutting and pinholes okay.
      1) Application: Commercial class stairs.
   b. Finish #3; partially dressed weld with spatter removed.
      1) Application: Service class stairs.
   c. Finish #4; good quality, uniform undressed weld with minimal splatter.
      1) Application: Industrial class stairs.

K. Form changes in direction as follows:
   1. Form rail-to-end post connections and changes in rail direction by radius bends unless mitered corners are indicated.
   2. Form elbow and wall returns by bending or by inserting prefabricated elbow fittings.
   3. By bending to smallest radius that will not result in distortion of railing member.

L. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

M. Close exposed ends of railing members with prefabricated end fittings of same metal and finish as railings.

N. Provide wall returns at ends of wall and post mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.

   1. At brackets and fittings fastened to gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. Provide inserts and other anchorage devices for connecting railings to concrete [or] [masonry] Work.
   1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
   2. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide steel or stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
   1. Provide sleeves of same material as railings.

R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.9 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

A. Galvanized Railings: Hot-dip galvanize exterior stair components, including hardware, after fabrication.
   1. Comply with ASTM A123 for hot-dip galvanized railings.
   2. Comply with ASTM A153 for hot-dip galvanized hardware.
   3. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
   4. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
   5. Provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

B. Preparation of Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
   1. Comply with SSPC-SP 16. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with the following requirements:
   1. SSPC-SP 3: Interior railings.
   2. SSPC-SP 6 (WAB)/NACE WAB-3: Exterior railings.

E. Primer Application: Apply shop primer to prepared surfaces of railing components unless otherwise indicated.
   1. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.
   2. Do not apply primer to surfaces to be embedded in concrete or masonry.
   3. Do not apply primer to galvanized surfaces.
   4. Shop prime with universal shop primer unless primers specified in Section 099600 – High-Performance Coatings are indicated.
   5. Shop prime with the following primers specified in Section 099600 – High-Performance Coatings unless indicated otherwise:
      a. Interior Railing Components: MPI #107 (mod), corrosion-resistant, acrylic primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.
   1. Fit exposed connections together to form tight, hairline joints.
   2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
   3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.

4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 [1/16] inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in shop or in field.

3.4 ANCHORING POSTS

A. Anchor posts with floor flange and facia flange to steel stair stringers or other metal surfaces by bolting unless welding is indicated on Drawings.

B. Anchor posts with floor flange and facia flange to concrete with concrete expansion anchors.

C. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

D. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

E. Leave anchorage joint exposed with 1/8 inch buildup, sloped away from post.

3.5 ATTACHING RAILINGS

A. Attach railing brackets to metal posts by welding. Grind welds smooth.

B. Attach handrails to wall with wall brackets.
1. Use type of bracket with predrilled hole for exposed bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
3. Secure wall brackets to building construction as follows:
   a. Concrete and Solid Masonry Anchorage: Use drilled-in expansion shields and hanger or lag bolts.
   b. Hollow Masonry Anchorage: Use toggle bolts.

c. Wood Stud Partitions: Use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry Work to locate backing members.
d. Steel-Framed Partitions: Use either of the following:
   1) Self-tapping screws of size and type required to support structural loads, to fasten brackets directly to steel framing or concealed steel reinforcements.
   2) Toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 REPAIR

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair with galvanizing repair coating.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of finish coatings are specified in Section 099600 – High-Performance Coatings.

3.7 CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer.
   1. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction Work.
   1. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Wood products.
2. Preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Dimension lumber framing.
5. Miscellaneous lumber.
6. **Utility shelving**.
7. Plywood backing panels.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Lumber grading agencies, and abbreviations used to reference them, include the following:
1. WCLIB: West Coast Lumber Inspection Bureau.
2. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.
1. Indicate component materials and dimensions.
2. Include construction and application details.
3. Include data for preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
4. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
5. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
6. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC Board of Review.
2. **For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.**

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to AHJ that periodically performs inspections to verify that materials bearing classification marking is representative of material tested.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation.
   1. Protect wood products from weather by covering with waterproof sheeting, securely anchored.
   2. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. Certified Wood: The following wood products shall be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004.

B. Lumber:
   1. Comply with DOC PS 20 and with applicable rules of grading agencies indicated.
   2. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by ALSC Board of Review.
   3. Grade lumber by an agency certified by ALSC Board of Review to inspect and grade lumber under rules indicated.
   4. Factory mark each piece of lumber with grade stamp of grading agency.
   5. Dress lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber:
   1. 2 Inch Nominal Thickness or Less: 15 percent.
   2. More Than 2 Inch Nominal Thickness: 19 percent unless otherwise indicated.

D. Lumber fabricated from old growth timber is not permitted.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use Categories as follows:
   1. UC1: Interior construction not in contact with ground or subject to moisture.
   2. UC2: Interior lumber not in contact with ground but may be subject to dampness, including wood in contact with concrete and masonry.

3. UC3A: Exterior construction not in contact with ground but exposed to all weather cycles including intermittent wetting.
4. UC3B: Exterior construction not in contact with ground, exposed to all weather cycles including prolonged wetting.
5. UC4A: Non-critical sawn products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, and sawn products not in contact with ground but with ground contact-type hazards or that are critical or hard to replace.
6. UC4B: Critical or difficult-to-replace sawn products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, high decay potential, and salt water splash.
7. Preservative Chemicals: Acceptable to AHJ and containing no arsenic or chromium.
   a. Do not use inorganic boron (SBX) for sill plates.
8. After treatment, redry boards and dimension lumber to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by ALSC Board of Review.

D. Application: Treat items indicated on Drawings as PT, and the following:
1. Concealed rough carpentry wood members in contact with masonry or concrete.
2. Wood framing and furring attached directly to interior of below-grade exterior masonry or concrete walls.

2.3 FIRE-RETARDANT-TREATED LUMBER

A. Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this Article, that are acceptable to AHJ, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with flame front not extending more than 10.5 feet beyond centerline of burners at any time during test.
1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898.
   a. Application: Exterior locations and where indicated, including wood members associated with roof deck assemblies.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity.
   a. Application: Where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood, including backing panels, after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing and inspecting agency acceptable to AHJ.

E. Application: Treat items indicated on Drawings as FRT, and the following:
1. Framing for raised platforms.
2. Concealed blocking.
3. Framing for non-load-bearing partitions.
4. Framing for non-load-bearing exterior walls.
5. Wood nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
6. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
1. Species: Douglas fir-larch; WCLIB or WWPA
2. Application: Interior, non-load-bearing partitions.

B. Load-Bearing Partitions by Grade: Construction or No. 2 grade.
1. Species: Douglas fir-larch; WCLIB or WWPA unless indicated otherwise on Drawings.
2. Application: Exterior walls and interior load-bearing partitions.

C. Joists, Rafters, and Other Framing Not Listed Above: Construction or No. 2 grade.
1. Species: Douglas fir-larch; WCLIB or WWPA [As indicated on structural Drawings.]

D. Joists, Rafters, and Other Framing Not Listed Above: Any species and grade with a modulus of elasticity of at least 1,300,000 psi and an extreme fiber stress in bending of at least 1,300 psi for 2 inch nominal thickness and 12 inch nominal width for single-member use.

2.5 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Furring.
5. Utility shelving.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
1. Species: Douglas fir-larch; WCLIB or WWPA unless indicated otherwise on Drawings

C. Utility Shelving: Construction or No. 2 grade lumber of the following species:]
1. Species: Douglas fir-larch; WCLIB or WWPA unless indicated otherwise on Drawings As indicated on structural Drawings.
2. Provide lumber with 15 percent maximum moisture content.

D. Concealed Boards: Standard or No. 3 Common grade lumber of the following species.
1. Species: Douglas fir-larch; WCLIB or WWPA unless indicated otherwise on Drawings
2. Provide lumber with 15 percent maximum moisture content.

E. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir or wood having similar decay-resistant properties.

F. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

G. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other Work.

H. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4 inch nominal thickness.

2.7 FASTENERS

A. Provide fasteners of size and type indicated, that comply with requirements specified in this Article for material and manufacture, and are acceptable to AHJ.
1. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
2. Where rough carpentry is in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153 or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, as appropriate for substrate, based on the following:
1. Mechanical Anchors:
   a. Masonry: ICC-ES AC01.
   b. Concrete: ICC-ES AC193.
2. Adhesive Anchors:
   a. Masonry: ICC-ES AC58.
   b. Concrete: ICC-ES AC308.
3. Materials:
   a. Carbon-Steel Components: Zinc plated to comply with ASTM B633, Class Fe/Zn 5.
   b. Stainless Steel with Bolts and Nuts: Comply with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.8 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. MiTek Industries, Inc.
4. Phoenix Metal Products, Inc.
5. Simpson Strong-Tie Co., Inc.
6. Tamlyn.
7. USP Structural Connectors.

8. Approved substitution.

B. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2 inch minimum side cover **where indicated on structural Drawings**.
   1. Socket Base: 0.064 inch thick
   2. Standoff and Adjustment Plates: 0.108 inch thick.

C. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports **where indicated on structural Drawings**.
   1. Width: 1-1/4 inches
   2. Thickness: 0.050 inch
   3. Length: As indicated

D. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.
   1. Strap Width: 1-1/2 inches.
   2. Thickness: 0.050 inch.

E. Rafter Tie-Downs (Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
   1. Strap Width: 2-1/4 inches.
   2. Thickness: 0.064 inch.

F. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs **where indicated on structural Drawings**.
   1. Strap Width: 1-1/4 inches.
   2. Thickness: 0.050 inch.
   3. Length: 36 inches.

G. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed **where indicated on structural Drawings**.
   1. Bolt Diameter: 5/8 inch
   2. Width: 2-1/2 inches
   3. Body Thickness: 0.108 inch
   4. Base Reinforcement Thickness: 0.108 inch

H. Wall Bracing:
   1. T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
   2. Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

I. Materials: Unless otherwise indicated, fabricate from the following materials:
   1. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653, G60 coating designation.
      a. Use for interior locations unless otherwise indicated.
   2. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.034 inch thick.
      a. Use for preservative-treated lumber and where indicated.
   3. Stainless-Steel Sheet: ASTM A666, Type 304.
      a. Use for exterior locations and where indicated.

2.9 SOUND ISOLATION SYSTEMS

A. Resilient Furring Channels (RFC): Steel sheet members designed to reduce sound transmission.
   1. Asymmetrical Single Leg (RFC-1):
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) CEMCO: RC1 Resilient Channel.
         2) ClarkDietrich: RC Deluxe
         3) SCAFCO Steel Stud Company: Serenity-RC-Plus.
         4) Studco Building Systems US, LLC: RC1-18.
         5) Approved substitution.
      b. Channel Size:
         1) Top Flange: 1-1/4 inches minimum.
         2) Depth: 1/2 inch.
         3) Overall Width: 2 inches minimum.
      c. Metal Thickness: 0.0179 inch minimum.

B. Resilient Sound Isolation Clips (RSIC-1): Metal and rubber clip system for reducing sound transmission in wall and ceiling assemblies when used in conjunction with appropriate metal furring channels.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ClarkDietrich: CDSC Sound Clip.
      b. PAC International, Inc.: RSIC-1.
      c. Pliteq Inc.: GenieClip RST.
      d. Regupol America, LLC: SonusClip.
      e. Soundproofing Company (The): RSIC-1 Resilient Sound Isolation Clip.
      f. Studco Building Systems US, LLC: Resilmount A237R Sound Isolation Clip.
      g. Approved substitution.
   2. Metal Clip: Galvanized or aluminum-zinc coated steel, minimum 0.0451 inch thick.
   3. Rubber Isolator: Natural or thermoplastic rubber compound, blended with fire-inhibiting compounds, molded to isolate ferrule from clip.
      a. Minimum of 12 micro-vibration controlling pedestals at point of contact with framing member.
      b. Manufactured to ASTM D2000, M2 AA 510 A13, which includes:
         1) Hardness: ASTM D2240, Shore A: 47.
         2) Modulus 300 Percent, ASTM D412, Die C: minimum 769 psi.
         3) Tensile Strength: ASTM D412, Die C; minimum 1,624 psi.
         4) Elongation at Break, ASTM D573: minimum 454 percent.
   4. Design Load Rating: Minimum 36 lbs./isolator when used with 0.0179 inch thick metal studs.
   5. Size: Nominal 3 inch by 1-1/4 inch by 1-7/16 inch.
   6. Ferrule: Zinc-electroplated steel.
   7. Projection: 1-5/8 inches from supporting structure with 7/8 inch drywall furring channels.

2.10 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Provide one of the following types as suitable for locations indicated:
   1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1 inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
   2. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Flexible Flashings: Refer to Section 076500 – Flexible Flashing for the following:
   1. FA.FLSHG-1: Elastomeric flashing.
   2. SA.FLSHG-1: Rubberized-asphalt flexible flashing.
   3. SA.FLSHG-4: Butyl rubber flexible flashing.

C. Installation Adhesives: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
   1. Application: For gluing furring and sleepers to wood, concrete, or masonry.
   2. Verify VOC content is 70 g/L or less.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set Work to required levels and lines, with members plumb, true to line, cut, and fitted.
   1. Fit rough carpentry accurately to other construction.
   2. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum boards and lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels.
   2. Space clips not more than 16 inches on center.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches on center with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches on center. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2 inch nominal thickness.
   3. Concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
   4. Concealed spaces behind combustible cornices and exterior trim at not more than 20 feet on center.

H. Blocking for Owner-Furnished Products:
   1. Where products are indicated as Owner-furnished/Owner-installed (OFOI) and Owner-furnished/Contractor-installed (OFCI), coordinate with Owner to obtain product information for each product to determine blocking requirements. Provide appropriate blocking for each of these products.

2. Owner-furnished/Contractor-installed products may include the following:
   a. Toilet and bath accessories.
   b. Healthcare accessories.
   c. Equipment mounting boards.
   d. Wall-mounted shelves.
   e. Other items as indicated on Drawings.

I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.
3. Application: Items not continuously protected from liquid water.

K. Where preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

L. Securely attach rough carpentry Work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

M. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

N. Use steel common nails unless otherwise indicated.
1. Make tight connections between members.
2. Install fasteners without splitting wood.
3. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other Work.
1. Form to shapes indicated and cut as required for true line and level of attached Work.
2. Coordinate locations with other Work involved.

B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish Work.

B. Furring to Receive Plywood or Paneling: Install 1 by 3 inch nominal-size furring at 24 inches on center.

C. Furring to Receive Gypsum Board: Install 1 by 2 inch nominal-size furring vertically at 16 inches on center.

3.4 INSTALLATION OF WALL AND PARTITION FRAMING

A. Provide single bottom plate and double top plates using members of 2 inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
   1. Interior Partitions and Walls: 2 by 6 inch nominal, 2 by 8 inch nominal, and 2 by 4 inch nominal size wood studs spaced 16 inches on center unless otherwise indicated.
   2. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with 3 or more studs, except that 2 studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
   1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4 inch nominal depth for openings 48 inches and less in width, 6 inch nominal depth for openings 48 to 72 inches in width, 8 inch nominal depth for openings 72 to 120 inches in width, and not less than 10 inch nominal depth for openings 10 to 12 feet in width.
   2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings unless indicated otherwise. Provide headers of depth indicated.

D. Provide diagonal bracing where indicated, at 45-degree angle, full-story height unless otherwise indicated.

3.5 INSTALLATION OF FLOOR JOIST FRAMING

A. Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
   1. Where supported on wood members, by toe nailing or by using metal framing anchors.
   2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.

C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

D. Do not notch in middle third of joists; limit notches to 1/6 depth of joist, 1/3 at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.

E. Provide solid blocking of 2 inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2 inch nominal thickness by depth of joist over supports.

G. Anchor members paralleling masonry with 1/4 by 1-1/4 inch metal strap anchors spaced not more than 96 inches on center., extending over and fastening to 3 joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.

H. Provide solid blocking between joists under jamb studs for openings.

I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
   1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

J. Provide bridging of type indicated below, at intervals of 96 inches on center between joists.
   1. Diagonal wood bridging formed from bevel-cut, 1 by 3 inch nominal-size lumber, double-crossed and nailed at both ends to joists.
   2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
   1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1 by 8 inch nominal-size or 2 by 4 inch nominal-size stringers spaced 48 inches on center crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
   1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
   2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

C. Provide collar beams (ties) as indicated or, if not indicated, provide 1 by 6 inch nominal-size boards between every third pair of rafters, but not more than 48 inches on center Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.7 INSTALLATION OF PLYWOOD BACKING PANELS

A. Install plywood backing panels by fastening to studs.
   1. Coordinate locations with utilities requiring backing panels.
   2. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

3.8 INSTALLATION OF SOFFIT FRAMING

A. Provide bottom and top plates using members of 2 inch nominal thickness whose widths equal that of framing and as indicated on Drawings. Fasten plates to supporting construction unless otherwise indicated.

1. Interior Soffits: 2 by 4 inch nominal size wood studs spaced 24 inches on center unless otherwise indicated.

3.9 PROTECTION

A. Protect rough carpentry from weather.
   1. If, despite protection, wood that becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment.
   2. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Miscellaneous dimension lumber.
   2. Concealed wood blocking and nailers.
   3. Wood furring.
   4. Plywood backing panels.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.
   1. Indicate component materials and dimensions.
   2. Include construction and application details.
   3. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   4. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   5. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
   6. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
   1. Preservative-treated wood.
   2. Fire-retardant-treated wood.
   3. Power-driven fasteners.
   4. Post-installed anchors.

B. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to AHJ that periodically performs inspections to verify that materials bearing classification marking is representative of material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces.
   1. Stack lumber flat with spacers between each bundle to provide air circulation.
   2. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with applicable rules of any rules-writing agency certified by ALSC Board of Review. Provide lumber graded by an agency certified by ALSC Board of Review to inspect and grade lumber under rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
   3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber:
   1. 2 Inch Nominal Thickness or Less: 15 percent.
   2. More Than 2 Inch Nominal Thickness: 19 percent unless otherwise indicated.

2.2 PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1 Use Categories as follows:
   1. UC1: Interior construction not in contact with ground or subject to moisture.
   2. UC2: Interior construction not in contact with ground but may be subject to moisture.
      a. Includes wood in contact with concrete and masonry.
   3. UC3A: Exterior construction not in contact with ground but exposed to all weather cycles including intermittent wetting.
   4. UC3B: Exterior construction not in contact with ground, exposed to all weather cycles including prolonged wetting.
   5. UC4A: Non-critical sawn products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, and sawn products not in contact with ground but with ground contact-type hazards or that are critical or hard to replace.
   6. UC4B: Critical or difficult-to-replace sawn products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, high decay potential, and salt water splash.
   7. Preservative Chemicals: Acceptable to AHJ and containing no arsenic or chromium.
   8. After treatment, redry boards and dimension lumber to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by ALSC Board of Review.
   1. For exposed lumber indicated to receive stained or natural finish, mark end or back of each piece, or omit marking and provide certificates of treatment compliance issued by inspection agency if acceptable to inspection agency or AHJ.

D. Application: Treat items indicated on Drawings as PT.
   1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Concealed rough carpentry wood members in contact with masonry or concrete.
   3. Wood furring attached directly to interior of below-grade exterior masonry or concrete walls.
   4. **Wood floor plates that are installed over concrete slabs-on-grade**.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this Article, that are acceptable to AHJ, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with flame front not extending more than 10.5 feet beyond centerline of burners at any time during test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898.
      a. Application: Exterior locations and where indicated, including wood members associated with roof deck assemblies.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
      a. Application: Where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
   1. For exposed lumber indicated to receive stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing and inspection agency if acceptable to AHJ.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings as FRT.
   1. Concealed blocking.
   2. Wood nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.

3. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
   1. Species: Douglas fir-larch; WCLIB or WWPA.
   2. Application: Interior, non-load-bearing partitions.

B. Load-Bearing Partitions: Construction or No. 2 grade.
   1. Species: Douglas fir-larch; WCLIB or WWPA unless indicated otherwise on Drawings.
   2. Application: Exterior walls and interior load-bearing partitions.

2.5 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
   1. Species: Douglas fir-larch; WCLIB or WWPA unless indicated otherwise on Drawings

C. Concealed Boards: Standard or No. 3 Common grade lumber of the following species.
   1. Species: Douglas fir-larch; WCLIB or WWPA unless indicated otherwise on Drawings.
   2. Provide lumber with 15 percent maximum moisture content.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other Work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4 inch nominal thickness.

2.7 FASTENERS

A. Provide fasteners of size and type indicated, that comply with requirements specified in this Article for material and manufacture, and are acceptable to AHJ. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153 or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to AHJ, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to AHJ, as appropriate for substrate, based on the following:
   1. Mechanical Anchors:
      a. Masonry: ICC-ES AC01.
      b. Concrete: ICC-ES AC58.
   2. Adhesive Anchors:
      a. Masonry: ICC-ES AC193.
      b. Concrete: ICC-ES AC308.
   3. Materials:
      a. Carbon-Steel Components: Zinc plated to comply with ASTM B633, Class Fe/Zn 5.
      b. Stainless Steel with Bolts and Nuts: Comply with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.8 MISCELLANEOUS MATERIALS

A. Flexible Flashings: Refer to Section 076500 – Flexible Flashing for the following:
   1. SA.FLSHG-1: Rubberized-asphalt flexible flashing.
   2. SA.FLSHG-4: Butyl rubber flexible flashing.

B. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
   1. Verify VOC content is 70 g/L or less.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
   1. Fit carpentry accurately to other construction.
   2. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Provide blocking as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board at corners and intersections where blocking does not provide a surface for fastening edges of panels.
   2. Space clips not more than 16 inches on center.

C. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches on center with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
   3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet on center.

D. Blocking for Owner-Furnished Products:

1. Where products are indicated as Owner-furnished/Owner-installed (OFOI) and Owner-furnished/Contractor-installed (OFCI), coordinate with Owner to obtain product information for each product to determine blocking requirements. Provide appropriate blocking for each of these products.
2. Owner-furnished/Contractor-installed products may include the following:
   a. Equipment mounting boards.
   b. Other items as indicated on Drawings.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Securely attach miscellaneous carpentry Work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

G. Use steel common nails unless otherwise indicated.
1. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials.
2. Make tight connections between members.
3. Install fasteners without splitting wood.
4. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WALL AND PARTITION FRAMING

A. Provide single bottom plate and double top plates using members of 2 inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions **and for load-bearing partitions where framing members bearing on partition are located directly over studs**. Fasten plates to supporting construction unless otherwise indicated.
1. Interior Partitions and Walls: **2 by 6 inch nominal** size wood studs spaced **16 inches** on center unless otherwise indicated.
2. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with 3 or more studs[, except that 2 studs may be used for interior non-load-bearing partitions].

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4 inch nominal depth for openings 48 inches and less in width, 6 inch nominal depth for openings 48 to 72 inches in width, 8 inch nominal depth for openings 72 to 120 inches in width, and not less than 10 inch nominal depth for openings 10 to 12 feet in width.
2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings unless indicated otherwise. Provide headers of depth indicated.

D. Provide diagonal bracing where indicated, at 45-degree angle, full-story height unless otherwise indicated.

3.3 INSTALLATION OF PLYWOOD BACKING PANELS

A. Install plywood backing panels by fastening to studs.
   1. Coordinate locations with utilities requiring backing panels.
   2. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

3.4 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for attaching other Work. Form to shapes indicated and cut as required for true line and level of attached Work. Coordinate locations with other Work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.5 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish Work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1 inch by 3 inch nominal-size furring at 24 inches on center.

C. Furring to Receive Gypsum Board: Install 1 by 2 inch nominal-size furring vertically at 16 inches on center.

3.6 PROTECTION

A. Protect rough carpentry from weather.
   1. If, despite protection, wood that becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment.
   2. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1053

SECTION 061113 – ENGINEERED WOOD PRODUCTS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes structural framing with engineered wood products.

1.02 SUBMITTALS

A. Product Data: For each factory-fabricated product, indicate component materials and dimensions and include construction and application details.

B. Research/Evaluation Reports: Show compliance with building code in effect for Project.

1.03 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Stack off of ground; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Prefabricated Wood I-Joists:

    a. Truss Joist (Design Basis).
    b. Boise Cascade Corporation.
    c. Georgia-Pacific Corporation.
    d. Louisiana-Pacific Corporation.
    e. Other manufacturers (subject to Owner’s Representative’s approval).

2. Glulaminated, Laminated Vertical Veneer Lumber, Parallel Strand Lumber, Laminated Strand Lumber:

    a. American Plywood Association/EWS certified producers.
    b. American Institute of Timber Construction certified producers.

c. Products shall be fabricated using waterproof adhesives.

2.02 GENERAL

A. Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.03 ENGINEERED WOOD PRODUCTS

A. Wood I-Joists: Prefabricated units complying with APA PRI-400; depths and performance ratings not less than those indicated.

1. Bases of design are indicated on the Drawings.
2. Web Material: Either oriented strand board or plywood, Exposure 1.
3. Structural Capacities: Establish and monitor structural capacities according to ASTM D5055.
4. Trademark: Factory mark I-joists with APA trademark indicating nominal joist depth, joist class, span ratings, mill identification, and I-joist compliance with APA standard.

B. Engineered Wood Beams:

1. Glulaminated wood beams are shown on the Drawing as the basis of design.
2. Where appearance is not a factor, veneer or strand materials of equivalent strength and stiffness may be substituted upon evaluation and approval of the Owner's Representative.
3. Lamination layout shall be V4, unbalanced, visually graded, unless otherwise specified. Balanced layout and MSR graded may be substituted without addition cost to Owner.
4. Appearance grade shall be Industrial Appearance Grade, unless otherwise noted.
5. No camber or manufacturer's standard camber shall be acceptable, unless otherwise noted on the Drawings.

2.04 SUPPLEMENTARY PRODUCTS

A. Wood I-Joists:

1. Rim boards and blocking shall be from the same manufacturer as the joists and shall be applied in compliance with the manufacturer's recommendations.
2. Dimension lumber or plywood blocking or stiffeners shall be of sizes recommended by the manufacturer. Materials shall meet the requirements of Section 062020 – Rough Carpentry.
3. Fastenings shall comply with the minimum requirements of the manufacturer or as shown on the Drawings. Take care to avoid splitting or other damage to the joists.

B. Metal Brackets, Straps, and Hangers:

1. Metal connectors shall be fabricated specifically to match the dimensions of the engineered wood products. Bending or cutting dimensional lumber connectors to fit shall not be allowed.
2. Joists and beams shall be firmly seated in hangers.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. For Glulaminated products, care shall be taken to install in the correct orientation, with camber and/or surfaces marked "TOP" facing upward.

C. Manufacturer's protective wrapping shall be removed prior to installation.

END OF SECTION

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   a. Wall sheathing.
   b. Roof sheathing.
   c. Roof substrate and cover boards.
   d. Parapet sheathing.
   e. Composite nail base insulated roof sheathing.
   f. Subflooring and underlayment.
   g. Shear panel sheathing.
   h. Sheathing joint-and-penetration treatment materials.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project site.
   a. Review the following:
      1. Air and vapor-permeable barrier sheathing requirements and installation.
      2. Special details.
      3. Transitions.
      4. Mockups.
      5. Air-leakage testing.
      6. Protection.
      7. Scheduling that covers air-barrier and water-resistant barrier sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   a. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   b. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   c. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
   d. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
   a. Wood-preservative-treated plywood.
   b. Fire-retardant-treated plywood.
   c. Air-barrier and water-resistant glass-mat gypsum sheathing.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

B. Testing Agency Qualifications:
   a. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that material bearing classification marking is representative of material tested.
   b. For testing and inspecting agency providing tests and inspections related to air-barrier and water-resistant glass-mat gypsum sheathing: an independent agency, qualified in accordance with ASTM E329 for testing indicated, and certified by Air Barrier Association of America, Inc.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier and water-resistant glass-mat gypsum sheathing assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
   a. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers.
   b. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E783 or ASTM E2357.
   c. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D4541.
   d. Notify Architect 7 days in advance of dates and times when mockups will be tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packaging and store in an enclosed shelter providing protection from damage and exposure to the elements.
   a. Store within temperature limits required by manufacturer.
   b. Store air- and water-resistive sheathing board supported on risers on a flat platform.
   c. Comply with manufacturer's written instructions for safety and handling.

B. Stack panels flat with spacers beneath and between each bundle to provide air circulation.
   a. Protect sheathing from weather by covering sheathing covering sheathing with waterproof sheeting, securely anchored.
   b. Provide for air circulation around stacks and under coverings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace structural insulated sheathing products that fail in materials or workmanship within specified warranty period.
   a. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Fire-Resistance Ratings: As tested per ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Certified Wood: Certify the following wood products as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004.
   a. Plywood.
   b. Oriented strand board.

B. Certified Wood: Certify the following wood products in accordance with American Tree Farm System's "AFF Standard," AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or standards of Program for Endorsement of Forest Certification.
   a. Plywood.
   b. Oriented strand board.

C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground and Use Category UC3b for exterior construction not in contact with ground.
   a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with concrete [or] [masonry] or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when test is extended an additional 20 minutes, and with flame front not extending more than 10.5 feet beyond centerline of burners at any time during test.
   a. Use treatment that does not promote corrosion of metal fasteners.]

b. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   1. Use for exterior and interior locations where indicated.
c. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516, and design value adjustment factors shall be calculated according to ASTM D6305.
   1. Span ratings after treatment shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:
   a. Plywood used within Type 1A construction.

2.5 WALL SHEATHING

A. Plywood Wall Sheathing (SHTHG-1): Either DOC PS 1 or DOC PS 2, Exposure 1 sheathing.
   a. Span Rating: Not less than 24/0.
   b. Nominal Thickness: As indicated on Drawings, but not less than 15/32 inch.

B. Oriented-Strand-Board (OSB) Sheathing (SHTHG-2): DOC PS 2, Exposure 1 sheathing.
   a. Span Rating: Not less than 16/0
   b. Nominal Thickness: Not less than 5/16 inch

C. Glass-Mat Gypsum Sheathing Board (SHTHG-3): ASTM C1177, with fiberglass mat laminated to both sides and with manufacturer's standard edges. Products: Subject to compliance with requirements, provide one of the following:
   1. American Gypsum: M-GLASS Type X Exterior Gypsum Sheathing.
   2. CertainTeed Gypsum; Saint-Gobain: GlasRoc Sheathing Board Type X
   3. Georgia-Pacific Gypsum LLC: DensGlass Fireguard Sheathing.
   4. National Gypsum Company: Gold Bond eXP Fire-Shield Sheathing.
   5. PABCO Gypsum: PABCO GLASS Sheathing Type X.
   6. USG Corporation: Securock Glass-Mat Sheathing Firecode X.
   7. Approved substitution.
   b. Core: Type X, 5/8 inch thick.
   c. Size: 48 inches by longest practical length for vertical installation.
   d. Maximum Framing Spacing: 16 inches on center.
   e. Application:

D. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing (ABWR.SHTHG-1): ASTM C1177, Type X, coated fiberglass mat gypsum sheathing with integral weather-resistant barrier and air barrier complying with ASTM E2178.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1. Georgia-Pacific Gypsum LLC: DensElement Barrier System.
      2. USG Corporation: Securock ExoAir 430.
      3. Approved substitution.
   b. Thickness: 5/8 inch thick.
   c. Size: 48 inch wide by longest practical length for vertical installation.

d. Edges: Square.
e. Flashing and Transitions Strips: As acceptable to sheathing manufacturer.
f. Air Permeance: ASTM E2178; maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference.
g. Vapor Permeance: ASTM E96, Desiccant Method, Procedure A; minimum 20 perms.
h. Sheathing Assembly Air Leakage: ASTM E2357; maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.
i. Fire Propagation Characteristics: Complies with NFPA 285 testing as part of an approved assembly.
j. UV Resistance: Can be exposed to sunlight for [30] [90] [180] days according to manufacturer's written instructions.
k. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by sheathing manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

E. Cementitious Backer Units, Walls: ASTM C1325, Type A.
a. Products: Subject to compliance with requirements, provide one of the following:
1. FinPan, Inc.: ProTec Concrete Backer Board. James Hardie Building Products, Inc.: Hardiebacker 500 Cement Board. National Gypsum Company: Permabase Cement Board. USG Corporation: Securock Cement Roof Board, Roof Sheathing. Approved substitution.
b. Thickness: 5/8 inch
c. Face Finish:
1. Unexposed Face: Smooth.
2. Exposed Face: Cementitious finish.
d. Maximum framing spacing is 16 inches on center.
e. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

F. Tile Backer Units: Cementitious tile backer units as specified in Section 092900 – Gypsum Board.

G. Paper-Surfaced Gypsum Sheathing: ASTM C1396, gypsum sheathing; with water-resistant-treated core and water-repellent paper bonded to core's face, back, and long edges.
a. Products: Subject to compliance with requirements, provide one of the following:
1. CertainTeed Gypsum; Saint-Gobain: CertainTeed Type X Sheathing Treated Core.
2. Georgia-Pacific Gypsum LLC: ToughRock Gypsum Sheathing.
3. Approved substitution.
b. Type and Thickness: Type X, 5/8 inch, thick.
c. Edge and End Configuration: V-shaped, tongue-and-groove long edges; square ends.
d. Size: 48 by 96 inches for vertical installation.
e. Locations: Exterior soffits.

2.6 ROOF SHEATHING

A. Plywood Roof Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.
a. Span Rating: Not less than 60
b. Performance Category: 3/4 PERF CAT
c. Field verify thickness to match existing at locations required to replace existing damaged roof sheathing.

1. Submit discrepancies to Architect for review prior to ordering or proceeding with Work.

B. Oriented-Strand-Board Sheathing (OSB): DOC PS 2, Exposure 1, Structural I sheathing.
   a. Span Rating: Not less than 16/0
   b. Nominal Thickness: Not less than 7/16 inch

2.7 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.
   a. Span Rating: Not less than 16.
   b. Nominal Thickness: Not less than 23/32 inch.
   c. Edge Detail: Tongue and groove.
   d. Surface Finish: Fully sanded face.
   e. Applications:
      1. Where carpet and pad flooring is scheduled if not indicated to be installed over plywood subfloor and plywood underlayment.
      2. Do not use with other types of flooring surfaces.

B. Oriented-Strand-Board (OSB) Combination Subfloor-Underlayment: DOC PS 2, Exposure 1 single-floor panels.
   a. Span Rating: Not less than 16
   b. Nominal Thickness: Not less than 23/32 inch
   c. Edge Detail: Square
   d. Surface Finish: Fully sanded face.

C. Plywood Subflooring: DOC PS 1, Exposure 1 single-floor panels or sheathing.
   a. Span Rating: Not less than 16.
   b. Nominal Thickness: Not less than 23/32 inch.

D. Oriented-Strand-Board (OSB) Subflooring: DOC PS 2, Exposure 1
   a. Span Rating: Not less than 16
   b. Nominal Thickness: Not less than 23/32 inch

E. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.
   a. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exterior, C-C Plugged with fully sanded face.
   b. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8 inch nominal thickness.
   c. Plywood Underlayment for Carpet: DOC PS 1, Exposure 1, Underlayment

2.8 STRUCTURAL INSULATED SHEATHING PANELS The following FR OSB was added for the IFC package on Greenwood's The Hemlock:

1. Structural Insulated Sheathing (SI.SHTHG): Magnesium oxide (MgO)-coated, fire-rated sheathing panel with panel manufacturer's rigid foam insulation fused to rear face of sheathing and air and water-resistive barrier factory-applied to front face of sheathing.
   a. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      1. DuPont de Nemours, Inc.: ArmorWall Plus FR SIS. Approved substitution.
   b. Panel Size: 48 by 96 inches.
   c. Panel Thickness: Thicknesses below includes 1/2 inch MgO facer board.

1. 2 inches (1-1/2 inch insulation) with R-value of R-10.
2. 2-3/4 inches (2-1/4 inch insulation) with R-value of R-15.
3. 3-3/4 inches (3-1/4 inch insulation) with R-value of R-21.

d. Insulation: Closed cell, Class 1 rated urethane fused directly to rear face of MgO board.
   1. Laminated insulation is not acceptable.
   2. Closed Cell Content: Equal to or greater than 90 percent.

e. Panel Properties:
   1. Air and Water Resistive Barrier:
      a) Air Permeance: ASTM E2178; max. 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. pressure difference.
      b) Water Vapor Permeance: ASTM E96 Procedure B; Water Method; 18 perms min at 10 mils.
   2. Sheathing Assembly Air Leakage: ASTM E2357; maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.

f. Fire Propagation Characteristics: Complies with NFPA 285 testing as part of an approved assembly.

g. UV Resistance: Can be exposed to sunlight for 15 days according to manufacturer's written instructions.

h. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by sheathing manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

2.9 SHEAR PANEL SHEATHING Structural panels consisting of gypsum wall sheathing laminated to steel sheets that act as both a sheathing and shear wall.

B. Sheathing Panel: Paper-Surfaced Gypsum Wall Sheathing as specified under Wall Sheathing Article above.

C. Sheet Steel: ASTM A653, Commercial Steel (CS), Grade 33, G40 coating,
   a. Products: Subject to compliance with requirements, provide the following:
      1. International Materials Inc.: Sure-Board Series 200/200S.
      2. Approved substitution.
   b. Thickness: Minimum 0.027 inch.
   c. Sizes: 48 inches W by maximum length.

D. Adhesives: Non-structural, water soluble, non-combustible type adhesive used to attach steel sheet to gypsum wallboard or other non-structural sheathing, provided or recommended by shear panel sheathing manufacturer.

2.10 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   a. Provide fasteners with hot-dip zinc coating complying with ASTM A153

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

E. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

F. Screws for Fastening Sheathing to Cold-Formed Metal Framing:
   a. Wood Structural Panels: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
   b. Gypsum Sheathing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
      1. For light-gage steel framing less than 0.0329 in. thick, use screws that comply with ASTM C1002.
      2. For cold-formed steel framing from 0.033 in. to 0.112 in. thick, use screws that comply with ASTM C954.

G. Screws for Fastening Shear Panel Sheathing:
   a. Provide length recommended by shear panel sheathing manufacturer.
   b. Provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

2.11 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
   a. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 in. wide, 10 by 10 or 10 by 20 threads/in., of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

B. Sealant for Paper-Surfaced Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 – Joint Sealants.

C. Joint Compound for Exterior Applications:
   a. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.
   b. Paper-Surfaced Gypsum Sheathing: At exterior gypsum soffit board locations, use setting-type taping and setting-type, sandable topping compounds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged, broken, and chipped.

C. Ensure steel framing is in place and ready to receive structural concrete panel Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than 3 support members.

B. Cut panels at penetrations, edges, and other obstructions of Work, and fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   a. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
   b. ICC-ES evaluation report for fastener.

D. Wood Framing:
   a. Use common wire nails unless otherwise indicated.
   b. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials.
   c. Make tight connections.
   d. Install fasteners without splitting wood.

E. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of workday when rain is forecast.

3.3 INSTALLATION OF WOOD STRUCTURAL PANEL

A. Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   a. Combination Subfloor-Underlayment:
      1. Glue and Screw to wood framing.
      2. Screw to cold-formed metal framing.
      3. Space panels 1/8 inch apart at edges and ends.
   b. Subflooring:
      1. Glue and Screw to wood framing.
      2. Screw to cold-formed metal framing.
      3. Space panels 1/8 inch apart at edges and ends.
   c. Underlayment:
      1. Screw to subflooring.
      2. Space panels 1/32 inch apart at edges and ends.
      3. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.
   d. Wall and Roof Sheathing:
      1. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
      2. Screw or nail to framing.
      3. Space panels 1/8 inch apart at edges and ends.

3.4 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253 and with manufacturer's written instructions.
   a. Fasten gypsum sheathing to framing with screws.
   b. Install panels with 3/8 in. gap where non-load-bearing construction abuts structural elements.
   c. Install panels with 1/4 in. gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation:
   a. Install sheathing with V-grooved edge down and tongue edge up.
   b. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing.
   c. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than 1 stud spacing.
   d. Attach boards at perimeter and within field of board to each steel stud.
   e. Space fasteners approximately 8 inches on center and set back a minimum of 3/8 in. from edges and ends of boards.

D. Vertical Installation:
   a. Install vertical edges centered over studs.
   b. Abut ends and edges with those of adjacent panels.
   c. Attach at perimeter and within field of panel to each stud.
   d. Space fasteners approximately 8 in. on center and set back a minimum of 3/8 in. from edges and ends of panels.

E. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.
   a. Glass-Mat Fiber-Reinforced Gypsum Sheathing:
      1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints.
      2. Apply sealant and trowel to embed entire face of tape in sealant.
      3. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
   b. Paper-Surfaced Gypsum Sheathing:
      1. Apply elastomeric sealant to joints and fasteners and trowel flat.
      2. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

3.5 INSTALLATION OF CEMENTITIOUS BACKER UNITS

A. Install panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Refer to Section 092900 – Gypsum Board for installation of cementitious tile backer units.

3.6 INSTALLATION OF ROOF SUBSTRATE AND COVER BOARDS

A. Refer to the following Sections for installation of roof substrate and cover boards:
   a. Refer to Section 074113.16 – Standing-Seam Metal Roof Panels.
   b. Refer to Section 073013 – Roofing Underlayments.

B. Comply with manufacturer's written recommendations.

C. Install shear panel sheathing in locations indicated on structural Drawings for shear panels.

D. Seal joints in sheathing panel as specified in Part 3 above according to sheathing panel type.

3.7 PROTECTION

A. Gypsum Sheathing:
   a. Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing.
   b. Apply covering immediately after sheathing is installed.

END OF SECTION

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood trusses products.

1.2 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.
   1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
   2. Indicate sizes, stress grades, and species of lumber.
   3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
   4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
   5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
   6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses, indicating compliance with performance and design criteria.
   1. Include analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For metal connector-plate manufacturer.
   2. For fabricator.
   3. For professional engineer indicating experience with providing delegated-design engineering services of the kind indicated.
      a. Include documentation that engineer is licensed in state in which Project is located.

B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

D. Evaluation Reports: For the following, from ICC-ES:
   1. Metal-plate connectors.
   2. Metal truss accessories.

1.5 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
   1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Delegated-Design Engineer Qualifications: Professional engineer experienced in providing delegated-design engineering services of the kind indicated and is legally qualified to practice in state where Project is located.

D. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to AHJ that periodically performs inspections to verify that material bearing classification marking is representative of material tested.

E. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

F. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
   1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
   2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
   3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Delegated-Design: Engage a qualified professional engineer, as defined in Section 013573 – Delegated-Design Procedures, to design metal-plate-connected wood trusses, including attachment to building construction.

B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
   1. Design Loads: As indicated on structural Drawings.
   2. Maximum Deflection under Design Loads:
      a. Live Load: L/360.

b. Total Load: L/240.

C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

E. Certified Wood: Wood products shall be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004.

F. Seismic Performance: Shop-fabricated wood trusses and connectors shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

2.2 WOOD PRODUCTS

A. Lumber: Comply with DOC PS 20 and with applicable rules of any rules-writing agency certified by ALSC Board of Review.
1. Provide lumber graded by an agency certified by ALSC Board of Review to inspect and grade lumber under rules indicated.
2. Factory mark each piece of lumber with grade stamp of grading agency.
3. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
4. Provide dressed lumber, S4S.
5. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Minimum Chord Size for Roof Trusses: 2 by 4 inches nominal for both top and bottom chords, unless indicated otherwise.

C. Minimum Specific Gravity for Top Chords: 0.50.

D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber as indicated on structural Drawings.

2.3 METAL CONNECTOR PLATES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpine; a division of ITW, Inc.
2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
3. CompuTrus, Inc.
4. Eagle Metal Products.
5. Jager Building Systems, Inc.
6. MiTek Industries, Inc.
7. Robbins Engineering, Inc.
8. Truswal Systems Corporation.

B. Fabricate connector plates to comply with TPI 1.

C. Hot-Dip Galvanized-Steel Sheet: ASTM A 653; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
1. Use for interior locations unless otherwise indicated.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, and not less than 0.035 inch thick.
1. Use for exterior locations and where indicated.

2.4 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
   2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with General Structural Notes with ASTM A563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: See General Structural Notes.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cleveland Steel Specialty Co.
   2. KC Metals Products, Inc.
   3. Phoenix Metal Products, Inc.
   4. Simpson Strong-Tie Co., Inc.
   5. USP Structural Connectors.
   6. Alpine Engineered Products, Inc.
   7. Cherokee Metal Products, Inc.; Masengill Machinery Company.
   8. CompuTrus, Inc.
   9. Eagle Metal Products.
   10. Jager Building Systems, Inc.
   11. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
   12. Robbins Engineering, Inc.
   13. TEE-LOK Corporation; a subsidiary of Berkshire Hathaway Inc.
   14. Truswal Systems Corporation.

B. Allowable design loads, as published by manufacturer, shall comply with or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.
   1. Use for interior locations unless otherwise indicated.

D. Stainless-Steel Sheet: ASTM A240 or ASTM A 666, Type 304.
   1. Use for exterior locations and where indicated.

E. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below.
   1. Size: 1-1/2 inches wide by 0.050 inch thick.

F. Truss Tie-Downs (Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.
   1. Size: 2-1/4 inches wide by 0.062 inch thick.

G. Truss Tie-Downs (Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.
   1. Size: 2-1/2 inches wide by 0.062 inch thick.

H. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls. Clip is fastened to truss through slotted holes to allow for truss deflection.
   1. Size: 11/4 inches wide by 0.050 inch thick.

I. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4 inch long seat; formed from metal strap 0.062 inch thick with tabs bent to extend over and be fastened to supporting member.

J. Roof Truss Bracing/Spacers: U-shaped channels made to fit between 2 adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.
   1. Size: 1-1/2 inches wide by 1 inch deep by 0.040 inch thick.

K. Drag Strut Connectors: Angle clip with one leg extended for fastening to side of girder truss.
   1. Angle Clips: 3 by 3 by 0.179 by 8 inches with extended leg 8 inches long. Connector has galvanized finish.
   2. Angle Clips: 3 by 3 by 0.239 by 10-1/2 inches with extended leg 10-1/2 inches long. Connector has painted finish.

L. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
   2. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153 or of Type 304 stainless steel.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Coating: Zinc-rich, cold galvanizing compound as specified in Section 055000 – Metal Fabrications.

2.7 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1.
   1. Position members to produce design camber indicated.
   2. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses at 24 inches on center as indicated on structural Drawings.
   1. Adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.
   1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
   1. Install bracing to comply with Section 061000 – Rough Carpentry.
   2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not comply with requirements.
   1. Damaged trusses may be repaired according to truss repair details signed and sealed by qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIR

A. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780 and manufacturer's written instructions.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and permanent individual truss member restraint/bracing are installed in accordance with approved truss submittal package.

END OF SECTION

SECTION 062020 – ROUGH CARPENTRY **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes the following:

1. Framing with dimension lumber.
2. Wood nailers, blocking, and sheathing.

1.02 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces.
2. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
3. For lumber pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 – PRODUCTS

2.01 LUMBER, GENERAL

A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 “American Softwood Lumber Standard” and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee’s (ALSC) Board of Review.

B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:

1. WCLIB – West Coast Lumber Inspection Bureau.
2. WWPA – Western Wood Products Association.

C. Grade Stamps:

1. Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece; or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.

D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20 for moisture content specified for each use.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide lumber with 15 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.02 DIMENSION LUMBER

A. For light framing provide “Stud,” “No. 3,” or “Standard” grade lumber for stud framing (2 to 4 inches thick, 2 to 4 inches wide, 10 feet and shorter) and “Stud” or “No. 3” grade for other light framing (2 to 4 inches thick, 2 to 6 inches wide), any species.

2.03 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: “Standard” grade light-framing-size lumber of any species or board-size lumber as required. “No. 3 Common” or “Standard” grade boards per WCLIB or WWPA rules.

2.04 CONSTRUCTION PANELS, GENERAL

A. Construction Panel Standards: Comply with PS 1 “U.S. Product Standard for Construction and Industrial Plywood” for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.

B. Trademark: Furnish construction panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.

2.05 CONCEALED PERFORMANCE-RATED CONSTRUCTION PANELS

A. General: Where construction panels are indicated for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements designated under each application for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.

1. Wall Sheathing: APA RATED SHEATHING.

   a. Exposure Durability Classification: EXPOSURE 1.
   b. Span Rating: As required to suit stud spacing indicated.

2. Floor and Roof Sheathing: As indicated on Structural Drawings.

2.06 CONSTRUCTION PANELS FOR BACKING

A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.07 AIR INFILTRATION BARRIER

A. Asphalt-saturated organic felt complying with ASTM D226, Type I (No. 15 asphalt felt), unperforated.

2.08 FASTENERS AND SCREEN

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A153 or AISI Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: ASTM F1667.

C. Power Driven Fasteners: National Evaluation Report NER-272.

D. Wood Screws: ANSI B18.6.1.

E. Lag Bolts: ANSI B18.2.1.

F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and where indicated, flat washers.

G. Insect Screen: Galvanized steel 18/18 mesh.

2.09 METAL FRAMING ANCHORS

A. General:

1. Provide metal framing anchors of type, size, metal, and finish that comply with requirements specified, including the following:

a. Current Evaluation/Research Reports: Provide products for which model code evaluation/ research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this project.
b. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent testing laboratory.

B. Galvanized Steel Sheet: Steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication to comply with ASTM A525 for Coating Designation G60 and with ASTM A446, Grade A (structural quality); ASTM A526 (commercial quality); or ASTM A527 (lock-forming quality); as standard with manufacturer for type of anchor indicated.

2.10 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark Requirements.

B. Pressure-treat aboveground items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, studs, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates installed over concrete slabs directly in contact with earth.

C. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of nailers, blocking, and similar supports to allow attachment of other construction.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.

E. Use common wire nails unless otherwise indicated. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.02 WOOD NAILERS AND BLOCKING

A. Install wood nailers and blocking where shown and where required for attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work.

3.03 WOOD FRAMING, GENERAL

A. Framing Standard: Comply with AF&PA *Wood Frame Construction Manual*, unless otherwise indicated.

B. Install framing members of size and spacing indicated.

C. Anchor and nail as shown, and to comply with the following:

1. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-Nails, and allied fasteners.
2. Published requirements of manufacturer of metal framing anchors.
3. "Table 2304.9.1 – Fastening Schedule" of the International Building Code.

D. Do not splice structural members between supports.

3.04 STUD FRAMING

A. General: Arrange studs so that wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Install single bottom plate using 2-inch-thick members whose widths equal that of studs; single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction.

B. Construct corners and intersections with not less than 3 studs. Install miscellaneous blocking and framing as required for support of facing materials, fixtures, specialty items, and trim.

C. Frame openings with multiple studs and headers. Install nailed header members of thickness equal to width of studs. Set headers on edge and support on jamb studs.

1. For nonbearing partitions, install double-jamb studs and headers not less than 4 inches deep for openings 3 feet and less in width, and not less than 6 inches deep for wider openings.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. General: Comply with applicable recommendations contained in Form No. E30, "APA Design/ Construction Guide – Residential and Commercial," for types of construction panels and applications indicated.

B. Fastening Methods:

1. Fasten panels as indicated below:

a. Sheathing: Nail to framing.
b. Plywood Backing Panels: Nail to supports.

3.06 AIR INFILTRATION BARRIER

A. Cover sheathing with air infiltration barrier as follows:

1. Apply asphalt-saturated organic felt horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with corrosion-resistant staples.

END OF SECTION

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior standing and running trim for transparent finish.
2. Interior standing and running trim for opaque finish.
3. Closet and utility shelving.
4. Interior wood **stairs and** railings.
5. **Preservative-treated wood material.**
6. Miscellaneous materials.
7. Shop priming.
8. Shop finishing.

B. Related Requirements:
1. Section 099000 –Painting and Coating, for priming and backpriming of interior architectural woodwork.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Preinstallation Meetings: Conduct meeting at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Wood-Preservative Treatment:
1. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Indicate type of preservative used and net amount of preservative retained.
3. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.

C. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

D. Shop Drawings:
1. Include dimensioned plans, elevations, sections, and attachment details.
2. Show large-scale details of fabricated items at a minimum 1 inch:1 foot.
3. Show locations and sizes of furring, blocking with center lines, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

4. Apply AWI Quality Certification or WI Certified Compliance Program label to Shop Drawings.

E. Samples for Verification: For the following:
1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on 1 side and 1 edge.
2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished interior architectural woodwork.
3. Veneer-Faced Panel Products for Transparent Finish: 8 by 10 inches, for each species and cut. Include at least 1 face-veneer seam and finish as specified.
4. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color.
   a. Finish 1/2 of exposed surface.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and Installer.

B. Product Certificates: For the following:
1. Composite wood products.
2. Adhesives.

C. Evaluation Reports: For **preservative-treated** wood materials, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: For AWI Quality Certification Program (QCP) or WI Certified Compliance Program (CCP).

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
1. Shop with a minimum 5 years of documented experience.
2. Shop with at least 5 projects in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
3. Manufacturer's Certification: Licensed participant in AWI’s Quality Certification Program (QCP) or WI’s Certified Compliance Program (CCP).

B. Installer Qualifications: Manufacturer of products and licensed participant in AWI's Quality Certification Program (QCP) or WI's Certified Compliance Program (CCP).

C. Mockups: Comply with Section 014339 – Mockups.
1. Build mockups of typical interior architectural woodwork as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with referenced woodworking standards.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
   1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-Work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for remainder of construction period.

B. Do not install architectural woodwork materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include fuzzy or splotchy surface contamination and discoloration.

C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

D. **Field Measurements: Where paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work**.
   1. **Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings**.

E. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit.
   1. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Engage woodworking firm acceptable to Owner and Architect and complies with the following:
   1. Meets requirements of these Specifications.
   2. Assumes undivided responsibility for production of interior architectural woodwork and the following”
      a. Section 123623.13 – Plastic-Laminate-Clad Countertops.
   3. Do not engage woodworking firm without written approval from Owner and Architect.

2.2 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Standards" or WI's "North American Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
1. Provide labels and certificates from AWI or WI certification program indicating that woodwork **and installation** complies with requirements of grades specified.
2. Contract Documents may contain requirements that are more stringent than referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of referenced quality standard.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Custom

B. Hardwood Lumber:
1. **Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated**.
2. Species: Red oak
3. Cut: Plain sawn
4. Wood Moisture Content: 5 to10 percent.
5. For trim items wider than available lumber, use veneered construction. Do not glue for width.
   a. For veneered base, use hardwood lumber core, glued for width.
6. For base wider than available lumber, glue for width. Do not use veneered construction.
7. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

C. Softwood Lumber:
1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
2. Species: Douglas fir, Superior or C & Btr finish.
3. Cut: Plain sawn.
4. Wood Moisture Content: 5 to10 percent.
5. For trim items wider than available lumber, use veneered construction. Do not glue for width.
   a. For veneered base, use softwood lumber core, glued for width.
6. For base wider than available lumber, glue for width. Do not use veneered construction.
7. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

2.4 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Architectural Woodwork Standards Grade: Custom
1. Wood Species: Any closed-grain hardwood.
   a. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content: 5 to 10 percent.

2.5 CLOSET AND UTILITY SHELVING

A. Architectural Woodwork Standards Grade: Custom [Premium].

B. Shelf Material: **veneer-faced panel product with veneer edge banding**

C. Metal Closet Rods: 1-5/16 inch diameter, **aluminum** tubes complying with BHMA A156.16, L03131.

D. Metal Rod Flanges: **Aluminum**

2.6 INTERIOR WOOD **STAIRS AND** RAILINGS

A. Architectural Woodwork Standards Grade: Custom

B. Wood for Transparent Finish:
1. Species and Cut: Red oak, plain sawn, unless indicated otherwise.
2. Wood Moisture Content: 5 to 10 percent.

C. **Wood for Opaque Finish**:
1. Species: Any closed-grain hardwood, except that eastern white pine, sugar pine, or western white pine may be used for risers, stringers, and moldings.
2. Wood Moisture Content: 5 to 10 percent.

D. Rough Carriages for Stairs:
1. Laminated veneer lumber, made with an exterior-type adhesive complying with ASTM D2559, and with the following allowable design values as determined according to ASTM D5456:
   a. Extreme Fiber Stress in Bending, Edgewise: 3,100 psi for 12 inch nominal-depth members, unless indicated otherwise.
   b. Modulus of Elasticity, Edgewise: 2,000,000 psi, unless indicated otherwise.
2. Wood Grade: Select Structural No. 1 grade, kiln-dried to 15 percent maximum moisture content:
   a. Acceptable Species: **Douglas fir-larch or Hem-fir.**

E. Treads and Landings: Plywood, DOC PS 1, Exposure 1, Underlayment single-floor panels, APA-rated Sturd-I-Floor.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Boise Cascade Corporation: Plywood Sturd-I-Floor.
   b. Georgia-Pacific Building Products: Plytanium Sturd-I-Floor.
   c. Roseburg Forest Products: RigidFloor Underlayment.
   d. Approved substitution.
2. Span Rating: Not less than 24.
3. Performance Category: 1-1/8 PERF CAT.
4. Edge Detail: Square.
5. Surface Finish: Fully sanded face.
6. Applications:
   a. Where carpet flooring is scheduled.

F. **Finishes for Stair Parts: Transparent, unless indicated otherwise**.

G. Handrail Brackets: **Cast aluminum** with wall flange drilled **for exposed anchor and tapped for concealed hanger bolt** and with support arm for screwing to underside of rail. Size to provide 1-1/2 inch clearance between handrail and face of wall.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Blum, Julius & Co., Inc.
   b. The Wagner Companies.

c. Approved substitution.

H. Handrail/Bumper Rail Brackets: Pairs of extruded-aluminum channels: 1 for fastening to back of rail and 1 for fastening to face of wall, assembled in overlapping fashion and fastened together at top and bottom with self-tapping screws.

1. Size to provide 1-1/2 inch clearance between handrail and wall.

2.7 HARDWOOD SHEET MATERIALS

A. Composite Wood Products: Provide materials that comply with requirements of Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Recycled Content of MDF: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 90 percent.
2. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde (ULED) resins as defined in California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or made with no added formaldehyde.

B. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. ampine; Div. of Timber Products Company: Apex MDF.Arauco North America: Trupan Standard MDF.Georgia-Pacific Wood Products LLC: UltraStock Premium MDF. Roseburg Forest Products Co.: Medite II. Timber Products Company: Masisa Ultralight MDF. West Fraser Timber Co., Ltd.: WestPine EcoGold MDF. Weyerhaeuser Company: Super-Refined MDF2. Particleboard: ANSI A208.1, Grade M-2

D. Softwood Plywood: DOC PS 1**, medium-density overlay**.

E. Veneer-Faced Panel Products (Hardwood Plywood): Manufacturer's stock, exposed-edge, cross-laminated hardwood veneer faced plywood core panels complying with HPVA HP-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   a. States Industries, LLC: ApplePly.
   b. Approved substitution
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Columbia Forest Products: Europly PLUS.
   b. Roseburg Forest Products Co.: SkyPly Veneer
   c. Segezha Group: Baltic Birch, available from regional distributors.
   d. States Industries, LLC: ApplePly
   e. Timber Products Company: Veneer Core
3. Construction: Veneer core.
4. Core Material: Laminations of 1/16 inch thick alder, birch, or poplar hardwood layers. Free of edge voids in veneer at exposed surfaces.
5. Glue Bond: Type II (interior).
6. Face Veneer Species and Cut: Plain-sliced
7. Veneer Matching: Selected for similar color and grain.
8. Backing Veneer Species: Same species as face veneer.
9. Panel Thickness: 3/4 inch
10. Panel Size: 48 by 96 inches.

11. Face Pattern: Manufacturer's standard pattern, with grooves at edges, center, and third points of panels, and at other locations to provide pattern resembling random-width boards.
12. Finish: As selected by Architect from manufacturer's full range
13. Sustainability:
    a. Urea formaldehyde-free.
    b. CARB-exempt.

2.8 PRESERVATIVE-TREATED-WOOD MATERIALS

A. **Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment)**.
   1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)
   2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

B. Extent of Preservative-Treated Wood Materials: Treat interior architectural woodwork in contact with concrete or masonry.
   1. Items fabricated from the following wood species need not be treated:
      a. Redwood
      b. Western red cedar
      c. White oak.
      d. African mahogany.
      e. Honduras mahogany.
      f. Ipe.
      g. Dark red meranti.
      h. Teak.

2.9 FIRE-RETARDANT-TREATED WOOD MATERIALS

A. Fire-Retardant-Treated Wood Materials: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced Architectural Woodwork Standards. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when test is extended an additional 20 minutes, and with flame front not extending more than 10.5 feet beyond centerline of burners at any time during test.
   1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
   2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.

3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.

4. Mill lumber before treatment, and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less in accordance with ASTM E84.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Arauco North America: Duraflake FR.
   b. Timber Products Company: Encore FR.
2. Performance Requirements:
   a. Panels 3/4 Inch Thick and Less: Comply with ANSI A208.1 for Grade M-2, except for the following minimum properties:
      1) Modulus of Rupture: 1,600 psi.
      2) Modulus of Elasticity: 300,000 psi.
      3) Internal Bond: 80 psi.
      4) Screw-Holding Capacity on Face and Edge:250 and 225 lbf, respectively.
   b. Panels 13/16 to 1-1/4 Inches Thick: Comply with ANSI A208.1 for Grade M-2, except for the following minimum properties:
      1) Modulus of Rupture: 1,300 psi.
      2) Modulus of Elasticity: 250,000 psi.
      3) Linear Expansion: 0.5 percent.
      4) Screw-Holding Capacity on Face and Edge:250 and 175 lbf, respectively.
3. Surface-Burning Characteristics: Comply with ASTM E84.
   a. Flame Spread: 25.
   b. Smoke Developed: <200.
4. Provide panels listed and labeled by a testing and inspecting agency acceptable to AHJ.

D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to comply with the following.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. ampine; Div. of Timber Products Company: Apex FR.
   b. ARAUCO North America: Trupan Fire-Rated MDF.
   c. Roseburg Forest Products Co.: Medite FR.
   d. Approved substitution.
2. Class A Fire Rating: Comply with ASTM E84:
   a. Flame-Spread: 25 or less.
   b. Smoke Developed: 200 or less.

2.10 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber kiln-dried to less than 15 percent moisture content.

1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.
   a. Provide where in contact with concrete or masonry.
   b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

c. Preservative Chemicals: Acceptable to AHJ and containing no arsenic or chromium.

d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

2. Fire-Retardant Treatment: Complying with requirements; provide where indicated and where required by AHJ.

B. **Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer**.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.
1. Verify adhesives have a VOC content of 70 g/L or less.

2.11 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
1. Ease edges to radius indicated for the following:
   a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
   b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

C. Complete fabrication and assembly to maximum extent possible before shipment to Project site.
1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. If Architect will examine Work in woodwork shop, notify Architect 7 days in advance of dates and times interior architectural woodwork fabrication will be complete.
4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
   a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
   b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

D. Stairs: Cut rough carriages to accurately fit treads and risers.
1. Glue treads to risers, and glue and nail treads and risers to carriages.
2. House **wall and face** stringers, and glue and wedge treads and risers.
3. Fabricate stairs with treads and risers no more than 1/8 inch from indicated position and no more than 1/16 inch out of relative position for adjacent treads and risers.

2.12 SHOP PRIMING

A. Preparations for Finishing: Comply with referenced Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of Work.

B. Interior Architectural Woodwork for Opaque Finish: Shop prime with 1 coat of wood primer as specified in Section 099000 –Painting and Coating.
   1. Backpriming: Apply 1 coat of primer, compatible with finish coats, to concealed surfaces of woodwork. Apply 2 coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.13 SHOP FINISHING

A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of Work.
   1. Backpriming: Apply 1 coat of sealer or primer, compatible finish coats, to concealed surfaces of interior architectural woodwork. Apply 2 coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

C. Transparent Finish:
   1. Architectural Woodwork Standards Grade: Custom
   2. Finish: System – 11, Polyurethane, Catalyzed.Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
   4. Staining: None required
   5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
   6. Filled Finish for Open-Grain Woods: After staining, if any, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
   7. Sheen: Flat, 15-30 gloss units measured on 60-degree gloss meter per ASTM D523.

D. Opaque Finish:
   1. Architectural Woodwork Standards Grade: Custom
   2. Comply with requirements specified in Section 099000 – Painting and Coating.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated Work for completion and complete Work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
   1. Shim as required with concealed shims.
   2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining Work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes in accordance with AWPA M4.

F. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

G. Standing and Running Trim:
1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
5. Install trim with no more variation from straight line than 1/8 inch in 96 inches.

3.3 INSTALLATION OF WOOD STAIRS AND RAILINGS

A. **Stairs: Securely anchor carriages to supporting substrates**.
1. Comply with Drawings and approved Shop Drawings.
2. Install with steel framing anchors, bolts, and accessories.
a. Secure as detailed for strength and rigiditiy.
3. Install stairs with treads and risers no more than 1/8 inch from indicated position.
4. Secure with countersunk, concealed fasteners and blind nailing.
5. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with wood surface.

B. Wood Landing Panels and Treads:
1. Landing Panels:
a. Glue and Screw to wood framing.
b. Space panels 1/8 inch apart at edges and ends.
2. Treads:
a. Apply glue to stringer tread bearing supports in accordance with glue manufacturer's written instructions.
1) Apply continuous line of glue on stringers.
b. Lay tread over supports and screw to framing with 3-1/2 inch long flathead screws at 6 inches on center along each support.

C. Railings:
1. Install rails with no more than 1/8 inch in 96 inch variation from a straight line.
2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
a. Secure with countersunk, concealed fasteners and blind nailing.
b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with wood surface.
3. Wall Rails: Support rails on wall brackets securely fastened to wall framing.

a. Space rail brackets evenly along run, but not more than 96 inches on center.

3.4 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of referenced quality standard for specified grade.

B. Where not possible to repair, replace defective woodwork.

C. **Shop Finish:** Touch up finishing Work specified in this Section after installation of interior architectural woodwork.
   1. Fill nail holes with matching filler where exposed.
   2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

D. Field Finish: See Section 099000 – Painting and Coating for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.5 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program (QCP) or WI's Certified Compliance Program (CCP) certifying that woodwork, including installation, complies with requirements of referenced quality standards for specified grade.
   1. Inspection entity shall prepare and submit report of inspection.

3.6 CLEANING

A. Clean interior architectural woodwork on exposed and semiexposed surfaces.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace architectural woodwork materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 065000 – STRUCTURAL PLASTICS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Materials, Fabrication, and Erection: Conform to the relevant sections of AISC Code of Standard Practice for Steel Buildings and Bridges.

B. Comply with OSHA and Building Code requirements.

1.02 SUBMITTALS

A. Shop Drawings: All fiber reinforced plastic fabrications illustrating dimensions, erection details, cuts, copes, connections, holes, threaded fasteners, and joints. Base dimensional data on actual field measurements where connections interface with other materials required.

B. Manufacturer's Data: Submit complete data including dimensions, resins, colors, and other information.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials in such a manner as to prevent damage to finished surfaces.

B. Store above grade in clean dry locations.

PART 2 – PRODUCTS

2.01 FIBER REINFORCED PLASTIC STRUCTURAL SECTIONS

A. Pultruded sections as manufactured by Bedford Reinforced Plastics, Inc.; Enduro Composite Systems; Strongwell; or equal.

2.02 GRATING

A. Grating shall be of the material and dimensions as noted, as manufactured by Strongwell, Fibergrate, Enduro, or equivalent.

B. Fabricate to comply with OSHA requirements.

C. Width of any single grating section shall not exceed 4 feet, unless otherwise dimensioned on the Drawings.

D. All anchor bolts and fasteners for anchoring to beam and channel flanges shall be stainless steel.

2.03 FLOOR PLATE

E. Floor and cover plates shall be furnished with a slip-resistant grit surface with thicknesses as noted.

2.04 STAINLESS STEEL

A. Used for fastenings or attachments of F.R.P. elements:

1. Bars and Shapes: ASTM A276, Type 304
2. Plates: ASTM A240, Type 304
3. Bolts: ASTM A193, Type 316
4. Nuts: ASTM A194, Type 316

PART 3 – EXECUTION

3.01 FABRICATION

A. Fabricate in accordance with the Drawings and additional requirements specified in this section.

B. Shop Assembly:

1. Fabricate units in as large parts and sections as practicable.
2. Holes in Members: Punch or drill as necessary to receive bolts and similar items.
3. Seal cut ends to prevent UV deterioration and moisture absorption.

3.02 ERECTION

A. Set and secure accurately to the required lines and levels.

B. Protect the finish from scratches, nicks, and dents during erection.

C. Grating:

1. Anchor to supports with approved fastening devices.
2. Top of grating and supports set flush with adjacent surface.

D. Repair all field cuts with manufacturer’s recommended sealing resins.

END OF SECTION

SECTION 067500 – FIBERGLASS REINFORCED PLASTIC (FRP) FLAT ODOR CONTROL TANK COVERS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The scope of this specification shall include materials for fiberglass reinforced plastic (FRP) flat tank covers, which may include, but not limited to:

1. Tank cover deck panels.
2. Structural supports.
3. Flashing and trim.
4. Fasteners and anchors.
5. Bulb gaskets and sealant.
6. Tank cover accessories and appurtenances indicated on Drawings.

1.02 QUALITY ASSURANCE

A. Contractor shall be responsible for verifying all field dimensions for development and approval of manufacturer's drawings.

B. Contractor shall review and confirm in writing the approval of manufacturer's drawings.

C. Tank cover manufacturer shall have full responsibility for design and supply of all tank cover materials. Split responsibility for materials and design is not acceptable.

D. Within the last 10 years, tank cover manufacturer shall have completed a minimum of ten projects of similar type as those required in this scope and that were specific for covering of wastewater treatment plant process tanks.

1.03 PRODUCT SUBSTITUTIONS

A. Substitutions shall be considered if the Engineer has received a written request at least 2 weeks prior to bid date. Bidders shall be notified by addendum if substitutions are acceptable.

B. Requests for substitutions shall include technical information and any other information required for evaluation.

1.04 PERFORMANCE TESTING

A. Materials shall comply with Federal and Local laws or ordinances, applicable codes, standards, regulations, and/or regulatory agency requirements including:

1. ASTM D638, Standard Test Method for Tensile Properties of Plastics.
2. ASTM D790, Standard Test Method for Flexural Properties of Plastics and Electrical Insulating Materials.
3. ASTM D695, Standard Test Method for Compressive Strength of Plastics.
4. ASTM E84, Standard Test Method for Surface Burning Characteristics of Plastics.

B. Structural framing and deck panels shall meet the performance and design criteria listed herein for the spans and conditions indicated on the Drawings. Individual units (independent of any foam-filled core) shall demonstrate compliance with design criteria by full-scale testing.

1. FRP Deck Panels: Large-Scale Uniform Load and Deflection Test.
2. FRP Structural Components: 3 Point Load Bending Test.

1.05 DESIGN CRITERIA

A. Design Loads shall comply with local codes. Combined loads shall be determined by Allowable Stress Method.

1. Live: 50 psf (personnel uniform loading).
2. Snow: 25 psf.
3. Wind Uplift: 15 psf.
4. Dead:

a. Deck Panels: Individual units and other materials attached to and supported by the decking panels.
b. Structure: Total weight of the cover structure and other material attached to and supported by the cover structure.

B. Design Loads shall comply with local codes. Combined loads shall be determined by Allowable Stress Method.

1. Dead + Live or Snow Load: Deflection Limit = L/120 (min); Min. Factor of Safety Flexural Strength = 2.5.
2. Wind Uplift less Dead Load: Deflection Limit = L/60; Factor of Safety Flexural Strength = 1.5.

C. Concentrated Loads (Includes Personnel Loads): Cover deck panels shall be capable of supporting a 500-pound Concentrated Load over a 1-square-foot area located at mid-span of the panel span with maximum deflection of L/180. Compliance shall be demonstrated by full-scale testing with certification by an independent, registered P.E.

D. Air Infiltration: Air infiltration for tank cover under 0.5 inch water column negative pressure shall not exceed 1 CFM/LF of gasketed panel side joint and 2.2 CFM/LF of tank cover perimeter and penetrations. Compliance shall have NEBB Certification based on HVAC Duct Leakage Test per “NEBB Procedural Standards for Testing, Adjusting, Balancing, of Environmental Systems.”

E. Cover panels shall meet these requirements for removability:

1. Each cover panel shall be removable without having to remove more than one or two adjacent panels.
2. Each cover panel shall be removable vertically and without cutting of a cover component.

1.06 SUBMITTALS

A. Submittals shall include, but not be limited to:

1. Drawings including layouts; connection and framing details; fastener types and spacing; product description.
2. Material certifications.
3. Engineering calculations, signed by a registered Washington State professional engineer, confirming compliance with specified structural design criteria.
4. Operation and Maintenance Data for FRP cover and hatches.

PART 2 – PRODUCTS

2.01 MANUFACTURER(S)

A. The standard for design, characteristics, and performance shall be:

1. Enduro, 16602 Central Green Boulevard, Houston, TX. Telephone: 713-358-4000; website: www.endurocomposites.com.
2. Strongwell Co., 400 Commonwealth Avenue, Bristol, VA. Telephone: 276-645-8000; website: www.strongwell.com.
3. Approved Equal.

2.02 MATERIALS

A. Fiberglass reinforced plastic (FRP) structural components including cover panels, beams, and framing shall be manufactured by pultrusion process. Contact molded or hand-laid up fiberglass materials are not acceptable as structural components.

1. Tank Cover Panels:

a. Resin type for FRP tank cover decking shall be UV stabilized isophthalic polyester. General purpose or orthothalic polyester is not acceptable.
b. Glass fiber reinforcements shall be 50 percent (minimum) of the material weight.
c. Materials shall be fire retardant and have a flame spread rating of 25 or less per ASTM E84.

d. Materials shall exhibit these Physical Properties (at a minimum):

Tensile Strength	40,000 psi	ASTM D638
Flexural Strength	45,000 psi	ASTM D790
Flexural Modulus	1,690,000 psi	ASTM D790
Compressive Strength	37,000 psi	ASTM D695
Izod Impact (Notched)	25	ASTM D256
Water Absorption	0.25 percent max	ASTM D570

e. Cover panels shall be sealed at side-laps with non-adhesive, 1-inch-diameter neoprene bulb gasket per ASTM C864. The side-lap gaskets shall be factory installed and oriented vertically so they are compressed when an adjacent panel is placed into position.
f. The top of the tank cover decking shall be flat with factory applied, non-skid, and UV resistant surface.
g. Color of deck panels shall be standard gray or beige, unless otherwise selected by Owner.

B. Access Hatches:

1. Access hatches shall be raised with one-leaf hatch door and fabricated from pultruded fiberglass components.
2. Access hatches and framing shall fit inside a single deck panel so that individual deck panels with hatches can be removed without affecting adjacent panels and not require additional framing. Standard sizes, which shall be indicated on Drawings, include 22- or 24-inch by 30-, 36-, or 48-inch dimensions.
3. Underside of hatch lids shall be sealed with factory installed, 3/8 inch-diameter neoprene bulb gasket. Perimeter hatch curb shall be sealed to decking surface with adhesive sealant.
4. Hatches shall have a stainless steel hold-open device to prevent door from blowing open or closing on itself. Hatches shall be secured with hand-operable latches and without special tools.
5. Hatch lids shall have factory applied non-skid, UV resistant surface with plastic or stainless steel lift handles.
6. View port hatches, if indicated on Drawings, shall be 12 inches square or less.
7. Hatch openings shall be factory cut into the tank cover decking by manufacturer.

C. FRP Structural Framing:

1. Resin type for FRP beams and framing members shall be vinyl ester.
2. Glass fiber reinforcements shall be 50 percent (minimum) of the material weight.
3. Structural components shall be fire retardant and have a flame spread rating of 25 or less per ASTM E84.
4. Metallic angles or plates attached to FRP beams or fastening connections shall be 316 Stainless Steel.
5. Structural framing design and materials will be supplied by tank cover manufacturer.

D. Sampling Ports: Sampling ports shall be sized and located as indicated on Drawings.

E. Flashing and Trim:

1. Fiberglass flashing shall be isophthalic polyester with thickness, dimensions, and profile as shown on the Drawings.

2. Non-radius end flashing shall be factory attached to individual deck panels.
3. Slide gate flashings (if indicated on Drawings) shall be aluminum brush type.

F. Air Vents and Connections (if indicated on Drawings):

1. FRP gooseneck ventilation piping (if indicated on Drawings) with bird screen shall be provided by tank cover manufacturer. Size and quantity shall be as indicated on Drawings.
2. FRP stub-vent connections with a blind flange (if indicated on Drawings) shall be provided by tank cover manufacturer. Connections shall extend at least 6 inches from top of tank cover deck. Size and quantity shall be as indicated on Drawings.

G. Pipe Penetrations:

1. Pipe penetrations shall be fitted by Contractor to penetrate cover at a 90-degree angle.
2. Pipe penetrations shall be flashed in the field with a Sealtite retrofit, zipper type, pipe flashing or equal as provided by tank cover manufacturer.

H. Hardware:

1. Fasteners, anchorage, hinges, and other structural accessories located on underside of cover shall be 316 Stainless Steel.
2. Non-structural hardware shall be either of the materials specified under L.1. or FRP.
3. Perimeter flashing anchors, concrete anchors, or other hardware not exposed to the inside environment of the tank shall be 304 Stainless Steel.
4. Fasteners to attach tank cover decking to structural supports shall be 316 Stainless Steel.

I. Gaskets and Sealants:

1. All panel side laps and perimeter conditions shall be gasketed.

   a. Gaskets located along longitudinal side laps between panels shall be factory installed, 1-inch-diameter neoprene, bulb type.
   b. Gaskets under non-radius end flashing shall be factory installed, bulb type.
   c. Gaskets under flashing with a radius and at perimeter of circular tanks shall be installed by the Contractor.

2. Adhesive sealant shall be applied by Contractor at various locations as required by manufacturer to maximize odor containment.

PART 3 – EXECUTION

3.01 HANDLING AND STORAGE

A. Material Handling:

1. At the time of delivery, all materials shall be inspected for shipping damage. The freight company and manufacturer shall be notified immediately of any damage or quantity shortages.

2. The Contractor shall protect FRP materials from cuts, scratches, gouges, abrasions, and impacts. When lifting crated FRP materials, spreader bars shall be used (not wire slings unless materials are fully protected). FRP components shall not be dragged across one another unless separated by a non-scratching spacer.

3.02 INSTALLATION

A. Before placing and attaching components, the erector must confirm alignment and location of bearing plates, surfaces, brackets, saddles, etc. All bearing surfaces must be clean and free of debris.

B. Before placing secondary framing members or deck, the erector must check the alignment and location of truss members.

C. Erection shall proceed according to sequences shown on the approved Drawings.

D. If applicable, Contractor shall assemble any trusses and ledger angles as shown on manufacturer's drawings. Install trusses, beam seats, or structural and ledger angles in locations shown on the approved Drawings.

E. Position FRP tank cover beams (if applicable) in locations, as shown on the approved manufacturer's drawings. Field modifications (cuts, copes, holes, etc.) other than work shown on the drawings are not allowed without the manufacturer's written consent. Field cutting shall be indicated on drawings by manufacturer where needed.

F. Anchor FRP beams and adjust tank cover components into final position with proper bearing and alignment at joints, laps, and supports before fastening. Refer to manufacturer's installation instructions for proper fastener selection, fastener location, driving techniques, and pertinent information for fastening equipment.

G. Starting at the end shown by manufacturer on field drawings, position and place tank cover deck panels in locations as shown. Field modifications (cuts, copes, holes, etc.) other than work shown on the drawings are not allowed without the manufacturer's written consent.

H. Fasten or anchor FRP tank cover deck panels into location as shown on approved Drawings.

I. Place and attach flashing as shown on approved Drawings.

END OF SECTION

SECTION 070543 - CLADDING SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rainscreen attachment systems.
   2. Cladding support systems.

B. Related Requirements:
   1. Section 072100 – Thermal Insulation, for continuous exterior insulation.
   2. Section 074213.13 – Formed Metal Wall Panels.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate alignment of wall framing with size, location, and installation of rainscreen attachment **cladding support** system components.
   2. Coordinate construction to ensure that assemblies fit properly to supporting and adjoining construction.

B. Preinstallation Meetings: Conduct meeting at Project site.
   1. Discuss sequence and scheduling of cladding support system Work and interface with other trades affected by Work of this Section.
   2. Review wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing Work.
   3. Review and document methods, procedures, and manufacturer's installation guidelines and safety procedures for exterior wall assembly.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For products indicated below, submit 2 Samples each:
   1. Wall Brackets: Full size.
   2. Rails: 12-inch-long sections.

C. Shop Drawings: Include the following:
   1. Fabrication, elevation and sections of each condition, and installation layouts.
   2. Interface of cladding support attachment components with each type of substrate and exterior cladding material associated with cladding support system.
   3. Methods of installation, anchorage and expansion joints, width, bow, camber, and squareness tolerances necessary to accommodate thermal and moisture related movement.
   4. Submit Shop Drawings that have been engineered and certified by professional engineer licensed in the State in which Project is located.
      a. Include seal and signature of professional engineer on Shop Drawings.

D. Delegated-Design Submittal: For cladding support system, indicating compliance with performance and design criteria.
   1. Include analysis data and calculations signed and sealed by qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For Installer.
   2. For professional engineer indicating experience with providing delegated-design engineering services of the kind indicated.
      a. Include documentation that engineer is licensed in state in which Project is located.

B. Certificates: Manufacturer's certificate certifying that products of this Section meet or exceed specified requirements.

C. Evaluation Service Reports: Affirm compliance with specified requirements.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For cladding support system components to include in maintenance manuals that include recommendations for periodic checking and adjustment, and periodic cleaning and maintenance of cladding support components.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Security Fasteners: Furnish not less than 3 percent of each type and size of cladding support system components installed.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm that specializes in manufacturing of specified cladding support systems with a minimum of 5 years of documented experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 5 years of documented experience.

C. Delegated-Design Engineer Qualifications: Professional engineer experienced in providing delegated-design engineering services of the kind indicated and is legally qualified to practice in state where Project is located.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect products against transportation damage.
   2. Provide markings to identify components consistently with Drawings.
   3. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well-ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weather-tight covering installed to provide ventilation.

3. Store at a slope to ensure positive drainage of accumulated water.
4. Do not store in enclosed spaces where ambient temperature can exceed 120 deg F.
5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.9 FIELD CONDITIONS

A. Existing Conditions: Prior to fabrication of exterior wall system, verify actual supporting and adjoining construction. Take field measurements of structure and substrates to receive cladding support and cladding system.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of cladding support system that fail in materials or workmanship within specified warranty period.
1. Failures include the following:
a. Structural failure of components when materials and components are provided
2. Warranty includes the following:
a. Labor and material for removal and replacement of defective material.
b. Labor to remove and reinstall façade finish panels, finish closures, and façade finish accessories necessary to access defective material.
3. Warranty Period: 10 years from date of Substantial Completion.

B. Special Installer's Warranty: Submit cladding support system Installer' warranty on form acceptable to Architect and Owner, signed by Installer, covering Work of this Section for warranty period:
1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advanced Architectural Products, LLC.
2. Cascadia Windows and Doors.
3. Engineered Assemblies, Inc.
4. Knight Wall Systems, Inc.
5. Northern Facades.
6. SFS Intec.
7. Smart ci.
8. Approved substitution.

B. Source Limitations: Obtain cladding support system components for a complete installation from cladding support system manufacturer.

2.2 PERFORMANCE CRITERIA

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 013573 – Delegated-Design Procedures, to design cladding support systems, including attachment to building construction.

B. Structural Performance: Provide cladding support systems capable of withstanding effects of gravity loads, based on testing per ASTM E1592:
1. Wind Loads: As indicated on Drawings.

2. Other Design Loads: As indicated on Drawings.

C. Seismic Performance: Cladding support systems, including anchors and connections, shall withstand effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.0.

D. Thermal Performance: Provide cladding support system that complies with ANSI/ASHRAE 90.1.

2.3 CLADDING SUPPORT SYSTEM

A. Cladding Support Components: Manufactured components that provide a thermally-broken exterior continuous insulation and cladding system.
1. Type-1: Fiberglass thermal spacers fabricated from 100 percent pultruded glass fiber and thermoset polyester resin.
   a. Products: Subject to compliance with requirements, provide the following:
      1) Cascadia Windows Ltd: Cascadia Clip.
      2) Approved substitution.
   b. Thickness, Top, Base, and Web: 3/16 inches nominal.
   c. Spacer Depth: As indicated on Drawings.
2. Type-2: Hot-dipped galvanized steel, minimum G90 coating, over-molded with plastic isolator.
   a. Products: Subject to compliance with requirements, provide the following:
      1) Northern Facades: ISOClip.
      2) Approved substitution.
   b. Size: 3.5 inch depth.
3. Type-3: Recycled materials, fire retardant additives, and integral continuous metal inserts the length of clip profile, internally-reinforced with glass fiber strands used internally for longitudinal and transvers strength.
   a. Products: Subject to compliance with requirements, provide the following:
      1) Advanced Architectural Products: GreenGirt CMH Sub-Framing Clips.
      2) Approved substitution.
4. Depth: As indicated on Drawings.
5. Spacing, Horizontally and Vertically: As indicated on Drawings.

B. Cladding Support Fasteners: Self-tapping and self-drilling screws, bolts, nuts, and other fasteners with corrosion-resistant coating as recommended by cladding support system manufacturer for substrate materials indicated.
1. Cladding Supports to Metal Stud Wall Framing: Use standard, self-tapping, 1/4 - 14 hex head type metal screws.
   a. Products: Subject to compliance with requirements, provide the following:
      1) Leland Industries Inc.: Master Driller No. 2 Mini Drill Point with NZF3000 coating.
      2) Approved substitution.
2. Cladding Supports to **Concrete**: Use standard 1/4 - 14 concrete screw with hex head in pre-drilled hole.
   a. Products: Subject to compliance with requirements, provide the following:
      1) Leland Industries Inc.: Concrete Screw with DT2000 or NZF3000 coating.
      2) Approved substitution.
3. Cladding Supports to Wood Stud Wall Framing: Use standard 1/4 - 10 hex head type wood screw anchors.
   a. Products: Subject to compliance with requirements, provide the following:

1) Leland Industries Inc.: Master Gripper with DT2000 or NZF3000 coating.
2) Approved substitution.

4. Lengths: As recommended by fastener and cladding support manufacturers to meet pull out requirements for each type of substrate.
   a. Stud Framing: Min.1-1/2 in. longer than clip depth to penetrate sheathing and stud.
   b. Concrete: Minimum1-1/2 in. embedment in pre-drilled holes.
   c. Concrete Masonry Units (CMU). Minimum 1 in. embedment in pre-drilled holes.
5. Use of impact wrenches, powder, air, or gas-actuated fasteners, or actuated fastener tools are not permitted.

2.4 ACCESSORIES

A. Bracing, Furring, Bridging, Plates, Gussets, and Clips: Formed sheet steel, thickness as necessary to meet structural requirements for conditions encountered.

B. Galvanic Protection: Tapes and other methods as necessary to separate and prevent contact between dissimilar metals.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
   1. Do not proceed with installation until unsatisfactory conditions have been corrected.
   2. Ensure air barrier is installed prior to installing rainscreen attachment **cladding support** system.
   3. Ensure fenestration, transitions, discontinuities, sills, and ledgers are flashed and sealed to move moisture to exterior of building.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates thoroughly prior to installation of cladding support system components.

B. Prepare substrates using methods recommended by **cladding support system** manufacturer for achieving best result under Project conditions.

3.3 INSTALLATION OF RAINSCREEN ATTACHMENT SYSTEM

A. Install cladding support system in accordance with manufacturer's instructions and approved Shop Drawings.

B. Establish level lines for panel coursing and positioning of system wall brackets and support rails.

C. Attach wall brackets and support rails with manufacturer's engineered fasteners to meet specified performance requirements.

D. Brackets:
   1. Install brackets and support rails to provide air gap indicated on Drawings.
   2. Mount brackets at 16 inches on center horizontally or as indicated on Drawings.
   3. Thermally isolate wall bracket attachments between metal bracket and support wall substrate.

4. Thermally isolate screw fastener washers between fastener heads and metal bracket.
5. Tighten fasteners to substructure to a snug tight condition. Do not over-torque beyond manufacturer's recommendation. If installed using hand tools, verify for each installer at beginning of project using snug-tight criteria. Do not use stripped holes

E. Rails:
1. Attach horizontal rail to wall bracket stem with approved fasteners.
2. Isolate horizontal rail from bracket between rail and bracket stem.
3. Attach horizontal rail at proper pre-punched pilot holes on bracket stem to align plumb and true. Account for irregularities in support wall.
4. **Establish and re-establish and restart vertical bracket locations using laser or chalk-line at fenestrations and other obstructions to establish horizontal alignments.**

3.4 INSTALLATION OF CLADDING SUPPORT SYSTEM

A. Install cladding support components in accordance with manufacturer's written instructions and approved Shop Drawings.
1. Comply with requirements of ASCE Structural Plastics Design Manual.
2. Install cladding support components in orientation, sizes, and locations indicated on Drawings.
3. Install cladding support system components level, plumb, and square.
4. Attach cladding support components securely to wall studs with fasteners recommended and approved by thermal spacer manufacturer.

3.5 INSTALLATION OF INSULATION

A. Installation of insulation is specified in Section 072100 – Thermal Insulation.

3.6 INSTALLATION OF EXTERIOR CLADDING MATERIAL

A. Refer to **Section 074213.13 – Formed Metal Wall Panels** for installation of exterior cladding materials.

3.7 TOLERANCES

A. Maximum Offset from True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

C. Tolerance: Accurately align and locate components to column lines and floor levels; adjust work to conform with following tolerances.
1. Plumb: 1/8 inch in 10 feet and 1/4 inch in 40 feet; non-cumulative.
2. Level: 1/8 inch in 20 feet and 1/4 inch in 40 feet; non-cumulative.
3. Alignment:
   a. Limit offsets to 1/16 inch where surfaces are flush or less than 1/2 inch out of flush and separated by less than 2 inches by reveal or protruding Work. Limit offsets to 1/8 inch in all other cases.
4. Location: 3/8 inch maximum deviation from measured theoretical location of any member.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Technical Service: Engage cladding support system manufacturer to perform intermittent and final inspections to verify installation is in conformance to manufacturer instructions and suitable as framing assembly for subsequent exterior cladding installations.

3.9 ADJUSTING

A. Inspect components after installation.

B. Adjust and reconfigure as necessary to accommodate cladding systems for installations over Work of this Section.

C. Do not reuse pre-drilled holes unless fastener size is increased.

D. Repair defective Work to Architect's satisfaction, and replace Work with new components that fail to be repaired properly.

3.10 PROTECTION

A. Protect installed cladding support system components from damage due to harmful weather exposures, physical abuse, and other causes until exterior cladding material is installed.

END OF SECTION

SECTION 071700 - BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bentonite waterproofing.
   2. Molded-sheet drainage panels.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project.
   1. Meeting Time: Schedule meeting a minimum of 2 weeks prior to beginning Work of this Section and related Work.
   2. Require attendance by Architect, Owner, Contractor, Installers, manufacturers' representatives, and other parties directly affecting Work of this Section.
   3. Review bentonite waterproofing requirements including surface preparation, substrate condition and pretreatment, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, and installation instructions.

B. Shop Drawings:
   1. Include installation details for waterproofing, flashing, penetrations, and interface with other Work.
      a. Indicate foundation wall to footing transition, inside and outside corner wall, and terminations.

C. Samples: For each of the following products, in sizes indicated:
   1. Waterproofing: 6 inches square.
   2. Molded-Sheet Drainage Panels: 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of bentonite waterproofing material.

B. Qualification Data: For Installer.

C. Sample Warranty: For manufacturer's special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by bentonite waterproofing manufacturer with a minimum of 5 years of experience.
   1. Installer shall have not less than 5 waterproofing projects similar to requirements for this Project with satisfactory in-service performance.

B. Manufacturer Qualifications: Company specializing in manufacturing of bentonite waterproofing components with a minimum of 5 years of experience.

C. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing on ground water.
   1. Obtain 2 liters water of samples from Project site at approximate locations where bentonite waterproofing will be installed.
   2. Ship water samples in uncontaminated, sealed, plastic containers. Include on container Project name, city, and state to bentonite waterproofing manufacturer for evaluation.
   3. Test water samples for acids, alkalis, brine, or other contaminants that may inhibit performance of bentonite waterproofing materials.
   4. Comply with bentonite waterproofing manufacturer's written instructions for testing.
   5. Submit manufacturer's test results and bentonite waterproofing manufacturer's product recommendations to Architect and Owner prior to start of bentonite waterproofing installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling:Deliver waterproofing materials in factory sealed and labeled packaging.
   2. Sequence deliveries to avoid delays while minimizing on-site storage.
   3. Handle and store waterproofing materials in compliance with waterproofing manufacturer's instructions and recommendations.
   4. Remove damaged materials from site and properly dispose of in a legal manner.

B. Storage:Do not double-stack pallets during shipping or storage.
   2. Protect waterproofing materials from moisture, excessive temperatures, sources of ignition, prolonged sunlight, and damage from construction operations.
   3. Provide cover, top and all sides, for materials stored on-site, allowing for adequate ventilation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturer's written instructions and warranty requirements.
   1. Do not apply bentonite waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
   2. Do not place bentonite clay products in panel or composite form on damp surfaces unless such practice is approved in writing by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain bentonite waterproofing materials and molded-sheet drainage panels from single source from single manufacturer.

2.2 GEOTEXTILE/BENTONITE SHEETS

A. Composite Polyethylene/Bentonite Membrane (BNT.WPR-X): Dual layer waterproofing membrane consisting of sodium bentonite clay granules heat-fused to layers of HDPE on one side and nonwoven polypropylene geomembrane on the other side.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing Inc.: CCW MiraCLAY GM.CETCO – Building Materials Group: Voltex DS.
      c. Tremco Incorporated: Paraseal GM/LG – 20 mil.
      d. W. R. Meadows, Inc.: Clay-Tite.Approved substitution.
   2. Physical Properties:
      a. Bentonite Mass per Unit Area: ASTM D5993; 1.0 lb/sq. ft. minimum.
      b. Grab Tensile Strength: ASTM D4632; minimum 120 lbf.Peel Adhesion to Concrete: ASTM D903, modified; 15 lbf/in.
      d. Puncture Resistance: ASTM D 4833; 140 lbf.Vapor Permeance: ASTM E96, Procedure B; 0.03 perms.
      f. Water Vapor Transmission Rate: ASTM E96; 0.03 grains/hr./sq. ft.
      g. Hydrostatic-Head Resistance: ASTM D5385, modified; 231 ft.

2.3 MOLDED-SHEET DRAINAGE PANELS

A. Molded-Sheet Drainage Panel (MSD.PANEL-2): Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing laminated to one side of core, and acts as protection over waterproofing membrane.
   1. Products: Subject to compliance with requirements, provide the following:
      a. American Hydrotech, Inc.: Hydrodrain 400.
      b. Carlisle Coatings & Waterproofing Inc.: CCW MiraDRAIN 6000/6200.
      c. CETCO – Building Materials Group: Aquadrain 15X.
      d. GCP Applied Technologies Inc.: Hydroduct 200.
      e. Siplast, Inc.: Paradrain Drainage Mat Series.
      f. Soprema, Inc.: Sopradrain 102.
      g. Tremco Incorporated: TREMDrain 1000.
      h. W. R. Meadows, Inc.: Mel-Drain 5035.
   2. Panel Size: 12 inch by 35 foot roll.
   3. Core Thickness: ASTM D1777; not less than 0.40 inch.
   4. Compressive Strength: ASTM D1621; not less than 15,000 psf.
   5. Puncture Resistance: ASTM D3787; 65 lbf.
   6. Elongation: ASTM D4632; 50 percent.
   7. Apparent Opening Size: ASTM D4751;70 US std. sieve.
   8. Flow Capacity: ASTM D4716; not less than 17 gpm/ft.
   9. Panel Orientation: Open core side against waterproofing, filter fabric side out.
   10. Application:
      a. Vertical and horizontal conditions needing high compressive strength and high flow capacity.

2.4 ACCESSORIES

A. Bentonite Waterstops: Manufacturer's self-expanding, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete.
   1. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc.: CCW MiraSTOP.
b. CETCO – Building Materials Group: Waterstop-RX-101.
c. Tremco Incorporated: Superstop.
d. W. R. Meadows, Inc.: Waterstop EC Plus.
e. Approved substitution.

2. Size: Nominal 1 inch by 3/4 inch.
3. Shape: Rectangular or trapezoidal.

B. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 sieve.

C. Bentonite Mastic: Bentonite compound of trowelable consistency, specifically formulated for application at joints and penetrations.

D. Bentonite Tubes: Manufacturer's standard water-soluble tube containing approximately 1.5 lb/ft. of granular bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.
1. Size: 2 inch diameter.

E. Metal Termination Bars: Manufacturer's standard stainless-steel or aluminum bars, predrilled at 6 inches on center, installed with noncorrosive fasteners.
1. Size: Minimum 1/8 inch thick by 1 inch wide.

F. Sealants: As recommended in writing by waterproofing manufacturer.
1. Comply with requirements specified in Section 079200 – Joint Sealants.

G. Tapes: Waterproofing manufacturer's recommended waterproof tape for joints between sheets, membranes, or panels.

H. Adhesive: Waterproofing manufacturer's water-based adhesive used to secure waterproofing to both vertical and horizontal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations and other conditions affecting performance of bentonite waterproofing.

B. Examine bentonite materials before installation. Reject materials that have been prematurely exposed to moisture.

C. Verify that substrate is complete and that Work that will penetrate waterproofing is complete and rigidly installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions.

B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.

C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair bonding ability of concrete or effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch, honeycomb areas, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.

D. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting bentonite waterproofing. Fill minor gaps and spaces 1/8 inch wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

A. Prepare substrates, voids, cracks, and cavities; and install waterproofing and accessories according to manufacturer's written instructions.
   1. Before installing, verify correct side of waterproofing that shall face substrate surface.
   2. Apply granular bentonite around penetrations in horizontal surfaces and changes in plane according to manufacturer's details in preparation for bentonite tubes and mastic.
   3. Apply bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
   4. Prime concrete substrates. Primer may be omitted on concrete surfaces that comply with manufacturer's written requirements for dryness, surface texture, and freedom from imperfections.

B. Apply bentonite tubes continuously on footing against base of wall to be waterproofed.

C. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts.

D. Install protection course before backfilling or placing overburden when recommended in writing by waterproofing manufacturer.

3.4 INSTALLATION OF GEOTEXTILE/BENTONITE SHEET

A. Install a continuous layer of waterproofing sheets directly against surface to be waterproofed. Lap ends and edges a minimum of 4 inches on horizontal and vertical substrates unless otherwise indicated. Stagger end joints between sheets a minimum of 24 inches. Fasten seams by stapling to adjacent sheet or nailing to substrate.

B. Concrete Walls: Starting at bottom of wall, apply waterproofing sheets horizontally against wall. Secure with masonry fasteners spaced according to manufacturer's written instructions. Extend to bottom of footing, grade beam, or wall, and secure.
   1. Termination at Grade: Extend waterproofing sheets to within 12 inches of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
   2. Underslabs: On horizontal surfaces, install waterproofing sheets according to manufacturer’s written instructions. Tie horizontal waterproofing sheet to vertical waterproofing sheets as required by waterproofing manufacturer, using corner transition sheets.
   3. Secure corner edges of membrane with washer-head fasteners or pneumatic staples at 12 inches on center.

3.5 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels according to manufacturer's written instructions. Use adhesives or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed waterproofing installation before covering with other construction, and provide written report stating that installation complies with manufacturer's written instructions.
   1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.

END OF SECTION

SECTION 071900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Penetrating water-repellents.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct meeting at Project site.
   1. Require attendance of parties directly affecting Work of this Section, including Contractor, Owner’s Representative, applicator, and manufacturer's representative.
   2. Review environmental regulations, test panel procedures, protection of surrounding areas and nonmasonry surfaces, surface preparation, application, field quality control, final cleaning, and coordination with other Work

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include the following manufacturer's information:
   1. Printed statement of VOC content.
   2. Standard colors.
   3. Printed application instructions.
   4. Recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For each type of water repellent.

C. Preconstruction Test Reports: For water-repellent-treated substrates.

D. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than 5 years of experience in actual production of specified products.

B. Installer's Qualifications: Firm trained and certified by coating manufacturer, with not less than 5 years of experience installing systems similar in complexity to those required for this Project, including specific requirements indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing of water repellents on mockups.
   1. In addition to verifying performance requirements, use mockups to verify manufacturer's written instructions for application procedure and optimum rates of product application to substrates.

2. Propose changes to materials and methods to suit Project.
3. Notify Architect 7 days in advance of dates and times when mockups will be tested.

B. Absorption Testing:
1. Perform absorption tests using RILEM Test No. II.4, water absorption under low pressure (pipe method).
2. Test surfaces scheduled for water repellent coatings prior to and 5 days following application.
3. The following results will be the basis for acceptable performance:
   a. Architectural concrete block/concrete brick surfaces:
      1) No less than 60 mph wind-driven rain minimum after 20 minutes.
   b. Clay brick, natural stone, cast-in-place concrete and precast concrete surfaces:
      1) 1.0 mil or less loss in 20 minutes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site In manufacturers original, unopened containers and packaging, bearing manufacturer's name label with the following information:
1. Name of material.
2. Manufacturer's stock number and date of manufacture.
3. Manufacturer's name.
4. Contents by volume for major pigment and vehicle constituents.
5. Application Instructions.
6. Color name and number (if applicable)

B. Store materials not in use in tightly covered containers. Maintain containers used in storage of coating materials in a clean condition, free of foreign materials and residue.

C. Protect materials from freezing where necessary.
1. Keep storage area neat and orderly. Remove flammable rags and waste daily.
2. Take precautions to ensure that workers and Work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing, and application of coatings.

1.8 FIELD CONDITIONS

A. Comply with manufacturer's recommendations regarding environmental conditions under which materials can be stored and applied.

B. Proceed with application only when existing and forecasted weather and substrate conditions permit coatings to be applied according to manufacturers' written instructions and warranty requirements

C. Environmental Requirements:
1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
5. Rain or snow is not predicted within 24 hours.
6. Not less than 24 hours have passed since surfaces were last wet unless longer period is required by repellent manufacturer.
7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree to repair or replace materials that fail to maintain water repellency specified in "Performance Criteria" Article within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain water repellents from single source from single manufacture.

2.2 PERFORMANCE CRITERIA

A. Performance: Water repellents shall meet the following performance requirements as determined by preconstruction testing on substrates representing those indicated for this Project.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:
   1. Concrete Masonry Units: ASTM C140.

C. Water-Vapor Transmission: Comply with one or both of the following:
   1. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E96.
   2. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D1653.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514.

E. Durability: Maximum 5 percent loss of water-repellent performance after 2,500 hours of weathering according to ASTM G154, or comparable test standard, compared to water-repellent-treated specimens before weathering.

F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.
   1. Reduction of Water Absorption: 80 percent.
   2. Reduction in Chloride Content: 80 percent.

2.3 PENETRATING WATER REPELLENTS

A. Penetrating Water Repellent, General: Clear, silane, siloxane, or silane/siloxane blend used to provide water repellency for surfaces indicated.

C. Penetrating Low-VOC Silane Water Repellent: Products: Subject to compliance with requirements, provide one of the following:
   a. Euclid Chemical Co.: Baracade Silane 40 WB.Evonik Corporation: Protectosil Aqua-Trete 40.Master Builders SolutionsBASF: MasterProtect H 400.ProSoCo, Inc.: Concrete Silane WB 40.Approved substitution.
   2. VOC Content: 400 g/L or less.
   3. Active Content: 40 percent minimum.
   4. Color: Clear.
   5. Applications:

a. Concrete Masonry Units
b. Split Face Concrete Masonry Units

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of Work.
   1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in 3 representative locations by method recommended by manufacturer.
   2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
   3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to cure before application of water repellent, according to repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.
   1. Concrete Masonry Units and Split Face Concrete Masonry Units: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents in accordance with ASTM E1857.

C. Protect adjoining Work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Water-repellent Work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect substrate before application of water repellent and to instruct Applicator on product and application method to be used.

B. Apply coating of water repellent on surfaces to be treated using 15 psi pressure spray with a fan-type spray nozzle to point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
   1. Owner will engage services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
   3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.

B. Coverage and Absorption Tests: Perform the following tests in presence of Architect. Notify Architect 7 days in advance of the dates and times when surfaces will be tested:
   1. Coverage: Hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
   2. Absorption: Using RILEM Test No. II.4, water absorption under low pressure (pipe method), test several different locations as directed by Architect. Include surfaces and head and bed joints.
   3. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as Work progresses. Correct damage to Work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass-fiber blanket insulation.
   2. Mineral-wool blanket insulation.
   3. Spray foam sealant.
   4. Polyethylene vapor retarders.

B. Related Requirements:
   1. Section 070543 – Cladding Support Systems.
   2. Section 074113.16 – Standing-Seam Metal Roof Panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of building thermal envelope.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources.
   1. Store inside and in a dry location.
   2. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

C. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

D. Recycled Content: Postconsumer recycled content plus 1/2 of pre-consumer recycled content not less than 1/4 percent.
   1. Verify adhesives have a VOC content of 70 g/L or less.

E. Recycled Content:
   1. Postconsumer recycled content plus 1/2 of pre-consumer recycled content not less than the following:
      a. Extruded Polystyrene Foam-Plastic Board: 50 percent.
      b. Glass-Fiber Blanket: 50 percent.
      c. Mineral-Wool Blankets: 40 percent.
      d. Mineral-Wool Board: 16 percent.

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, General (GFB.INSUL):
   1. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.
   2. Thermal Values: Minimum R-value of 3.5 per inch.
   3. Surface-Burning Characteristics: Comply with ASTM E84.
      a. Flame Spread: 25.
      b. Smoke Developed:
         1) Unfaced 50.
         2) Faced: 0.
   4. Combustibility: Noncombustible when tested according to ASTM E136.
   5. Sustainability:
      a. Greenguard Gold Certified.
      b. UL Validated formaldehyde-free.
      c. Sustainability: Red List Free.

B. Glass-Fiber Blanket, Unfaced (GFB.INSUL-X): ASTM C665, Type I.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed, Saint-Gobain: CertaPRO Sustainable Insulation.
      b. Johns Manville: Formaldehyde-free Unfaced Fiberglass.
      c. Knauf Insulation: EcoBatt Insulation with ECOSE Technology.
      d. Owens Corning Insulating Systems, LLC: EcoTouch PINK Fiberglas Insulation.
      e. Approved substitution.
   2. Applications:
      a. Exterior non-fire-rated stud framed walls.

2.3 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced (MWB.INSUL-1): ASTM C665, Type I; consisting of fibers; passing ASTM E136 for combustion characteristics.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Johns Manville: MinWool Sound Attenuation Fire Batts (SAFB).
      b. Rockwool International: Acoustical Fire Batts (AFB) evo.
      c. Thermafiber, Inc. (an Owens Corning company): Thermafiber SAFB (Sound Attenuation Fire Blankets).

d. Approved substitution.

2. Nominal Density by Thickness:
   a. 1-Inch Thick: 4.0 pcf.
   b. Thicker Than 1-Inch: 2.5 pcf.
3. Surface-Burning Characteristics: Comply with ASTM E84.
   a. Flame Spread: Maximum of 0.
   b. Smoke Developed: 0.
4. Sustainability:
   a. Greenguard Gold Certified.
   b. UL Validated formaldehyde-free.
5. Applications:
   a. Shaft wall framing.
   b. Elevator shafts.
   c. Exterior fire-rated metal stud wall cavities.
   d. Where indicated on Drawings.
   e. Where required by AHJ.

2.4 INSULATION ATTACHMENT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AGM Industries, Inc.
   2. Gemco.
   3. GLT Products.
   4. Hanlon Stud Welding.
   5. J/R Metal Frames Manufacturing.
   6. McMaster-Carr:
   7. Midwest Fasteners, Inc.
   8. Approved substitution.

B. Adhesively Attached, Spindle-Type Insulation Hanger: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washers.
   1. Plate: 0.105 inch thick by 1-1/2 sq. in. minimum perforated, galvanized carbon-steel sheet.
   2. Spindle: Galvanized, low-carbon steel nail welded to plate; length to suit depth of insulation indicated.

C. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Angle: Formed from 0.030 inch thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

D. Insulation-Retaining Washers: Self-locking washers with beveled edge for increased stiffness.
   1. Washers: 0.016 inch thick, galvanized steel sheet.
   2. Size: Minimum 1-1/2 sq. in. or in diameter, or as recommended by insulation hanger manufacturer as required to hold insulation securely in place.

E. Insulation Domed Caps: Self-locking caps designed to conceal exposed points of insulation hangers. Caps incorporate a steel insert designed for permanent retention of cap to spindle of insulation hangers.

1. Washers: 0.105 inch thick, galvanized carbon-steel sheet.
2. Size: 7/8 in. diameter, 5/16 in. high.
3. Applications: Provide domed cap washers in the following locations:
   a. Crawl spaces.
   b. Ceiling plenums.
   c. Attic spaces.
   d. Where indicated.

F. Insulation Support Strap: Continuous, galvanized metal support strip for insulation support.
1. Strap: 0.032 inch thick by 1 inch wide, with approximately 2-1/2 inch long pre-punched arrow-shaped tabs at 8 inches on center designed to hold insulation in place by impalement.

G. Anchor Adhesive: High strength, heavy-bodied, thermoplastic rubber adhesive, formulated for securely adhering insulation hangers substrates indicated without damaging insulation, fasteners, and substrates.
1. Do not use on wood, painted, or coated surfaces.

2.5 SHEET VAPOR RETARDERS (SVR)

A. Vapor Variable Sheet Vapor Retarder: Intelligent, vapor-variable vapor retarder designed to work as a vapor retarder and vapor barrier depending on humidity levels. For use with unfaced glass fiber and mineral wool insulation in wall and ceiling cavities.
1. Product: Subject to compliance with requirements, provide the following:
   a. CertainTeed, Saint-Gobain: MemBrain, the SMART Vapor Retarder. Pro Clima/Moll; Imported by 475 High Performance Building Supply: INTELLO Plus.Approved substitution.
2. Thickness: 2 mil minimum.
3. Material: Reinforced polyethylene copolymer with polypropylene fleece covering or polyamide (nylon) film.
4. Water-Vapor Permeance: When tested according to ASTM E96 Method indicated:
   a. Procedure A; Desiccant Method: Less than 1.0 perms.
   b. Procedure B; Water Method: Greater than 10.0 perms.
5. Surface Burning Characteristics: Class A ratings according to ASTM E84:
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.
6. Application:
   a. Interior face of exterior stud wall and ceiling systems with unfaced glass-fiber blanket or mineral fiber insulation.

B. Self-Adhering-Sheet Vapor Retarder (SA.SVR): ASTM D1970, polyethylene film laminated to layer of rubberized asphalt adhesive, cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle SynTec Incorporated: VapAir Seal 725TR Air & Vapor Barrier.
   b. Elevate: V-Force Vapor Barrier Membrane.
   c. Johns Manville: JM Vapor Barrier SA.
   d. Versico Incorporated: VapAir Seal 725TR Air & Vapor Barrier.
   e. Approved substitution.
2. Thickness: Minimum 30 mils, nominal.
3. Permeance Rating: ASTM E2178; maximum of 0.1 perm.
4. Peel Adhesion: ASTM D903; minimum 5.0 lbf/in.

5. Application: Roof cover boards at standing seam metal roofing.

2.6 INSULATION FOR MISCELLANEOUS VOIDS

A. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.

B. Spray Foam Sealant (SF.SLNT.1): Single component, low-pressure, closed cell, polyurethane foam used as an air barrier foam.
1. Products: Subject to compliance with requirements, provide one of the following:
a. DAP Products, Inc.: Draftstop 812.
b. Dow Chemical Company: Great Stuff Pro.
c. Franklin International: Titebond WeatherMaster X-Treme Window & Door.
d. Henkel Corporation: OSI QUAD Foam Window & Door Installation Foam.
e. Hilti, Inc.: CF 812 Window and Door Pro.
f. Soudal: SoudaFoam Door & Window.
g. Tremco, Inc.: ExoAir FlexFoam.
h. Approved substitution.
2. Applications:
a. Sealing perimeters of window and door rough openings in exterior walls.
b. Sound-deadening of hollow metal frames.

C. Spray Foam Sealant (SF.SLNT.2): Single component, closed cell, polyurethane foam.
1. Products: Subject to compliance with requirements, provide one of the following:
a. DAP Products, Inc.: Daptex Plus.
b. Dow Chemical Company: Great Stuff Pro.
c. Soudal: Soudasil.
d. WillsealUSA, LLC: Niversal Foam Sealant.
e. Approved substitution.
2. Applications: Miscellaneous voids.

2.7 ACCESSORIES

A. Vapor-Retarder Staples: Galvanized construction grade staples of type recommended by vapor-retarder manufacturer for installing vapor-retarder.

B. Vapor-Retarder Tape: Pressure-sensitive, double-sided tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor-retarder.

C. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

D. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
1. Verify adhesives have a VOC content of 70 g/L or less.

E. Roof Insulation Accessories: As recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
1. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and substrate boards to roof deck, and acceptable to roofing system manufacturer.

2. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach cover boards and roof insulation to roof deck or to another insulation layer as follows:
   a. Modified asphaltic, asbestos-free, cold-applied adhesive.
   b. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
   c. Full-spread, spray-applied, low-rise, 2-component urethane adhesive.
   d. Verify adhesives and sealants comply with the following limits for VOC content:
      1) Plastic Foam Adhesives: 50 g/L.
      2) Gypsum Board and Panel Adhesives: 50 g/L.
      3) Multipurpose Construction Adhesives: 70 g/L.
      4) Fiberglass Adhesives: 80 g/L.
      5) Contact Adhesives: 80 g/L.
      6) PVC Welding Compounds: 510 g/L.
      7) Other Adhesives: 250 g/L.
      8) Single-Ply Roof Membrane Sealants: 450 g/L.
      9) Nonmembrane Roof Sealants: 300 g/L.
      10) Sealant Primers for Nonporous Substrates: 250 g/L.
      11) Sealant Primers for Porous Substrates: 775 g/L.
   e. Verify building concentration of formaldehyde does not exceed half of indoor recommended exposure limit, or 33 mcg/cu. m, and acetaldehyde concentration does not exceed 9 mcg/cu. m.

F. Rafter Ventilation Channels: Preformed, rigid plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves. Provide channels with wind-wash baffles designed for attachment to top plates.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ADO Products: ProVent Baffle & Xtension Model PVB2348 Series.
      b. Brentwood Industries, Inc; AccuVent – ACBP Series.
      c. Approved substitution.
   2. Airflow Between Rafters: 2 in. clearance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Board Insulation: Stagger end joints and tightly butt panel edges in both directions for tight fit.

E. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

F. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

G. Use insulation support straps to supplement other attachment methods necessitated by Project conditions.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions.
1. If not otherwise indicated, extend insulation a minimum of 36 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Anchor Installation: Install foundation insulation using one of the following methods:
1. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
a. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
b. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
c. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
d. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
e. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or damp proofing according to manufacturer's written instructions.

3.5 INSTALLATION OF CLADDING SUPPORT SYSTEM

A. Refer to Section 070543 – Cladding Support Systems for installation of cladding support system components.

3.6 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation:
1. Install pads of adhesive spaced approximately 24 inches on center both ways on inside face and as recommended by manufacturer.
2. Fit courses of insulation between wall ties and other obstructions.
3. Press units firmly against inside substrates.
a. Supplement adhesive attachment of insulation by securing boards with 2-piece wall ties designed for this purpose and specified in Section 042000 – Concrete Unit Masonry.

B. Mineral-Wool Board Insulation:

1. Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.
2. Fit courses of insulation between obstructions, with edges butted tightly in both directions, and with faces flush.
3. Press units firmly against inside substrates.

3.7 INSTALLATION OF FRAMED CONSTRUCTION INSULATION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill cavities formed by framing members. If more than 1 length is required to fill cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3 inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. Attics: Install rafter ventilation channels between roof framing members in insulated attic spaces at vented eaves.
   5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   6. For wood-framed construction, install blankets according to ASTM C1320.

B. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
   1. Exterior Walls: Set units with facing placed toward interior of construction unless indicated otherwise on Drawings.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 pcf.
   2. Spray Foam Sealant: Apply according to manufacturer's written instructions.

3.8 INSTALLATION OF CONTINUOUS BOARD INSULATION

A. Install continuous insulation to fit between wall brackets of cladding support system.

B. Anchor Installation: Install board insulation on wall sheathing substrates by adhesively attached, spindle-type insulation anchors as follows:
   1. Fasten insulation anchors to substrate with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
   2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.

3.9 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Place SVR on warm side of framing unless indicated otherwise on Drawings.

B. Extend SVR to extremities of areas to protect from vapor transmission.

C. Secure SVR in place on studs with staples, adhesive, or tape as approved by SVR manufacturer.

D. Extend SVR to cover miscellaneous voids in insulated substrates, including insulation-filled miscellaneous voids.

E. At joints between separate sheets of SVR, overlap edges by no less than 3 inches and seal joints with vapor-retarder tape according to vapor-retarder manufacturer's written instructions.
   1. Locate joints over framing members or other solid substrates.

F. Form airtight seal between SVR and objects penetrating SVR, such as pipes, conduits, electrical boxes, and similar items, with vapor-retarder tape.

G. Repair tears or punctures in SVR with vapor-retarder tape immediately before concealment by other Work.

3.10 INSTALLATION OF VAPOR RETARDERS ON ROOF ASSEMBLIES

A. Refer to the following Sections for installation of SA.SVR:
   1. Refer to Section 074113.16 – Standing-Seam Metal Roof Panels.Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
   1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place.
   2. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
   3. Install insulation to fit snugly without bowing.

3.11 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building wrap.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

1.4 WARRANTY

A. Manufacturer's Product Warranty: To repair or replace weather barrier product that fails in materials within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. **Building Paper: Water-vapor-permeable, asphalt-saturated kraft building paper that complies with ICC-ES AC38, Grade D; except with water-resistance rating not less than 1 hour**..

B. Commercial Building Wrap: ASTM E1677, Mechanically-fastened, Type I air barrier; nonwoven, nonperforated polypropylene or polyolefin fabric, UV stabilized; and acceptable to authorities having jurisdiction. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Obdyke Incorporated: HydroGap Drainable Housewrap.Berry Plastics: TYPAR BuildingWrap. DuPont de Nemours, Inc.: Tyvek CommercialWrap.
   d. DuPont de Nemours, Inc.: Weathermate Plus Housewrap.Henry Company: WeatherSmart.
   f. Kingspan Insulation LLC: GreenGuard HPW Wrap
   g. SIGA Cover Inc.: SIGA Majrex 200.
   h. VaproShield LLC: WrapShield IT Integrated Tape . Approved substitution.
   2. Thickness: Nominally 0.020 inch.
   3. Tensile Strength: Minimum 65 lbs./30 in. when tested according to ASTM D882, Method A.
   4. Water-Vapor Permeance: When tested according to ASTM E96 Method indicated:
      a. Procedure A; Desiccant Method: Not less than 5 perms.
      b. Procedure B; Water Method: Not less than 20 perms.
   5. Air Permeance, Product: Not more than 0.001 cfm/sq. ft. at 1.57 lbf/sq. ft. when tested in accordance with ASTM E 2178.

6. Air Permeance, Assembly: Not more than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. when tested in accordance with ASTM E 2357 and evaluated by ABAA.
7. Allowable UV Exposure Time: Not less than 180 days.
8. Surface Burning Characteristics: ASTM E84, Class A.
   a. Flame Spread: 25.
   b. Smoke Developed: 25.
9. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
10. Application: Exterior wood and gypsum board sheathing panels.

C. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. SIGA Cover Inc.: Rissan 60.FLEXIBLE FLASHING
      b. Approved substitution.

PART 3 - EXECUTION

3.1 INSTALLATION OF WATER-RESISTIVE BARRIER

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:
   1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4 inch overlap unless otherwise indicated.

C. Building Wrap Comply with manufacturer's written instructions and warranty requirements.
   1. Seal seams, edges, fasteners, and penetrations with tape.
   2. Extend into jambs of openings and seal corners with tape.

3.2 INSTALLATION OF FLEXIBLE FLASHING

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
   1. Prime substrates as recommended by flashing manufacturer.
   2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
   3. Lap flashing over water-resistive barrier at bottom and sides of openings.
   4. Lap water-resistive barrier over flashing at heads of openings.
   5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION

SECTION 073013 - ROOFING UNDERLAYMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Synthetic sheet underlayment.

1.2 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Samples for Verification: 12 sq. in. Samples for the following products, to verify color selected:
   1. Synthetic sheet underlayment.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type of underlayment product indicated, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Research Reports: For synthetic underlayment, from ICC-ES, indicating that product is suitable for intended use under applicable building codes.

D. Sample Warranty: For manufacturer's materials warranty.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide underlayment and related roofing materials with fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E108 or UL 790, for application and roof slopes indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store underlayment materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.

B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.

C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.

D. Handle, store, and place underlayment materials in a manner to prevent damage to roof deck or structural supporting members.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.

1.7 WARRANTY

E. Manufacturer's Warranty: Refer to Section 074113.16 – Standing-Seam Metal Roof Panels for coverage of Total System Warranty Work.

F. Manufacturer's Warranty: Manufacturer agrees to repair or replace underlayment that fails within specified warranty period by allowing water to penetrate roofing substrates to which it is applied due to decomposition beneath primary roof covering under which it is installed.
1. Warranty Periods: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Synthetic Sheet under Shingles and Metal Roofing
1. Atlas Roofing Corporation: Summit 180.
2. CertainTeed Corporation: DiamondDeck High-Performance Synthetic Underlayment.
3. GAF: Tiger Paw Premium Roof Deck Protection.IKO Industries, Inc.: RoofGard-Cool Grey.Intertape Polymer Group: Palisade Synthetic Underlayment.Kirsch Building Products, LLC: SharkSkin Ultra.Kirsch Building Products, LLC: SharkSkin Comp.Malarkey Roofing Products: Secure Start Plus.Owens Corning Roofing and Asphalt, LLC: Titanium UDL30.

2.2 UNDERLAYMENT MATERIALS

A. Source Limitations: Obtain underlayments through one source from a single manufacturer.

B. Synthetic Types
1. Malarkey "Secure Start
2. Grace "Tri-FLex"
3. CertainTeed "Diamond Deck"
4. InterWrap Inc. "Titanium UDL 25 Plus

2.3 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D4586, Type II, asbestos free, of consistency required for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS, METAL ROOF PANELS

A. Comply with metal roofing and underlayment manufacturers' written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
   1. Complete underlayment installation ready to receive Work of Section 074113.16 – Standing Seam Metal Roof Panels.

B. Underlayment:
   1. Install wrinkle free, in shingle fashion to shed water.
      a. Lap sides not less than 4 inches.
      b. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.
      c. Overlap side edges not less than 3-1/2 inches.
      d. Extend underlayment into gutter trough.
      e. Roll laps with roller.
   2. Application:
      a. Install underlayment over entire roof deck receiving metal roof panels.
      b. Unless indicated otherwise, provide additional 36 in. wide layer of underlayment along perimeter of roof.
      c. Use underlayment manufacturer's recommended methods for ensuring full adhesive contact with substrate.
      d. Around roof-penetrating elements, to 18 inches beyond penetrating element.

3.3 INSTALLATION OF UNDERLAYMENT MATERIALS, SHEET METAL FLASHING

A. Comply with sheet metal flashing and underlayment manufacturers' written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
   1. Complete underlayment installation ready to receive Work of Section 076200 – Sheet Metal Flashing and Trim.

B. Underlayment:
   1. Apply primer if required by underlayment manufacturer.
   2. Install wrinkle free, in shingle fashion to shed water.
      a. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.
      b. Overlap side edges not less than 3-1/2 inches.
      c. Roll laps and edges with roller.
   3. Application:
      a. Underneath parapet caps, coping, and other sheet metal flashing systems where indicated on Drawings.

3.4 PROTECTION

A. Protect installed underlayments until installation of roof covering and sheet metal flashing and trim.

END OF SECTION

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standing-seam metal roof panels.

B. Related Requirements:
   1. Section 073013 – Roofing Underlayments.
   2. Section 074293 – Soffit Panels, for metal soffits.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
   2. Coordinate metal panel installation with rain drainage Work, flashing, trim, construction of soffits, and other adjoining Work to provide a leakproof, secure, and noncorrosive installation.

B. Preinstallation Meetings: Conduct meeting at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose Work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review structural loading limitations of deck during and after roofing.
   6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
   7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   8. Review temporary protection requirements for metal panel systems during and after installation.
   9. Review procedures for repair of metal panels damaged after installation.
   10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
3. Submit Shop Drawings that have been engineered and certified by professional engineer licensed in the State in which Project is located.
    a. Include seal and signature of professional engineer on Shop Drawings.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:
1. For Installer.
2. For professional engineer indicating experience with providing delegated design engineering services of the kind indicated.
    a. Include documentation that engineer is licensed in state in which Project is located.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm that specializes in manufacturing of specified metal roofing systems with a minimum of 10 years of documented experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 5 years of documented experience.

C. Delegated Design Engineer Qualifications: Professional engineer experienced in providing delegated design engineering services of the kind indicated and is legally qualified to practice in state where Project is located.

D. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of Work.

E. Mockups: Comply with Section 014339 – Mockups.
1. Build mockup of typical roof area and eave, including fascia, [and soffit] as shown on Drawings; including attachments, underlayment, and accessories.
    a. Mockup Size: 12 sq. ft. by full thickness.
    b. Illustrate a complete assembly of each profile, proposed thickness, and finish.
    c. Illustrate each type of exposed seam and seam termination.
2. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
1. Failures include the following:
a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: 2 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes the following:
a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain standing-seam metal roof panels from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Recycled Content: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 50 percent.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 013573 – Delegated Design Procedures, to design standing-seam metal roof panel systems, including attachment to building construction.

C. Structural Performance: Provide metal panel systems capable of withstanding effects of the following loads, based on testing according to ASTM E1592:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/180 of span.

D. Seismic Performance: Exterior metal panel systems, including anchors and connections, shall withstand effects of earthquake motions determined according to ASCE 7.
   1. Component Importance Factor: 1.0.

E. Air Leakage: Air leakage of not more than 0.02 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
   1. Test-Pressure Difference:
      a. Positive 0.08 cfm/lin. ft. at 1.57 lbf/sq. ft.
      b. Negative 0.13 cfm/lin. ft. at 1.57 lbf/sq. ft.
   2. Test-Pressure Difference: Positive and negative 0.08 cfm/lin. ft. at 1.57 lbf/sq. ft.

F. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
   1. Test-Pressure Difference: 15 lbf/sq. ft.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: UL 90.

H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 STANDING-SEAM METAL ROOF PANELS

A. Factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips inside laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

E. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels): Structural metal panel formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located

under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   a. MBCI Metal Roof and Wall Systems: SuperLok.
   b. Approved substitution from one of the following:
      1) Bridger Steel, Inc.
      2) Metal Sales Manufacturing Corporation.
      3) Petersen Aluminum Corp.
      4) Taylor Metal Inc.
2. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A792, Class AZ50 coating designation; structural quality. Prepainted by coil-coating process to comply with ASTM A755.
   a. Nominal Thickness: 0.0232 inch.
   b. Exterior Finish: 2-coat fluoropolymer.
   c. Color: Match MBCI Signature 300 Harbor Blue.
3. Clips: 2-piece floating to accommodate thermal movement.
   a. Material: 0.0250-inch thick, stainless-steel sheet or as required to meet performance requirements.
4. Panel Coverage: 16 inches.
5. Panel Height: 2 inches.

2.4 UNDERLAYMENT MATERIALS

A. Roofing Underlayments:
   1. Type 1 Underlayment as specified in Section 073013 – Roofing Underlayments.

2.5 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653, G90 coating designation or ASTM A792, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Roof Curbs: Fabricated from same material as roof panels, minimum 0.048 inch nominal thickness; with bottom of skirt profiled to match roof panel profiles, with welded top box and integral full-length cricket. Fabricate curb subframing of minimum 0.060 inch nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads, of size and height indicated. Finish roof curbs to match metal roof panels.
   1. Insulate roof curb with 1 inch thick, rigid insulation.

E. Panel Fasteners: Self-tapping screws designed to withstand design loads.

F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
   1. Joint Sealant: ASTM C920; as recommended in writing by metal roof panel manufacturer and complying with Section 079200.
   2. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.6 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.7 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of Work.
   1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
   2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking, and that installation is within flatness tolerances required by metal roof panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF ROOF SUBSTRATE BOARDS

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.
   1. At steel roof decks, install substrate board at right angle to flutes of deck.
      a. Locate end joints over crests of steel roof deck.
      b. Tightly butt substrate boards together.

2. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
3. Adhere substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.4 INSTALLATION OF VAPOR-RETARDER

A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches, respectively.
   1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
   2. Seal laps by rolling.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:
   1. Install base layer of insulation with joints staggered as follows:
      a. Stagger end joints within each layer not less than 24 inches in adjacent rows for 48 by 48 inch insulation boards.
      b. Stagger long joints continuous and end joints within each layer not less than 12 inches in adjacent rows for 48 by 96 inch insulation boards.
      c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
      d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
      e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to diameter of drain bowl plus 24 inches.
         1) Trim insulation, so that water flow is unrestricted.
      f. Fill gaps exceeding 1/4 inch with insulation.
      g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
      h. Fully adhere base layer of insulation using adhesive specifically formulated for adhering specified board-type roof insulation to substrate board.
   2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
      a. Stagger end joints within each layer not less than 24 inches in adjacent rows for 48 by 48 inch insulation boards.
      b. Stagger long joints continuous and end joints within each layer not less than 12 inches in adjacent rows for 48 by 96 inch insulation boards.
      c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
      d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
      e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation, so that water flow is unrestricted.

f. Fill gaps exceeding 1/4 inch with insulation.

g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

h. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF UNDERLAYMENT AND FLASHING

A. Underlayments: Install underlayment as specified in Section 073013 – Roofing Underlayments.

B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 – Sheet Metal Flashing and Trim.

3.7 INSTALLATION OF STANDING SEAM METAL ROOF PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of openings.
   a. Fasten with self-tapping screws.
   b. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel Work proceeds.
6. Locate panel splices over, but not attached to, structural supports.
   a. Stagger panel splices and end laps to avoid a 4-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws.
   a. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to exterior; use galvanized-steel fasteners for surfaces exposed to interior.

C. Anchor Clips: Anchor metal roof panels and other components of Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.

2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
4. Watertight Installation:
   a. Apply a continuous ribbon of sealant to seal joints of metal panels, using sealant as recommend in writing by manufacturer as needed to make panels watertight.
   b. Provide sealant between panels and protruding equipment, vents, and accessories.
   c. At panel splices, nest panels with minimum 6 inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

H. Roof Curbs: Install flashing around bases where they meet metal roof panels.

I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.9 REPAIR

A. Replace standing-seam metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional Work with specified requirements.

D. Prepare test and inspection reports.

3.11 CLEANING

A. On completion of standing-seam metal panel installation, remove unused materials.

B. Clean exposed metal finished surfaces as recommended in writing by standing-seam metal panel manufacturer.

C. Clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.12 PROTECTION

A. Remove temporary protective coverings and strippable films as standing-seam metal panels are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Maintain standing-seam metal panels in clean condition during construction.

END OF SECTION

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.

B. Related Requirements:
   1. Section 070543 – Cladding Support Systems.
   2. Section 072500 – Weather Barriers.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate metal panel assemblies with rain drainage Work, flashing, trim, and other adjoining Work to provide a leakproof, secure, and noncorrosive installation.

B. Preinstallation Meetings: Conduct meeting at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose Work interfaces with or affects metal panels.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal panel assembly during and after installation.
   8. Review of procedures for repair of metal panels damaged after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

3. Submit Shop Drawings that have been engineered and certified by professional engineer licensed in the State in which Project is located.
   a. Include seal and signature of professional engineer on Shop Drawings.

C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

D. Delegated-Design Submittal: For formed metal wall panel systems, indicating compliance with performance and design criteria.
1. Include analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:
1. For Installer.
2. For professional engineer indicating experience with providing delegated-design engineering services of the kind indicated.
   a. Include documentation that engineer is licensed in state in which Project is located.

B. Product Test Reports: For concealed-fastener, lap-seam metal wall panels for tests performed by a qualified testing agency.

C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm that specializes in manufacturing of specified metal panel systems with a minimum of 10 years of documented experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 5 years of documented experience.

C. Delegated-Design Engineer Qualifications: Professional engineer experienced in providing delegated-design engineering services of the kind indicated and is legally qualified to practice in state where Project is located.

D. Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products.
1. Maintain UL certification of portable roll-forming equipment for duration of Work.

E. Mockups: Comply with Section 014339 – Mockups.
1. Build mockups of typical metal panel assembly, where directed by Architect, including corner, supports, attachments, and accessories.
   a. Mockup Size: Approximately 10 sq. ft.
   b. Illustrate a complete assembly of each profile, proposed thickness, and finish.
2. Water-Spray Test: Conduct water spray test of mockups of metal wall panel assembly, testing for water penetration per AAMA 501.2.

3. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
1. Failures include the following:
a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: 5 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes the following:
a. Color fading more than 5 Hunter units when tested per ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested per ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: Minimum 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
1. AEP Span, a Division of ASC Profiles, Inc.
2. ATAS International, Inc.
3. Berridge Manufacturing Company.
4. CENTRIA Architectural Systems.

5. Innovative Metals Company, Inc. (IMETCO).
6. MBCI.
7. McElroy Metal, Inc.
8. Metal Sales Manufacturing Corporation.
9. Morin; a Kingspan Group Company.
10. Petersen Aluminum Corp.
11. Taylor Metal Products.

2.2 PERFORMANCE CRITERIA

A. Recycled Content: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 50 percent.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 013573 – Delegated-Design Procedures, to design formed metal panel assemblies, including attachment to building construction.

C. Structural Performance: Provide metal panel assemblies capable of withstanding effects of gravity loads, based on testing per ASTM E1592:
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of span.

D. Seismic Performance: Exterior metal composite material panel systems, including anchors and connections, shall withstand effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.0.

E. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft.
2. Test Panel Size: Minimum 10 sq. ft. test panel that includes horizontal and vertical joints.

F. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
1. Test-Pressure Difference: 12 lbf/sq. ft.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.3 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant inside laps. Include accessories required for weathertight installation.

B. Box-Rib-Profile, Concealed-Fastener Metal Wall Panels: Formed with various raised profiles indicated by manufacturer's model numbers, spaced across panel width. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
a. AEP Span, a Division of ASC Profiles, LLC: Flex Series, in the following percentages:

1) Series 1.2FX30-12: 25 percent.

b. Approved substitution from one of the following:
1) Berridge Manufacturing Company.
2) Metal Sales Manufacturing Corporation.
3) Petersen Aluminum Corp.

2. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A792, Class AZ50 coating designation; structural quality. Prepainted by coil-coating process to comply with ASTM A755.
a. Exterior Finish: 2-coat fluoropolymer.
b. Color: Selected by Architect from manufacturer's full range.
3. Nominal Thickness: 0.0294 inch.
4. Rib Width and Spacing:
a. Series 1.2FX30-12: One 6 inch rib with 6 inch reveal.
5. Panel Coverage: 12 inches.
6. Panel Height: Nominal 1.5 inches.

2.4 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653, G90 coating designation or ASTM A792, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam, or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide EPDM, PVC, or neoprene sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920 as recommended in writing by metal panel manufacturer and complying with Section 079200.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 FABRICATION

A. Fabricate and finish metal panels and accessories at factory, by manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets, sealants, or separator strips that provide weathertight seal and prevent metal-to-metal contact and minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. 2-Coat Fluoropolymer: AAMA 621; fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Finish consists of the following:
      a. Prime Coat: Minimum total dry film thickness of 0.15 to 0.20 mils.
      b. Finish Coat: Minimum total dry film thickness of 0.70 to 0.80 mils.
      c. Total Dry Film Thickness: 0.85 to 1.00 mils.
      d. Secular Gloss: ASTM D523; 8 to 15 at 60 deg.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat

a. Total Dry Film Thickness: Minimum 0.50 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF METAL WALL PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated.
   1. Install panels perpendicular to supports unless otherwise indicated.
   2. Anchor metal panels and other components of Work securely in place, with provisions for thermal and structural movement.
   3. Shim or otherwise plumb substrates receiving metal panels.
   4. Flash and seal metal panels at perimeter of openings.
      a. Fasten with self-tapping screws.
      b. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   5. Install screw fasteners in predrilled holes.
   6. Locate and space fastenings in uniform vertical and horizontal alignment.
   7. Install flashing and trim as metal panel Work proceeds.
   8. Locate panel splices over, but not attached to, structural supports.
      a. Stagger panel splices and end laps to avoid a 4-panel lap splice condition.
   9. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws.
      a. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   10. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
   2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
   3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
   5. Flash and seal panels with weather closures at perimeter of openings.

E. Watertight Installation:
   1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
   2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion.
   1. Coordinate installation with flashings and other components.
   2. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   3. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual."
   1. Provide concealed fasteners where possible and set units true to line and level as indicated.
   2. Install Work with laps, joints, and seams that are permanently watertight.
   3. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems.
   4. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
   5. Expansion Provisions:
      a. Provide for thermal expansion of exposed flashing and trim.
      b. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches of corner or intersection.
      c. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 REPAIR

A. Replace formed metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Water-Spray Test: After installation, test assembly of 75 foot by 2 story minimum area by 2 bay area or as directed by Architect, for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.

D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional Work with specified requirements.

F. Prepare test and inspection reports.

3.6 CLEANING

A. On completion of formed metal panel installation, remove unused materials.

B. Clean exposed metal finished surfaces as recommended in writing by formed metal panel manufacturer.

C. Clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.7 PROTECTION

A. Remove temporary protective coverings and strippable films as formed metal panels are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Maintain formed metal panels in clean condition during construction.

END OF SECTION

SECTION 074293 - SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiber-cement soffits.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fiber-cement panel assemblies with rain drainage Work, flashing, trim, construction of soffits, and other adjoining Work to provide a leakproof, secure, and noncorrosive installation.

B. Preinstallation Meetings: Conduct meeting at Project site.
   1. Comply with preinstallation meeting requirements in Section 074646 – Fiber-Cement Siding.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Include fabrication and installation layouts of fiber-cement panel assemblies ls; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Include detailed drawings of atypical, non-standard applications of cementitious soffit materials which are outside scope of standard details and specifications provided by manufacturer.
   3. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Fiber-Cement Soffits: 12 inch long by actual width Sample of soffit.
   2. 12 inch long by actual width Samples of trim and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fiber-cement panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 5 years of documented experience.

B. Mockups: Comply with Section 014339 – Mockups.
   1. Build mockup as indicated in Section 074646 – Fiber-Cement Siding.
   2. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, fiber-cement panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.

B. Unload, store, and erect fiber-cement panels in a manner to prevent cracking, chipping, and breaking.

C. Stack panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fiber-cement systems that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:
      a. Structural failures including cracking and deforming.
      b. Deterioration of materials beyond normal weathering.
   2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fiber-cement soffit panels and fiber-cement siding from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

B. Structural Performance: Provide fiber-cement siding systems capable of withstanding effects of the following loads, based on testing according to ASTM E330:
   1. Wind Loads and Other Design Loads: As indicated on Drawings.

C. Seismic Performance: Exterior fiber-cement siding systems, including anchors and connections, shall withstand effects of earthquake motions determined according to ASCE 7.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 FIBER-CEMENT SOFFIT PANELS

A. ASTM C1186 Type A, Grade II fiber-cement; noncombustible when tested according to ASTM E136.
   1. Surface Burning Characteristics: Class A according to ASTM E84:
      a. Flame Spread: 25.
      b. Smoke Developed: 0.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Fiber-cement soffit panels from same collection as siding and complying with the following:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. James Hardie Building Products, Inc.: Hardie Soffit Panels, Vented Cedarmill.
      b. Approved substitution.
   2. Nominal Thickness: Not less than 1/4 inch.
   3. Pattern: 24 inch wide sheets with wood-grain texture.
   4. Edges: Profiled on 4 edges, with ship-lapped edges between adjacent panels.
      a. Edge Sealant: Joint sealant factory-applied to 1 end and 1 side edge between adjacent panels.
   5. Ventilation: Provide perforated soffit.
   6. Factory primed with manufacturer's standard acrylic primer.

2.4 MISCELLANEOUS MATERIALS, FIBER-CEMENT SOFFIT PANELS

A. Fasteners: Stainless steel for fastening fiber cement.
   1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or 3 screw-threads, into substrate.
   2. For fastening to wood, use siding nails or ribbed bugle-head screws of sufficient length to penetrate a minimum of 1 inch into substrate.

B. Insect Screening for Soffit Vents: Stainless steel, 18 by 18 mesh.

C. Paint: As specified in Section 099000 –Painting and Coating, and acceptable to fiber-cement siding manufacturer.
   1. Provide primer acceptable to fiber-cement panel manufacturer if panels are not shop-primed.

D. Joint Sealant: SLNT-U3 urethane sealant, as specified in Section 079200 and acceptable to fiber-cement manufacturer, that provides 2 sided adhesion.
   1. Color: Match color of fiber-cement components.

2.5 FABRICATION

A. Fabricate and finish fiber-cement panels and accessories at factory, by manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, panel supports, and other conditions affecting performance of Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by panel manufacturer.

B. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement soffit and related accessories.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FIBER-CEMENT PANELS

A. Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
   1. Do not install damaged components.
   2. Install fasteners no more than 16 inches on center.
   3. Clean cut and exposed panel edges and apply cut edge sealer.
   4. Install joint sealants to produce a weathertight installation where indicated or required.

B. Soffit Panels:
   1. Before installing soffit panels, install insect screen over ventilation holes on back of soffit panel using fasteners or adhesive.
   2. Fasten soffit panels to soffit subframing using fasteners acceptable to soffit panel manufacturer.
   3. Install fiber-cement soffit panels with minimum space between butt joints to allow for thermal movement.
   4. Align butt joints over center of subframing members.
   5. Install soffit panels with ventilation holes oriented away from building.

3.3 REPAIR AND CLEANING

A. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

C. Where required by Federal, state, or local jurisdictions, provide acceptable means of containing and disposing of dust and debris created by handling, cutting, and installing of fiber-cement panels.

END OF SECTION

SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiber-cement siding.

B. Related Requirements:
   1. Section 074293 – Soffit Panels, for fiber-cement soffits.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

B. Preinstallation Meetings: Conduct Meeting at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Provide detailed drawings of atypical, non-standard applications of cementitious siding materials which are outside scope of standard details and specifications provided by manufacturer.

C. Samples for Verification:
   1. 12 inch long by actual width Sample of siding.
   2. 12 inch long by actual width Samples of trim and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement siding and soffit.

B. Sealant Certification: From fiber-cement manufacturer indicating acceptance of proposed joint sealant.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

D. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.

E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish full lengths of fiber-cement siding and soffit, including related accessories, in a quantity equal to 2 percent of amount installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity specializing in performing type of work specified and approved by manufacturer with a minimum of 3 years of documented experience.

B. Mockups: Comply with Section 014339 – Mockups.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Build mockups for fiber-cement siding and soffit, including related accessories.
      a. Size: 48 inches long by 60 inches high.
      b. Include outside corner on one end of mockup and inside corner on other end.
   3. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:
      a. Structural failures including cracking and deforming.
      b. Deterioration of materials beyond normal weathering.
   2. Warranty Period: 50 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace fiber-cement panels that show evidence of deterioration of factory-applied finishes within specified warranty period. Deterioration includes the following:
   1. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: Minimum 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Structural Performance: Provide fiber-cement siding systems capable of withstanding effects of the following loads, based on testing according to ASTM E330:
   1. Wind Loads and Other Design Loads: As indicated on Drawings.

B. Seismic Performance: Exterior fiber-cement siding systems, including anchors and connections, shall withstand effects of earthquake motions determined according to ASCE 7.
   1. Component Importance Factor: 1.0.

C. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 FIBER-CEMENT PRODUCTS, GENERAL

A. ASTM C1186 Type A, Grade II fiber-cement; noncombustible when tested according to ASTM E136.
   1. Surface Burning Characteristics: Class A according to ASTM E84:
      a. Flame Spread: 25.
      b. Smoke Developed: 0.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 FIBER-CEMENT SIDING

A. Fiber-Cement Siding (FC.SIDING): Solid-core fiber-cement panel rainscreen system complying with the following:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. KMEW USA Inc.: CERACLAD Rain Screen Exterior Siding System.
      b. Approved substitution.
   2. Panel Texture: Smooth texture.
   3. Nominal Thickness: Not less than 5/8 inch.
   4. Profile: Cast Stripe 8 Reveal.
   5. Factory finished with manufacturer's standard 3 coat finish with anti-efflorescence protection.
      a. Prefinished Color: Urban Cedar, Honey.

2.5 FIBER-CEMENT TRIM

A. Fiber-cement corner units from same collection and same material as panels.
   1. Thickness: Not less than 5/8 inch.
   2. Returns:3-3/16 inch each side.
   3. Vertical Corner:
      a. Length: 120 inches
      b. Coverage: 5.9 sq. ft.
   4. Horizontal Corner:
      a. Length: 18 inches
      b. Coverage: 0.89 sq. ft.
   5. Factory finished with manufacturer's standard 3 coat finish with anti-efflorescence protection.
      a. Prefinished Color: As selected by Architect.

2.6 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended or provided by fiber-cement panel manufacturer for Project configuration.
   1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Installation Components: Materials recommended by fiber-cement siding manufacturer for intended use, compatible with rainscreen siding system, and matching color and texture of adjacent siding unless otherwise indicated:
   1. Starter Bars: Galvanized steel.
   2. Caulking Joiner: Aluminum-zinc-magnesium alloy coated steel.
   3. Panel and Corner Clips: Aluminum-zinc-magnesium alloy coated steel.
   4. Cut Edge Sealer: Concrete sealer recommended by fiber-cement siding manufacturer.
   5. Joint Sealant: SLNT-U3 silicone sealant as specified in Section 079200.
      a. Color: Match color of fiber-cement components.
   6. Touch-up Paint Kit: Provided by fiber-cement siding manufacturer.

C. Closures Components: Premanufactured products complying with the following:
   1. Material: 0.015 inch thick aluminum.
   2. Sizes:
      a. Corners: As indicated on Drawings.
      b. Junction Flashing: 6 inches wide for 3 inch coverage on each side of butt joints.
   3. Surface: Match siding texture.
   4. Finish: Manufacturer's standard primer on exposed surfaces and epoxy coating on concealed surfaces.

D. Flashing: Provide stainless-steel flashing complying with Section 076200 – Sheet Metal Flashing and Trim at window and door heads and where indicated.

E. Fasteners: Stainless steel for fastening fiber cement.
   1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or 3 screw-threads, into substrate.

F. Paint: As specified in Section 099000 –Painting and Coating, and acceptable to fiber-cement siding manufacturer.
   1. Provide primer acceptable to fiber-cement panel manufacturer if panels are not shop-primed.

G. Joint Sealant: SLNT-U3 urethane sealant, as specified in Section 079200 and acceptable to fiber-cement manufacturer, that provides 2 sided adhesion.
   1. Color: Match color of fiber-cement components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding, soffit, and related accessories.

B. Verify that weather or air barrier has been installed over substrate completely and correctly, and is ready to receive Work of this Section.

C. Verify that flashing is installed above door and window trim and casings, above horizontal trim between panels, and where else indicated.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
   1. Do not install damaged components.
   2. Install fasteners no more than 16 inches on center.
   3. Clean cut and exposed panel edges and apply cut edge sealer.
   4. Install joint sealants to produce a weathertight installation where indicated or required.

B. Vertical Installation:
   1. Begin panel installation at left hand inside or outside corner. Continue working left to right and bottom to top.
   2. Seat flat edge of panel on vertical starter bar.
   3. Install first clip as close to starter bar as possible and no more than 3 inches above starter bar. Install additional clips within 3 inches of panel edges.
   4. Install panel clips to ship-lapped edge of panel minimum 16 inches on enter to secure panel to wall and to maintain desired cavity for air circulation.
   5. Fit panels tightly together on both horizontal and vertical joints ensuring that panel edges are properly seated in clips.
   6. Do not directly fasten items to panels. Provide blocking behind panel and fasten objects through panels into blocking and building frame.

C. Trim Boards:
   1. Install materials according to siding manufacturer's written instructions.
   2. Ensure flashing is installed around wall openings.
   3. Fasten trim into framing, sheathing, or blocking as indicated on Drawings, using manufacturer's recommended fasteners at manufacturer's recommended spacing.
   4. Inside Corners: Trim with single board trim both sides of corner.
   5. Outside Corners: Attach trim on both sides of corner.
   6. Allow 1/8 inch gap between trim and siding.
   7. Seal gap with specified joint sealant.
   8. Fasten through overlapping boards. Do not nail between lap joints.

D. Roof Edge Flashing:
   1. Where vertical surfaces of fiber-cement panels meet roof edge flashing, provide 2 inch clearance between flashing and edge of fiber-cement panels, or as recommended by fiber cement siding manufacturer.

E. Tolerances:
   1. Maximum Variation of Siding Courses: Plumb, level, and out of plane within 1/4 inch tolerance in 10 foot.
   2. Maximum Offset Joint Alignment: 1/16 inch.

3.4 ADJUSTING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

3.5 CLEANING

A. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

B. Where required by Federal, state, or local jurisdictions, provide acceptable means of containing and disposing of dust and debris created by handling, cutting, and installing of fiber-cement panels.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sheet metal material fabrications.
   2. Miscellaneous materials.

B. Related Requirements:
   1. Section 073013 – Roofing Underlayments.
   2. Section 076500 – Flexible Flashings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
   2. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

B. Preinstallation Meetings: Conduct meeting at Project site.
   1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
   3. Review requirements for insurance and certificates if applicable.
   4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim, include the following:
   1. Plans, elevations, sections, and attachment details.
   2. Fabrication and installation layouts, expansion-joint locations, and keyed details.
      a. Distinguish between shop- and field-assembled Work.
   3. Materials, thickness, weight, and finish for each item and location in Project.
   4. Details for the following conditions:
      a. Forming, including profiles, shapes, seams, and dimensions.
      b. Joining, supporting, and securing, including layout of fasteners, cleats, clips, and other attachments, including pattern of seams.
      c. Termination points and assemblies.
      d. Expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
      e. Roof-penetration flashing.
      f. Edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashing.
      g. Detail corner units and end and back dam units.
      h. Connections to adjoining Work.
      i. Special conditions and applications.
   5. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.
   1. Sheet Metal Flashing and Trim: 12 in. long by actual width of unit, including finished seam with required profile.
      a. Include fasteners, cleats, clips, closures, and other attachments.
      b. Include the following:
         1) Trim.
         2) Metal closures.
         3) Expansion joints.
         4) Joint Intersections.
         5) Miscellaneous fabrications.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For roof edge flashing, from ICC-ES or an agency acceptable to AHJ showing compliance with ANSI/SPRI/FM 4435/ES-1.

D. Qualification Statement: For fabricator.

E. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers, with a minimum of 10 years of experience, who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
   1. For roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

B. Mockups: Comply with Section 014339 – Mockups.
   1. Build mockup of typical roof edge, including fascia, gutter, and downspout, approximately 10 feet long, including supporting construction, seams, attachments, underlayment, and accessories.
   2. Build mockup of typical window flashing, including heads, sills and sill pans, jambs, seams, attachments, and accessories.
   3. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
   1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from damage and exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes the following:
a. ASTM D2244; color fading more than 5 Hunter units.
b. ASTM D4214; chalking in excess of a No. 8 rating.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashing tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure.
1. Design Pressure: As indicated on Drawings.

D. Recycled Content: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 50 percent.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Provide clips that resist rotation and avoid shear stress as a result of thermal movements.
3. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792, Class AZ50 coating designation Zinc-coated (galvanized) steel sheet according to

ASTM A653, G90 coating designation, structural quality, prepainted by coil-coating process to comply with ASTM A755.

1. Recycled Content: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 25 percent.
2. Nominal Thickness: Indicated in Fabrications Articles.
3. Surface: Smooth, flat.
4. Exposed Coil-Coated Finish:
    a. 2-Coat Fluoropolymer: AAMA 621; fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Finish consists of the following:
    b. Prime Coat: Minimum total dry film thickness of 0.15 to 0.20 mils.
    c. Finish Coat: Minimum total dry film thickness of 0.70 to 0.80 mils.
    d. Total Dry Film Thickness: 0.85 to 1.00 mils.
    e. Secular Gloss: ASTM D523; 8 to 15 at 60 deg.
    f. Color: Selected by Architect from manufacturer's full range.
5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat
    a. Total Dry Film Thickness: Minimum 0.50 mils.

C. Stainless-Steel Sheet: ASTM A240 or ASTM A666, Type 304, dead soft, fully annealed.
1. Recycled Content: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 50 percent.
2. Nominal Thickness: Indicated in Fabrications Articles.
3. Surface: Smooth, flat.
4. Exposed Finish: 4 (polished directional satin).
    a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

2.3 UNDERLAYMENT MATERIALS

A. Roofing Underlayments: Specified in Section 073013 – Roofing Underlayments.

2.4 REGLETS

A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Fry Reglet Corporation.
    b. Keystone Flashing Company, Inc.
    c. Metal-Era, Inc.
    d. Approved substitution.
2. Source Limitations: Obtain reglets from single source from single manufacturer.

B. Exposed Metal Material:
1. Metallic-Coated Steel Sheet: Nominal 0.0276 inch thick.
2. Stainless Steel: 0.0188 inch thick.

C. Reglet Unit Types:
1. Corners: Factory miter and solder or continuously weld.
    a. Mechanically clinched and sealed watertight is acceptable if approved by Architect.
2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

D. Accessories:
   1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. MISCELLANEOUS MATERIALS

F. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

G. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: Stainless-steel rivets suitable for metal being fastened.
      c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   2. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153 or ASTM F2329.
   3. Rivets: Provide pop type rivets with closed-end.

H. Solder:
   1. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead unless indicated otherwise.

I. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing; permanently elastic, nonsag, nontoxic, and nonstaining.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Gibraltar Industries: Part #99415 Butyl Tape.H.B. Fuller Company: MB-10A Sealant Tape.
      c. Holcim Solutions and Products US, LLC: Tacky Tape SM5227.H-O Products Corporation: Poly-Seal SB Butyl Tape.
      e. Tremco: Tremco 440 Tape.Approved substitution.
   2. Size: Minimum 1/8 in. thick by 1/2 in. wide.
   3. Application:
      a. Between sheet metal flashings and associated backing plates and where indicated or recommended by tape manufacturer.
      b. Use in conjunction with specified joint sealant.

J. Friction-Resistant Tape: Ultra-high modular weight (UHMW) nonsag, nontoxic, nonstaining polyethylene tape with rubber adhesive on 1 side, in thickness as required to allow free movement in slip joints to prevent metal-to-metal friction.
   1. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
      a. Saint-Gobain Tape Solutions.

b. TapeCase.
c. 3M Commercial Solutions.
d. Approved substitution.

2. Size: 0.125 inch thick by 1/2 inch wide.
3. Application:
   a. Between contraction joints in sheet metal flashing and where indicated or recommended by tape manufacturer.
   b. Use in conjunction with specified joint sealant.

K. Joint Sealants: Refer to Section 079200 – Joint Sealants for sealing joints in sheet metal flashing and trim to remain watertight.
1. Elastomeric Sealant: SLNT.U1.
2. Butyl Sealant: SLNT.BR1.

L. Deicing System: Self-regulating trace heating system for deicing of roof, gutters, downspouts, and drainpipes, UL Listed, CSA Certified, and FM Approved.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. BriskHeat Corporation: SpeedTrace Roof and Gutter De-Icing Kit.
   b. King Electrical Mfg. Co.: SRK Series System.
   c. nVent Thermal Management, LLC: nVent: RAYCHEM IceStop System.
   d. ThermoSoft: NeverFreeze System.
2. Product Requirements:
   a. Length: As indicated on Drawings.
   b. Supply Voltage: 110-120V,
      1) Provide power connection where indicated on Drawings.
   c. Heating Power: 8 W/ft. at 32 deg F.
   d. Outer Jacket Material: Moisture and flame resistant thermoplastic.
   e. Color: Black.
   f. Nominal Width: 0.54 in.
   g. Nominal Thickness: 0.24 in.
   h. Ground Path Type: Braid.
   i. Conductor Material: Nickel-plated copper.
   j. Nominal Cable Weight: 92 lb/ft.
   k. Provide splice kits, end seals, foil tape, and other items for a complete installation.

2.5 FABRICATION, GENERAL

A. Fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
1. Shop-fabricate sheet metal flashing and trim to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Corners: For copings and fascia caps, factory miter and solder, continuously weld, or mechanically clinch and seal watertight into single units, with 18 in. to 24 in. extensions each way from corner.

6. Corners: For horizontal sill pans, factory miter and continuously solder corners of end and back dams watertight.
7. Conceal fasteners and expansion provisions where possible.
   a. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings, and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions:
1. Form metal for thermal expansion of exposed flashing and trim.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with SLNT.BR1 concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Cleats and Attachment Devices:
1. Fabricate from same material as accessory being anchored or from compatible, noncorrosive metal, and not less than thickness of metal being secured.
2. Fabricate devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate seams with flat lock seams.
1. Tin edges of nonmoving seams, form seams, and solder.
2. Seal moving seams with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
   a. Rivet joints where necessary for strength.

G. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:
1. Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in maximum 50 ft. long sections.
3. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice gutter thickness unless indicated otherwise.
4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
5. Gutter Profile: SMACNA Style F or as indicated on Drawings.
6. Expansion Joints: Butt type with cover plate.
7. Fabricate gutters from the following materials:
   a. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
   b. Galvanized Steel: 0.0276 inch thick.
8. Outlet Tubes: Fabricate rectangular outlet tubes of size required to accept specified downspouts.
9. Accessories: Gutter strainers.

B. Built-in Gutters:
   1. Fabricate to cross section indicated and to matching existing, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
   2. Fabricate in maximum 50 ft. long sections.
   3. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
   4. Fabricate gutters with built-in expansion joints.
   5. Fabricate gutters from the following materials:
      a. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
   6. Outlet Tubes: Fabricate rectangular outlet tubes of size required to accept specified downspouts.
   7. Accessories: Gutter strainer.

C. Sheet Metal Downspouts:
   1. Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows.
   2. Downspout Size: Fabricate to the following size unless indicated otherwise:
      a. Rectangular: 4 in. by 3 in.
   3. Fabricate downspouts from the following materials:
      a. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
   4. Fabricated Hanger Style: In accordance with SMACNA's "Architectural Sheet Metal Manual”:
      a. Rectangular: Fig. 1-35B.
   5. Fabricate downspout hangers from the following materials:
      a. Aluminum-Zinc Alloy-Coated Steel: 3 in. wide, 0.0636 inch thick.
      b. Provide fasteners of type to securely fasten downspouts to adjacent substrate.
   6. Downspout Boots: Contoured interior flow design with no boxed corners, weld seams or choke points; include integral lug slots and stainless steel fasteners
      a. Material: Gray cast iron, ASTM A48, Class 30.
      b. Configuration: Offset, angular, or 90 deg configuration as indicated on Drawings.
      c. Finish: Manufacturer's standard powder coating in color to match downspouts.
   7. Downspout Connections to Storm Drainage System: As indicated on civil Drawings.
      a. Downspout Connector: Neoprene coupler boot with stainless steel clamp unless indicated otherwise.

D. PVC Downspouts:
   1. Downspout Pipe: Schedule 40 PVC pipe.
      a. Provide pipe with bell ends where connections continue straight runs.
   2. Size: 4 inch diameter unless indicated otherwise.
   3. Fabricated Hanger Style: In accordance with SMACNA's "Architectural Sheet Metal Manual”:
      a. Round: Fig. 1-35E.
   4. Fabricate downspout hangers from the following materials:
      a. Aluminum-Zinc Alloy-Coated Steel: 3 in. wide, 0.0636 inch thick.
      b. Provide fasteners of type to securely fasten downspouts to adjacent substrate.
   5. Fittings: Standard fittings in straight, angled, and elbow profiles for connecting pipe components together to form configurations indicated.
   6. Cement, Primer, and Cleaner: Solvent-based products recommended by PVC manufacturer for welding connections watertight.

E. Parapet Scuppers:

1. Fabricate scuppers of dimensions required with closure flange trim to exterior, 4 inch wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.
2. Fabricate from the following materials:
   a. Stainless Steel: 0.050 inch thick.
   b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

F. Splash Blocks: Precast concrete, top surface curbed on 3 sides, and sloped from back to front for proper drainage; with fabricator's standard reinforcing.
1. Size: 16 by 32 by 3-1/2 inches.
2. Steel Bar Reinforcement: ASTM A615, Grade 60, deformed. Use hot-dip galvanized steel where concrete coverage will be less than 2 inches.
3. Exposed Surface Finish: Smooth form finish. Comply with ACI 301.
4. Color: Natural, consistent in color.
5. Concrete Design Mix: Not less than 3,000 psi, in place, at 28 days.
6. Air-Entraining Admixture: As recommended by splash block manufacturer to achieve minimum of 5 percent air content.
   a. Do not use calcium chloride or fly ash.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item unless otherwise specified in this Section or indicated on Drawings

B. Counterflashings: Fabricate to cover 4 inches of base flashing measured vertically; and in lengths required so that no step exceeds 8 inches and overall length is no more than 10 feet. Fabricate from the following materials:
1. Galvanized Steel: 0.0276 inch thick
2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
3. Provide metal reglets or receivers for installation.

C. Open-Valley Flashings: Fabricate from metal sheet not less than 24 inches wide in lengths not exceeding 10 feet, with 1 inch high, inverted-V profile water diverter at center of valley and equal flange widths of not less than 11 inches.
1. Fabricate from the following materials:
   a. Galvanized Steel: 0.0276 inch thick.
   b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
2. Hem flange edges for fastening with metal cleats.
3. Add stiffening ribs in flashings to promote drainage.

D. Drip Edges: Fabricate in lengths not exceeding 10 feet with minimum 2 inch roof deck flange and 11/2 inch fascia flange with 3/8 inch drip at lower edge.
1. Fabricate from the following materials:
   a. Galvanized Steel:0.0276 inch thick
   b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
2. Hem drip edges at 45 degs.

E. Eave, Rake[, Ridge, and Hip] Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.0276 inch thick
2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

F. Flashing Receivers: Fabricate from the following materials:
   1. Galvanized Steel: 0.0276 inch thick
   2. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

G. Roof-Penetration Flashing: Fabricate in accordance with SMACNA's "Architectural Sheet Metal Manual" Chapter 8.
   1. Fabricate from the following materials:
      a. Galvanized Steel: 0.0276 inch thick.
      b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

H. Vent Pipe Flashings: ASTM B749, Type L51121, copper bearing.
   1. Weight and Thickness: Minimum 3.0 lb/sq. ft., 0.0625 inch thick.
   2. Fabricate in accordance with SMACNA's "Architectural Sheet Metal Manual" Fig. 8-12A.

2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing:
   1. Fabricate continuous flashings in minimum 10 ft. long, but not exceeding 12 ft. long, sections, under copings, and at shelf angles.
   2. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings.
      a. Form flashing with 2 inch high end and back dams.
      b. Fully solder seams and corners of end and back dams.
   3. Fabricate from the following materials:
      a. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

B. Opening Flashings in Frame Construction:
   1. Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.
   2. Form head and sill flashing with 2 inch high end and back dams.
   3. Fully solder seams and corners of sill end and back dams.
   4. Fabricate from the following materials:
      a. Stainless Steel: 0.025 inch thick.
      b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

C. Horizontal Sill Pans:
   1. Fabricate horizontal sill pan flashings complying with the following:
      a. In sizes and configurations as indicated.
      b. Form from 1-piece flashing material extending full width of openings.
      c. Design to direct water away from building when installed.
   2. Form sill pan flashing with 2 inch high end and back dams.
   3. Fully solder seams and corners of end and back dams.
   4. Fabricate from the following materials:
      a. Stainless Steel: 0.025 inch thick.
      b. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Metal Roof Pipe Boots:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Aztec Washer Company: Master Flash Roof Flashings.
      b. DEKS North America, Inc.: Dektite Premium Roof Flashings.
      c. Approved substitution.

2. Materials:
   a. Base Flange and Tube: Nominal 0.0276 inch thick aluminum or corrosion-resistant galvanized steel.
   b. Pipe Collar: Nonfading, UV- and ozone-resistant EPDM, PVC, or silicone.
3. Pipe Size: Minimum 1/4 in. to 24 in. diameter.
4. Color: Black or Gray as selected by the Architect.
5. Physical Performance: Suitable for hot or cold vent pipe Type B installations and capable of withstanding the following surface temperatures:
   a. Intermittent EPDM: Min. 275 deg F.
   b. Continuous EPDM: Minus 58 deg F to plus 240 deg F.
6. Application:
   a. Pipe penetrations through metal roofing system.

B. Roof Flashing Pipe Boots:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Aztec Washer Company: Master Flash Roof Flashings.
   b. IPS Corporation: Multi-Size 4N1 Galvanized Base Roof Flashing.
   c. Menzies Metal Products: Multi-Flash Pipe Flashing Pitched.
   d. Oatey Co.: Galvanized Base No-Calk Roof Flashings.
   e. Approved substitution.
2. Materials:
   a. Base Flange and Tube: Nominal 0.0276 inch thick aluminum or corrosion-resistant galvanized steel.
   b. Pipe Collar: Nonfading, UV- and ozone-resistant EPDM, PVC, or silicone.
3. Pipe Size: Minimum 1-1/4 in. to 4 in. diameter.
4. Pipe Collar Color: Black or Gray as selected by the Architect.
5. Physical Performance: Suitable for hot or cold vent pipe Type B installations and capable of withstanding the following surface temperatures:
   a. Intermittent EPDM: Min. 275 deg F.
   b. Continuous EPDM: Min. 212 deg F.
6. Application:
   a. Sloped shingled roofs.

C. Equipment Support Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.0276 inch thick

D. Overhead-Piping Safety Pans: Fabricate from the following materials:
1. Galvanized Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of Work.
1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Underlayments: Underlayment installation is specified in Section 073013 – Roofing Underlayments.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings
   1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes.
      a. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   3. Anchor sheet metal flashing and trim and other components of Work securely in place, with provisions for thermal and structural movement.
   4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
   5. Install continuous cleats with fasteners spaced not more than 12 inches on center.
   6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least 2 fasteners. Bend tabs over fasteners.
   7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
   8. Do not field cut sheet metal flashing and trim by torch.
   9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating, by applying friction-resistant tape, or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
   1. Coat concealed side of uncoated stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
   1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
   2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
   3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed Work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated.
      a. Embed hooked flanges of joint members not less than 1 inch into sealant.
      b. Form joints to completely conceal sealant.

c. When ambient temperature at time of installation is between 40 deg F and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.
1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 – Joint Sealants.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
1. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
2. Do not solder metallic-coated steel sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint.
a. Fill joint completely.
b. Completely remove flux and spatter from exposed surfaces.
5. Stainless-Steel Soldering:
a. Tin edges of uncoated sheets using solder for stainless steel and acid flux.
b. Promptly remove acid flux residue from metal after tinning and soldering.
c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in zinc and uncoated aluminum where necessary for strength.

3.4 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:
1. Join sections with riveted and soldered joints or joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
7. Anchor gutter with gutter brackets spaced not more than 18 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
8. Install gutter with expansion joints at locations not exceeding 50 ft. apart, or as indicated.
a. Where downspouts are used, Install expansion joints between downspouts.
9. Install expansion-joint caps.
10. Install gutter strainers at openings of each gutter outlet tube.

C. Built-in Gutters:
1. Join sections with riveted and soldered joints.
2. Provide for thermal expansion. Slope to downspouts.
3. Provide end closures and seal watertight with sealant.
4. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing.
a. Lap sides minimum of 2 inches over underlying course.

b. Lap ends minimum of 4 inches.
c. Stagger end laps between succeeding courses at least 72 inches.
d. Fasten with roofing nails. Install slip sheet over underlayment.

5. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 18 inches apart.
6. Install gutter with expansion joints at locations indicated, but not exceeding 50 feet apart.
   a. Install expansion-joint caps.
7. Install gutter strainers at openings of each gutter outlet tube.

D. Sheet Metal Downspouts:
1. Connect downspouts to gutter outlet tubes, and fasten as recommended by Installer.
2. Join sections with 1-1/2- inch telescoping joints.
3. Attach downspouts to wall with fasteners designed to hold downspouts securely in place.
   a. Locate hangers at top and bottom and at approximately 60 inches on center.
   b. Design anchors and hangers to allow removal of downspouts without damage to downspouts and brackets.
4. Connect downspouts to underground drainage system or provide elbows at base of downspout to direct water away from building, as indicated on Drawings.

E. Expansion-Joint Covers:
1. Install expansion-joint covers at locations and of configuration indicated.
2. Lap joints minimum of 4 inches in direction of water flow.

F. Splash Pans:
1. Install where downspouts discharge on low-slope roofs.
2. Set in adhesive material compatible with substrate material.

G. Splash Blocks: Install where downspouts discharge on grade and where else indicated.

3.5 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install Work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
3. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3 inch centers.

C. Pipe or Post Counterflashing:
1. Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing.
2. Install stainless-steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
1. Extend counterflashing 4 inches over base flashing.
2. Lap counterflashing joints a minimum of 4 inches.
3. Secure in a waterproof manner by means of snap-in installation and sealant or interlocking folded seam or blind rivets and sealant unless indicated otherwise.

E. Roof-Penetration Flashing:
1. Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof.
2. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated.
1. Coordinate installation of wall flashing with installation of wall-opening components such as doors and louvers.
2. Coordinate installation of wall flashing with requirements specified in Section 076500 – Flexible Flashings.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.7 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

A. Metal Roof Pipe Boots:
1. Cut collar at factory markings to match pipe diameter.
2. Slide pipe boot flashing unit down over pipe.
3. Apply sealant on underside of flexible base flange.
4. Press flashing base flange into contours of metal roof panel.
5. Fasten to metal roof panel surface using EPDM washers and self-drilling fasteners.

B. Metal Roof Pipe Boots:
1. Cut collar at factory markings to match pipe diameter.
2. Slide pipe boot flashing unit down over pipe.
3. Apply sealant on underside of base flange.
4. Press flashing base flange onto underlayment and under shingles according to manufacturer's recommendations.
5. Fasten to roofing surface using appropriate fasteners and install subsequent shingle squares ensuring coverage of pipe boot flashing base and fasteners.
6. Lap flashing and shingles over pipe boot flanges.

C. Equipment Support Flashing:
1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

D. Overhead-Piping Safety Pans:
1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
2. Pipe and install drain line to plumbing waste or drainage system.

3.8 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.9 REPAIR

A. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

3.10 CLEANING

A. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
   1. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
   2. Clean and neutralize flux materials.
   3. Clean off excess solder.
   4. Clean off excess sealants.

3.11 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Maintain sheet metal flashing and trim in clean condition during construction.

END OF SECTION

SECTION 076500 - FLEXIBLE FLASHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Laminated flexible flashing.
   2. Adhered sheet flexible flashing.
   3. Fluid-applied flexible flashing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E119 by testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 WARRANTY

A. Manufacturer's Product Warranty: To repair or replace weather barrier product that fails in materials within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LAMINATED FLEXIBLE FLASHING

A. Stainless Steel Fabric Flashing (LM.FLSHG-1): Stainless steel core with polymer fabric laminated to bottom face with non-asphaltic adhesive.
   1. Products: Subject to compliance with requirements, provide 1 of the following:
      a. Hohmann & Barnard, Inc.: Mighty-Flash.
      b. PROSOCO, Inc.: R-Guard SS ThruWall.
      c. STS Coatings, Inc.: Wall Guardian Self Adhering Stainless Steel Flashing.
      d. York Manufacturing, Inc.: Multi-Flash SS.
   2. Physical and Performance Properties:
      a. Stainless Steel Sheet: ASTM A240 or ASTM A666, Type 304.
      b. Outer Layers: Polyethylene film or glass-fiber cloth bonded to 1 side of stainless steel sheet.
      c. Recycled Content: Minimum 90 percent.
      d. Fire Resistance: ASTM E84; Class B.
      e. Puncture Resistance: ASTM E154; 780 lbf minimum.
      f. Tensile Strength: ASTM D412; 32,000 psi minimum.
      g. Fungal Resistance: ASTM D3273; passes.

3. Applications:
    a. Through-wall flashing that is fully concealed from view.

B. Aluminum-Faced, Modified Bituminous Transition Membrane (LM.FLSHG-3): UV-resistant, self-adhering, water-resistive membrane consisting of rubberized asphalt laminated to a cross-laminated polyethylene film faced with aluminum foil on exposed face and release liner on adhesive side.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. GCP Applied Technologies Inc.: Perm-A-Barrier Aluminum Flashing.
    b. Henry Company: Blueskin Metal Clad.
    c. Protecto Wrap: Protecto Seal 45.
    d. Soprema: Soprasolin HD.
    e. W.R. Meadows, Inc.: Air-Shield Aluminum Flashing.
    f. Approved substitution.
2. Thickness: 0.040 inch (40 mils).
3. Physical and Performance Properties:
    a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
    b. Tensile Strength: Minimum 250 psi; ASTM D412, Die C.
    c. Ultimate Elongation: Minimum 80 percent; ASTM D412, Die C.
    d. Puncture Resistance: Minimum 40 lbf; ASTM E154.
    e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D570.
    f. Vapor Permeance: Maximum 0.1 perm; ASTM E96, Desiccant Method.
    g. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541 as modified by ABAA.
    h. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
    i. UV Resistance: Can be exposed to sunlight for 360 days according to manufacturer's written instructions.
4. Applications:
    a. Transitions between self-adhering sheet SAAB.VP air and water resistive barrier systems and waterproofing systems.

2.2 ADHERED SHEET FLEXIBLE FLASHING

A. Rubberized-Asphalt Transition Membrane (SA.FLSHG-2): Composite flashing product consisting of a pliable, adhesive, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film:Products: Subject to compliance with requirements, provide 1 of the following:
    a. Henry Company: Blueskin SA.
    b. SIGA Cover Inc.: SIGA Majvest 500 SA.
    c. VaproShield LLC: WrapShield SA.
    d. W. R. Meadows, Inc.: Air-Shield 25 mil Flashing Tape.
    e. York Manufacturing, Inc.: York Seal Flashing.
    f. Approved substitution.
2. Overall Thickness: Not less than 0.040 inch.
3. Accessories:
    a. Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
4. Applications:

a. Interface with self-adhering sheet (SAAB.VP) air and water resistive barrier systems, including at rough openings.

B. Rubberized-Asphalt Thru-Wall Flashing (SA.FLSHG-3): Composite flashing product consisting of a pliable, adhesive, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film:Products: Subject to compliance with requirements, provide 1 of the following:
   a. Heckmann Building Products Inc.: No. 82 Rubberized-Asphalt Thru-Wall Flashing.
   b. Henry Company: Blueskin TWF Self-Adhered Thru-Wall Flashing.
   c. Hohmann & Barnard, Inc.: Textroflash.
   d. Tremco, Inc.: ExoAir TWF Thru-Wall Flashing.
   e. VaproShield LLC: VaproFlashing SA.
   f. W. R. Meadows, Inc.: Air-Shield Thru-Wall Flashing.
   g. Wire-Bond: Aqua Flash 500.
   h. York Manufacturing, Inc.: York Seal Flashing.
   i. Approved substitution.
2. Overall Thickness: Not less than 0.040 inch.
3. Applications:
   a. Embedded through-wall flashing in unit masonry and in masonry veneer.
   b. Do not use copper flashing where flashing is partly exposed.

C. Self-Adhering, High Temperature Flashing (SA.FLSHG-6): Sheet flashing made from slip-resistant, polyethylene-film top surface laminated to a layer of SBS-modified asphalt adhesive, with release-paper backing.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coatings & Waterproofing Inc.: WIP 300HT.CertainTeed Corporation: WinterGuard HT.
   c. GCP Applied Technologies Inc.: Grace Ice and Water Shield HT.Henry Company: Blueskin PE200 HT.Approved substitution.
2. Physical Properties:
   a. Thickness: Minimum of 40 mils.
   b. Service Temperature: Minimum 230 deg F.
   c. Thermal Stability: ASTM D1970, stable after testing at 240 deg F.
   d. Low-Temperature Flexibility: ASTM D1970; passes after testing at minus 20 deg F.
   e. Vapor Permeance: 0.01 perms; ASTM E96.
   f. Allowable UV Exposure Time: Not less than 180 days.
3. Provide primer when recommended by underlayment manufacturer.
4. Applications: Flashing under sheet metal copings.

2.3 FLUID-APPLIED FLASHING

A. Elastomeric Flashing (FA.FLSHG-1): Roller-applied, single-component, silyl-terminated- polymer (STP) flashing material.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coatings & Waterproofing, Inc.: Barribond.
   b. DuPont de Nemours, Inc.: Tyvek Fluid Applied Flashing & Joint Compound+.Henry Company: Air-Bloc LF Liquid-Applied Flashing.
   d. Master Wall Inc.: SuperiorShield SuperiorFlash.Pecora Corporation: XL-Flash.
   f. PROSOCO, Inc.: R-Guard FastFlash.
   g. Soprema, Inc.: Sopraseal Liquid Flashing.
   h. VaproShield LLC: VaproLiqui-Flash.
   i. W.R. Meadows, Inc.: Air-Shield Liquid Flashing.

2. Performance Criteria:
   a. VOC Content: Maximum 30 g/L.
   b. Solids Content by Volume: 95 percent.
   c. Minimum Thickness: Minimum 15 mils but not less than manufacturer's recommended thickness.
   d. Tensile Strength: ASTM D412; minimum 100 psi.
   e. Elongation: ASTM D412; minimum 150 percent.
   f. Shore A Hardness: Tested according to the following:
      1) ASTM D2240: Minimum 35.
      2) ASTM C661; minimum 30.
   g. Water-Vapor Permeance: ASTM E96, Procedure B; Water Method, minimum 9 perms at 12 mil thickness.
   h. UV Resistance: Can be exposed to sunlight for a minimum of 180 days according to manufacturer's written instructions.
3. Applications:
   a. Interface with air and water resistive barrier systems, including at rough openings.

2.4 ACCESSORIES

A. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

B. Joint Reinforcing Strip: Manufacturer's recommended woven polyester or fiberglass mesh.
   1. Minimum Thickness: 30 mils.

C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F1667.

PART 3 - EXECUTION

3.1 INSTALLATION OF FLEXIBLE FLASHING

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
   1. Prime substrates as recommended by flashing manufacturer.
   2. Lap seams and junctures with other materials at least 8 inches except that at flashing flanges of other construction, laps need not exceed flange width.
   3. Lap flashing over water-resistive barrier at bottom and sides of openings.
   4. Lap water-resistive barrier over flashing at heads of openings.
   5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION

SECTION 078100 - APPLIED FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sprayed fire-resistive materials (SFRM).

1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate application of sprayed fire-resistive material with placement of clips, hangers, supports, sleeves, and other items required to penetrate sprayed fire-resistive material.
   2. Coordinate placement of ducts, piping, equipment, and other items that would interfere with application of sprayed fire-resistive material.

B. Preinstallation Meetings: Conduct meeting at Project site.
   1. Meeting Time: Schedule meeting a minimum of 2 weeks prior to beginning Work of this Section and related Work.
   2. Agenda:
      a. Review products, design ratings, thicknesses, bond strengths, and other performance requirements.
      b. Review applied fire protection systems and examine procedures for ensuring quality of installed systems.
      c. Review inspection and testing and inspecting agency procedures for field quality control, and installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
   1. Extent of fire protection for each construction and fire-resistance rating.
   2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum sprayed fire-resistive material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
   4. Treatment of sprayed fire-resistive material after application.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of sprayed fire-resistive material.

C. Evaluation Reports: For sprayed fire-resistive material, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm with a minimum of 3 years of experience in installing applied fireproofing similar in material, design, and extent to that indicated for this Project, with a minimum of 5 projects in which work has resulted in construction with a record of successful performance, in addition to having the following:
   1. Necessary experience, staff, and training to install manufacturer's products according to specified requirements.
   2. An established management system for applied fireproofing and trained supervisor to maintain oversight of applied fireproofing installation.
   3. Certified by specified applied fireproofing manufacturers.
   4. Certified by third party attesting to its ability to select and install applied fireproofing in accordance with Performance Criteria.

B. Mockups: Comply with Section 014339 – Mockups.
   1. Build mockup of each type of fire protection and different substrate and each required finish as specified below or as indicated on Drawings.
   2. Build mockup of exposed column condition using skip-troweled finish with corner beads to represent smooth texture and square corners and edges required for completed Work.
   3. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire protection for each fire-resistance design from single source.

2.2 PERFORMANCE CRITERIA

A. Assemblies: Provide fire protection, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Fire-Resistance Design: Indicated on Drawings, tested according to UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. For field applications, verify coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 50 g/L.
   3. Primers, Sealers, and Undercoaters: 100 g/L.
   4. Verify materials comply with testing and product requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Asbestos: Provide products containing no detectable asbestos.

2.3 SPRAYED FIRE-RESISTIVE MATERIALS

A. Sprayed Fire-Resistive Material, Commercial (Standard) Density: Manufacturer's standard gypsum-based, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. GCP Applied Technologies Inc.: Monokote MK-6 HY.
      b. Isolatek International Inc.: Cafco 300 Series
      c. Southwest Fireproofing Products Co.: Type 5GP
   2. Bond Strength: ASTM E736; minimum 150 lbf/sq. ft. cohesive and adhesive strength.
   3. Density: ASTM E605; 15 lbf/cu. ft., but not less than density specified in approved fire-resistance design.
   4. Compressive Strength: ASTM E761; minimum 10 lbf/sq. in.
   5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch.
   6. Combustion Characteristics: ASTM E136; non-combustible.
   7. Surface-Burning Characteristics: Comply with ASTM E84; testing by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 10 or less.
      b. Smoke-Developed Index: 10 or less.
   8. Corrosion Resistance: ASTM E937; no evidence of corrosion.
   9. Deflection: ASTM E759; no cracking, spalling, or delamination.
   10. Effect of Impact on Bonding: ASTM E760; no cracking, spalling, or delamination.
   11. Air Erosion: ASTM E859; maximum weight loss of 0.025 g/sq. ft. in 24 hours.
   12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in one of the following:
      a. ASTM G21: No growth on specimens
      b. ASTM D3274: Rating of 10 when tested according to ASTM D3273.
   13. Finish: Spray-textured finish.
   14. Application: Surfaces concealed from view behind other construction in completed Work, have not been defined as exposed, and are not indicated for application of medium density or high density sprayed fire-resistive material.

2.4 AUXILIARY MATERIALS

A. Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:
   1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Fire Resistance Directory" or in listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E736.

C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

E. Corner Beads: Plastic, nose-type corner bead designed for use with specified sprayed fire-resistive materials.

F. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.

G. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of Work and according to each fire-resistance design.
   1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
   2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

B. Verify that concrete Work on steel deck is complete before beginning Work.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related Work are complete before beginning Work.

D. Conduct tests according to sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other Work subject to damage from fallout or overspray of fire protection materials during application.

B. Clean substrates of substances that could impair bond of fire protection.

C. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers**, sealers, topcoats**, finishing, and other materials and procedures affecting fire protection Work.

B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
   1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.

D. Metal Decks:
   1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
   2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.

F. Spray apply fire protection to maximum extent possible. After spraying operation in each area, complete coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

G. Extend fire protection in full thickness over entire area of each substrate to be protected.

H. Install body of fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.

I. [For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fire protection that differs in color from that of encapsulant over which it is applied.]

J. [Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.]

K. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.

L. Cure fire protection according to sprayed fire-resistive material manufacturer's written instructions.

M. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fire protection to produce the following finishes:
1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
4. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out texture, eliminate surface markings, and square off edges.
    a. At exposed columns, finish sprayed fire-resistive material at corner beads to resemble finished cast-in-place concrete.

3.4 REPAIRS

A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to Work of other trades.

B. Repair fire protection damaged by other Work before concealing it with other construction.

C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials" or as indicated on Schedule of Special Inspections.

B. Perform tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fire protection will be considered defective if it does not pass tests and inspections.
1. Remove and replace fire protection that does not pass tests and inspections, and retest.
2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.6 CLEANING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.7 PROTECTION

A. Protect fire protection, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silicone joint sealants
2. Silane-modified polymer joint sealants
3. Butyl joint sealants.
4. Joint sealant backing.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct meeting at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2 in. wide joints formed between two 6 in. long strips of material matching appearance of exposed surfaces adjacent to joint sealants.

C. Joint Sealant Schedule: Include the following joint sealant information:
1. Applications listing proposed joint sealants and materials to which joint sealants are specified to be applied.
2. Locations, including textured sealants.
3. Designations.
4. Manufacturer and product names.
5. Formulations.
6. Colors.
7. Obtain Architect’s written approval of joint sealant schedule before starting Work of this Section.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by qualified testing agency. Include the following information for each joint sealant and substrate material to be tested:
1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

B. Preconstruction Laboratory Test Reports: From sealant manufacturer for each joint sealant and substrate material, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

E. Sample warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers who are trained and approved by sealant manufacturer with a minimum of 5 years of documented experience performing work similar in scale and scope to this Project.
   1. Single Source Responsibility: Provide field-installation of exterior joint sealers specified in this Section under responsibility of a single installer.

B. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct testing indicated.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Comply with Section 014339 – Mockups.
   1. Install sealants in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
   2. Conduct mockups of joint sealing systems specified in this Section as part of system mockups as specified by related Sections for purpose of verifying visual appearance, water and air infiltration testing, conducting pull tests to determine correct use of cleaning and primers, and to aid in determining general adequacy of system design.
   3. Include concrete systems, wall cladding, roofing and waterproofing systems, and window systems.
   4. Include system components including backing materials and bond breakers.
   5. Verify need for primers and other preinstallation preparation for each surface.
   6. Inspect mockups after 14 days and perform pull test under supervision of manufacturer’s representative to determine suitability and primer requirements.
   7. Adjust as needed for acceptance conforming to manufacturer’s instructions and provisions of Contract Documents.
   8. Protect accepted mockup as quality standard for Work of this Section.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.

3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying Work.
5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect 7 days in advance of dates and times when test joints will be erected.
4. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
5. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
6. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
    a. Test Method: Test joint sealants per Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
        1) For joints with dissimilar substrates, verify adhesion to each substrate separately: extend cut along 1 side, verifying adhesion to opposite side. Repeat procedure for opposite side.
7. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
8. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory.
    a. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements.
    b. Retest failed applications until test results prove sealants comply with indicated requirements

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. Ambient and substrate temperature conditions are 40 deg F or outside limits permitted by joint-sealant manufacturer.
2. Joint widths are less than those recommended by joint-sealant manufacturer for applications indicated.
3. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
4. Joint substrates are wet.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of structure caused by stresses on sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
   1. Verify sealants and primers for architectural and nonporous substrates have a VOC content of 250 g/L or less.
   2. Verify building concentration of formaldehyde does not exceed 1/2 of indoor recommended exposure limit, or 33 mcg/cu. m, and acetaldehyde concentration does not exceed 9 mcg/cu. m.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
   1. Where color is indicated to “match adjacent substrates” or “match existing,” provide either manufacturer’s standard color if matching color is available, or, if not available, provide field-tintable custom color.

2.2 URETHANE JOINT SEALANTS

A. Urethane (SLNT.U1): Single-component, nonsag, nontraffic-use, urethane joint sealant.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Adfast: Adthane 1800 series.Holcim Solutions and Products US, LLC: Permathane SM7120.Master Builders Solutions: MasterSeal NP 1.
      d. Pecora Corporation: Dynatrol I-XL.Sika Corporation: Sikaflex 1a.
      f. Tremco Incorporated: Dymonic 100.W. R. Meadows, Inc.: Pourthane NS.
      h. Approved substitution.
   2. Compliance: ASTM C920, Type S, Grade NS, Class 25/35/50, Use NT, G, M, A, and O.

2.3 SILANE-MODIFIED POLYMER JOINT SEALANTS

A. Silane-Modified Polymer, Mildew Resistant (SLNT.STP1): Single-component, mildew-resistant, nonsag, nontraffic-use, silyl-terminated polymer or silyl-terminated polyurethane joint sealant, formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Adfast: Adseal DWSP 1940 Series.Holcim Solutions and Products US, LLC: Permathane SM7713 MS.Holcim Solutions and Products US, LLC: ERSystems

2100 MS Adhesive Sealant.Master Builders Solutions: MasterSeal NP 150 or MasterSeal NP 100Pecora Corporation: DynaTrol I-XL Hybrid.Sherwin-Williams Company (The): Loxon H1.Sika Corporation: SikaHyflex-150LM.Approved substitution.

2. Compliance: ASTM C920, Type S, Grade NS, Class 50, Use NT.
3. Certified USDA or NSF approved.
4. Color: Translucent unless indicated otherwise.

B. Silane-Modified Polymer (SLNT.STP2): Single-component, nonsag, nontraffic-use, silyl-terminated polymer or silyl-terminated polyurethane joint sealant.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing Inc.: BarriBond.
      b. Henry Company: 925 BES Sealant.Novagard Solutions, Inc.: NovaBond Hybrid Construction Sealant.
      d. Sto Corp: StoGuard RapidSeal.
      e. TK Products Construction Coatings: Super Seal PE.Tremco Incorporated: Dymonic FC.Approved substitution.
   2. Compliance: ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.4 BUTYL JOINT SEALANTS

A. Butyl Joint Sealant: Single-component, synthetic or rubber based, nonhardening, nonskinning, non-drying, nonmigrating, solvent-release butyl sealant for joints with limited movement.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ADCO Products, Inc.: BP-300 Non-Skinning Butyl Sealant.
      b. Everkem Diversified Products: Rubber Guard-NS.
      c. H.B. Fuller Company: Foster ElastiSeal Butyl Rubber Sealant 95-88.
      d. Holcim Solutions and Products US, LLC: Acryl-R SM5430.
      e. Pecora Corporation: BC-98.
      f. Premier Building Solutions: XtraBond 1500NS.
      g. Sika Corporation: SikaLastomer-511. Tremco Incorporated: Trempro JS-773+.
      i. Approved substitution.
   2. Compliance: ASTM C1311, Class 12-1/2.
   3. Performance Requirements:
      a. Movement Capability: Plus/minus 12-1/2 percent.
      b. Service Temperature Range: 13 to 180 deg F.
   4. Color: Black.

2.5 TEXTURED SEALANTS

A. Urethane, Textured (SLNT.TX1): Single-component, nonsag, nontraffic-use, textured joint sealant.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Master Builders Solutions: MasterSeal TX 1.
      b. Pecora Corporation: 890FST-TXTR or DynaTrol I-XL Hybrid.
      c. Sherwin-Williams Company (The): Loxon TX.Sika Corporation: Sikaflex Textured Sealant.Tremco Incorporated: Vulkem 116.Approved substitution.
   2. Compliance: ASTM C920, Type S, Grade NS, Class 25 or 50, Use NT, G, M, A, and O.
   3. Movement Capability: Plus/minus 25 percent.
   4. Color: Match adjacent finish color.

2.6 SECURITY SEALANTS

A. Epoxy Security Sealant (SLNT.DTN1): Multicomponent, 100 percent solids, nonsag, tamper-proof sealant for joints with no movement.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ChemCo Systems, Inc.: CCS Bonder 217 Security Seal.
      b. Euclid Chemical Co.: Dural 452 Gel Epoxy.
      c. Master Builders Solutions: MasterEmaco ADH 327.
      d. Pecora Corporation: DynaPoxy EP-1200.Sika Corporation: Sikadur 31, Hi-Mod Gel.Approved substitution.
   2. Compliance: ASTM C881. Types I and IV, Grade 3.
   3. Performance Requirements:
      a. Compressive Strength: ASTM C695; 11,000 psi minimum.
      b. Shore D Hardness: ASTM C661; minimum 70.
      c. Tensile Strength: ASTM C638; 3,000 psi.
      d. Bond Strength: ASTM C882; 1,500 psi minimum.
   4. Volatile Organic Compound (VOC) Content: 100 g/L maximum.
   5. Color: Gray.

2.7 JOINT-SEALANT BACKING

A. Joint Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; as approved in writing by joint-sealant manufacturer, for joint applications indicated based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330; any of the following types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
   1. Type B (Bicellular Material with Surface Skin):
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Armacell LLC: FillPro Soft Type Backer Rod. Backer Rod Manufacturing Inc.: Titan Foam.
         3) Nomaco Engineered Foam Solutions: SOF Rod Bi-Cellular Backer Rod.
         4) Approved substitution.
      b. Applications: Interior and exterior joints subject to pedestrian or vehicular traffic, isolation and contraction joints, window glazing, curtain walls, perimeter of window, door, louver, and other metal frames.
   2. Type C (Closed-Cell Material with Surface Skin):
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Armacell LLC: FillPro Standard Backer Rod. Backer Rod Manufacturing Inc.: Mile High Foam.
         3) Nomaco Engineered Foam Solutions: HBR Closed Cell Backer Rod.
         4) W. R. Meadows, Inc.: Kool-Rod.
         5) Approved substitution.
      b. Applications: Exterior joints subject to pedestrian or vehicular traffic, isolation and contraction joints, window glazing, curtain walls, precast concrete, pavement, parking decks, and metal copings.
   3. Type O (Open-Cell Material):
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Armacell LLC: FillPro Open Cell Backer Rod. Backer Rod Manufacturing Inc.: Denver Foam.

3) Nomaco Engineered Foam Solutions: OCFoam Open-Cell Backer Rod.
4) Approved substitution.

b. Application: Interior and exterior vertical surfaces. Do not use on horizontal surfaces. Not immersible.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), existing joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
   a. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
   a. Nonporous joint substrates include the following:
      1) Metal.

B. Joint Priming:
1. Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
2. Apply primer to comply with joint-sealant manufacturer's written instructions.
3. Confine primers to areas of joint sealant bond: do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape:
1. Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears.
2. Remove tape immediately after tooling without disturbing joint seal.

3.3 JOINT SEALANT APPLICATIONS, GENERAL

A. Exterior Joints:
1. Seal open joints, whether or not the joint is indicated on Drawings, unless specifically indicated not to be sealed.
2. Exterior joints to be sealed include the following items.
   a. Wall expansion and control joints.
   b. Joints between door, window, and other frames and adjacent construction.
   c. Joints between different exposed materials.
   d. Openings below ledge angles in masonry.
   e. Other joints indicated below.

B. Interior Joints:
1. Do not seal interior joints unless specifically indicated to be sealed.
2. Interior joints to be sealed include the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. Other joints indicated below.

C. Excluded Joints: Do not seal the following types of joints.
1. Intentional weepholes in masonry.
2. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
3. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
4. Joints where installation of sealant is specified in another Section.
5. Joints between suspended panel ceilings/grid and walls unless indicated otherwise.

3.4 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Install sealant backings at joint widths of 1/2 in. or more, and joint depths of 3/4 in. or more.

2. Install sealant backings so that joint depth does not exceed 50 percent of joint width, unless otherwise recommended by sealant manufacturer.
3. Do not leave gaps between ends of sealant backings.
4. Do not stretch, twist, puncture, or tear sealant backings.
5. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants per requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated. Provide joint profile to match existing.

3.5 REPAIR

A. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints.

B. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

3.6 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Owner will engage qualified testing agency to field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
   a. Perform 10 tests for the first 1,000 feet of joint length for each kind of sealant and joint substrate.
   b. Perform 1 test for each 1,000 feet of joint length thereafter or 1 test per each floor per elevation.
2. Test Method: Test joint sealants per Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
   a. For joints with dissimilar substrates, verify adhesion to each substrate separately: extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.

c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

B. Evaluation of Field-Adhesion Test Results:
1. Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory.
2. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements.
3. Retest failed applications until test results prove sealants comply with indicated requirements.

C. Prepare test and inspection reports.

3.7 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.8 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances.

B. Protect joint sealants from damage resulting from construction operations or other causes.

C. Ensure joint sealants are without deterioration or damage at time of Substantial Completion.
1. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants promptly so installations with repaired areas are indistinguishable from original Work.

3.9 EXTERIOR JOINT-SEALANT SCHEDULE

A. Exterior joints in vertical surfaces and horizontal, nontraffic surfaces:
1. Joint-Sealant
a. Joints between concrete and adjacent surfaces.
b. Perimeter joints between hollow metal frames and adjacent surfaces.
c. Perimeter joints between aluminum frames and adjacent surfaces.
d. Doors and adjacent surfaces.
e. Joints between metal panels and between metal panels and adjacent surfaces.
f. Sheet metal flashing with movable, nonexpansion-type joints.
g. Contraction, isolation, and soft joints in the following materials, and where the following materials abut adjacent surfaces:
1) Cast-in-place concrete.
h. Other exterior non-traffic joints for which no other sealant type is Indicated.
2. Joint-Sealant SLNT.S1.
a. Other joints as indicated Drawings.

B. Exterior joints in horizontal traffic surfaces:

1. Joint-Sealant SLNT.U3.
2. Applications: Contraction, isolation, and soft joints in the following materials, and where the following materials abut adjacent surfaces:
   a. Cast-in-place concrete slabs.
   b. Concrete paving.
   c. Concrete sidewalks at building perimeter.
   d. Other concrete joints as indicated on Drawings.

C. Exterior Concealed Sealants:
1. Joint-Sealant
   a. Sealing of air barriers and weather-restive barriers.

D. Exterior Concealed Mastics:
1. Joint-Sealant
   a. Sheet metal flashing, metal Work, and other joints requiring minimal movement.
   b. Sealing of roof drains.
   c. Sealing seams of various sheet membranes and roofing where indicated.
   d. Bedding sealant for thresholds.
   e. Other locations indicated on Drawings where little or no movement is expected.

3.10 INTERIOR JOINT-SEALANT SCHEDULE

A. Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement:
1. Joint-Sealant
   a. Control joints in interior gypsum board walls and ceilings.
   b. Joints where interior gypsum board abuts adjacent surfaces.
   c. Perimeter of countertops at walls not subject to moisture.
   d. Perimeter joints between interior wall surfaces and hollow metal frames.
   e. Perimeter joints between interior wall surfaces and aluminum frames.
   f. Perimeter joints between interior wall surfaces and jambs of interior doors and windows.
   g. Perimeter joints between metal pipe shrouds and adjacent surfaces in interior walls.
   h. Perimeter joints between interior wall surfaces and mirror frame filler.
   i. Other joints as indicated on Drawings for which no other sealant type is Indicated.
2. Joint-Sealant
   a. Other joints as indicated Drawings.

B. Interior joints in horizontal traffic surfaces:
1. Joint-Sealant
   a. Isolation joints in cast-in-place concrete slabs.
   b. Other joints as indicated on Drawings.

C. Interior mildew-resistant joints in vertical surfaces and horizontal, nontraffic surfaces:
1. Joint-Sealant SLNT.S3 or SLNT.STP1.
   a. Perimeter joints between plumbing fixtures and adjoining walls, floors, and counters, including countertops, vanities, tubs, showers, and other locations subject to moisture.

D. Interior concealed sealants.
1. Joint-Sealant SLNT.STP2.
   a. Adhering vapor retarder to metal studs.

E. Acoustical Sealants:
   1. Joint-Sealant SLNT.AL2 as specified in Section 079219.

END OF SECTION

SECTION 079513 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior expansion joint cover assemblies.
   2. Interior expansion joint cover assemblies for walls

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Shop Drawings: For each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other Work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples for Verification: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

D. Expansion Joint Cover Assembly Schedule: Prepared by or under supervision of supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion control system.
   2. Expansion control system location cross-referenced to Drawings.
   3. Nominal joint width.
   4. Movement capability.
   5. Classification as thermal.
   6. Materials, colors, and finishes.
   7. Product options.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 QUALITY ASSURANCE

A. Mockups: Comply with Section 014339 – Mockups.
   1. Build mockup of typical exterior expansion joint cover assemblies at locations where directed by Architect.
   2. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE CRITERIA

A. Seismic Performance: Expansion joint cover assemblies shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

B. Expansion Joint Design Criteria:
1. Expansion Joint Cover Assembly Movement: Provide expansion joint assemblies with minimum 50 percent plus and minus movement, with minimum 2 inch total expansion and contraction, regardless of expansion joint type and model specified.
2. Expansion Joint Cover Assembly Movement: Provide expansion joint assemblies that meet the following movement requirements:
   a. Exterior Conditions:
      1) Joint Movement: As indicated on Drawings.
      2) Nominal Joint Width: As indicated on Drawings
      3) Movement: Plus/minus 50 percent.
   b. Interior Conditions:
      1) Joint Movement: As indicated on Drawings.
      2) Nominal Joint Width: As indicated on Drawings
      3) Movement: Plus/minus 50 percent.
3. Type of Movement: Seismic.
4. Floor-Mounted Expansion Joint Cover Assembly Load Capacity:
   a. Uniform Load: 50 lb/sq. ft.
   b. Concentrated Load: 300 lb.
   c. Maximum Deflection: 0.0625 inch.

C. Accessibility Standards:
1. Comply with applicable provisions in DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide specified products or comparable products by one of the following:
1. Balco, Inc.
2. Construction Specialties, Inc.
3. JointMaster, a Division of Inpro Corporation.
4. MM Systems Corporation.
5. Nystrom, Inc.
6. Watson Bowman Acme Corp.

B. Source Limitations: Obtain expansion joint control systems from single source from single manufacturer.

2.4 EXTERIOR EXPANSION CONTROL ASSEMBLIES

A. Exterior Metal-Plate Joint Cover: Assembly consisting of sliding metal cover plate in continuous contact with gaskets mounted on metal frames fixed to sides of joint gap.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
2. Balco, Inc.: 9WC-6.
3. Approved substitution.
4. Application: Wall to Roof.
5. Joint Size: 6 inches.
6. Installation: Surface-mounted.
7. Centering Devices: Centering bars.
8. Fire-Resistance Rating: Not less than that of adjacent construction.
9. Exposed Metal: Aluminum, paint to match adjacent metal wall or roof panels.
10. Seal: ASTM D4637; preformed elastomeric membrane or extrusion.
    a. Thickness: 0.045 inch minimum.
    b. Color: Black.

B. Exterior Metal-Plate Joint Cover: Assembly consisting of sliding metal cover plate in continuous contact with gaskets mounted on metal frames fixed to sides of joint gap.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
2. Balco, Inc.: 9W-6.
3. Approved substitution.
4. Application: Wall to Wall.
5. Joint Size: 6 inches.
6. Installation: Surface-mounted.
7. Centering Devices: Centering bars.
8. Fire-Resistance Rating: Not less than that of adjacent construction.
9. Exposed Metal: Aluminum, paint to match adjacent metal wall or roof panels.
10. Seal: ASTM D4637; preformed elastomeric membrane or extrusion.
    a. Thickness: 0.045 inch minimum.
    b. Color: Black.

C. Elastomeric-Seal Wall Joint Cover (Type-1): Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap. System includes manufacturer's standard secondary water barrier.
1. Basis-of-Design Product: Subject to compliance with requirements, provide FCVS – Flush Wall by Balco, Inc., or approved substitution from one of the following:
    a. Construction Specialties, Inc.
    b. InPro Corporation (IPC).
    c. MM Systems Corporation.
    d. Nystrom, Inc.
    e. Watson Bowman Acme Corp.
    f. Approved substitutions.
2. Application: Wall to wall
3. Installation: Recessed
4. Fire-Resistance Rating: Not less than that of adjacent construction unless indicated otherwise on Drawings
5. Exposed Metal:
    a. Aluminum: Manufacturer's standard
        1) Color: As selected by Architect from full range of industry colors and color densities.
    b. Stainless steel: Manufacturer's standard

6. Seal: Preformed elastomeric membrane or extrusion.
7. Color: Black or as selected by Architect from manufacturer's full range.

D. Elastomeric-Seal Wall Joint Cover (Type-2): Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap. System includes manufacturer's standard secondary water barrier.
1. Basis-of-Design Product: Subject to compliance with requirements, provide FCWWE – Flush Wall by Balco, Inc., or approved substitution from one of the following:
   a. Construction Specialties, Inc.
   b. InPro Corporation (IPC).
   c. MM Systems Corporation.
   d. Nystrom, Inc.
   e. Watson Bowman Acme Corp.
   f. Approved substitutions.
2. Application: Wall to wall
3. Installation: Recessed
4. Fire-Resistance Rating: Not less than that of adjacent construction unless indicated otherwise on Drawings
5. Exposed Metal:
   a. Aluminum: Manufacturer's standard
      1) Color: As selected by Architect from full range of industry colors and color densities.
   b. Stainless steel: Manufacturer's standard
6. Seal: Preformed elastomeric membrane or extrusion.
7. Color: Black or as selected by Architect from manufacturer's full range.

E. Horizontal and Vertical Insulated Vapor Barrier: Assembly consist of fiber reinforced EPDM membranes sandwiching commercial grade insulation adhered and pinned together.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   a. Inpro: JL Series
   b. Approved substitution.
2. Application: Wall to Wall.
3. Movement Rating: Plus/minus 50 percent.
4. Thermal Value: Min. R Value of 15 2. Must meet ASTM E1399 Cyclic movement requirements matching movement requirements specific to project.

2.5 INTERIOR EXPANSION CONTROL ASSEMBLIES

A. Center-Plate Wall Joint Cover: Assembly consisting of center plate that slides over metal frames fixed to sides of joint gaps.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
2. MM Systems Corporation: FX-K-2.1 Stud.
3. Approved substitution.
4. Application: Wall to corner.
5. Installation: Surface mounted.
6. Fire-Resistance Rating: Not less than that of adjacent construction.
7. Cover-Plate Design: Plain.
8. Exposed Metal: Aluminum, mill finish.

B. Metal-Plate Ceiling Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

2. MM Systems Corporation: ASCL-6-4 Stud.
3. Approved substitution.
4. Application: Wall to ceiling.
5. Installation: Surface mounted.
6. Fire-Resistance Rating: Not less than that of adjacent construction.
7. Cover-Plate Design: Plain.
8. Exposed Metal: Aluminum, mill finish.

2.6 MATERIALS

A. Aluminum:
1. Extrusions: ASTM B221, Alloy 6063-T5.
2. Sheet and Plate: ASTM B209, Alloy 6061-T6.
3. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A240 or ASTM A666, Type 304 for plates, sheet, and strips.

C. Elastomeric Strip Seals: ASTM E1783; assembly consisting of manufacturer's standard preformed elastomeric seal mechanically locked into a metal frame or edge rails cast into slab edges.

D. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107; factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and 30 minute working time.

2.7 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

2.8 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

2.9 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard flexible, continuous, elastomeric waterproof membrane within joint and attached to substrate on sides of joint.
1. Provide where indicated on Drawings.

B. Manufacturer's stainless-steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
   1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
   2. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.
   3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
   5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches on center.

C. Elastomeric Strip Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
   1. Provide in continuous lengths for straight sections.
   2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
   3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated Work so complete assemblies comply with performance requirements.
   1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.

3.4 FIELD QUALITY CONTROL

A. Engage manufacturer’s representative to perform preliminary evaluation, provide intermittent technical field support, and perform final inspection to ensure compliance to manufacturer’s instructions and Contract Documents.

B. Testing: Perform water tests at exterior expansion joint cover assemblies to verify weather tightness.

3.5 ADJUSTING

A. Adjust joint covers as necessary to accommodate joint movement.

B. Repair or replace Work not conforming to specified requirements.

3.6 CLEANING

A. Leave installation clean, free from debris and residue from Work of this Section.

3.7 PROTECTION

A. Do not remove protective covering until finish Work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect installations from damage by Work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior standard steel doors and frames.
   2. Exterior standard steel doors and frames.
   3. Borrowed lites.

B. Related Requirements:
   1. Section 088000 – Glazing.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
   2. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

B. Preinstallation Meeting: Conduct meeting at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door and frame type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of the following:
      a. Each different wall opening condition.
      b. Electrical raceway and preparation for electrified hardware, access control systems, and security systems.
      c. Anchorages, joints, field splices, and connections.
      d. Accessories.
      e. Moldings, removable stops, and glazing.
      f. Rough opening requirements.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.
   1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
   2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
   3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly, fire-rated borrowed-lite assembly, and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
   1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
   1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with 2 removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Standard Steel Doors and Frames:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Baron Metal Industries, Inc. ; an Assa Abloy Group company. Ceco Door Products; an Assa Abloy Group company. Curries Company; an Assa Abloy Group company. Pioneer Industries, Inc. Steelcraft; an Allegion Brand. Approved substitution.

B. Source Limitations:
   1. Obtain hollow-metal Work from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with R-Value of not less than 2.53 when tested according to ASTM C1363.
   1. Door Thermal Resistance: R-Value of 0.39 or less.
   2. Glazed Doors: R-value of 1.67.
   3. Solid Doors: R-value of 2.71.

2.3 STANDARD STEEL DOORS AND FRAMES, GENERAL

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, clearances, and as specified.

B. Provide hollow-metal door and frame types at locations indicated in Door Schedule.

2.4 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B.
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.
      c. Face: Uncoated steel sheet, minimum 0.042 inch thick.
      d. Edge Construction: Model 2, Seamless.
      e. Edge Bevel: Provide manufacturer's standard beveled edges.
      f. Core: Vertical steel-stiffeners.
      g. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.
   2. Frames:
      a. Material: Uncoated steel sheet, minimum 0.053 inch thick.
      b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
      c. Construction: Face welded.
   3. Exposed Finish: Prime.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A.
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.
      c. Face: Uncoated steel sheet, minimum 0.053 inch thick.
      d. Edge Construction: Model 2, Seamless.
      e. Edge Bevel: Provide manufacturer's standard beveled edges.
      f. Core: Vertical steel-stiffeners.
      g. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.
   2. Frames:

a. Material: Uncoated steel sheet, minimum 0.067 inch thick.
b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Face welded.

3. Exposed Finish: Prime.

C. Frames for Interior Wood Doors: SDI A250.8, Level 3; SDI A250.4, Level A.
1. Materials: Uncoated steel sheet, minimum 0.053 inch thick.
2. Construction: Face welded.
3. Exposed Finish: Prime.

2.5 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A.
1. Doors:
a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum 0.053 inch thick, with minimum A60 coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets.
h. Core: Vertical steel-stiffeners and polyurethane insulation.
i. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.
2. Frames: Flush-mount-type with punch and dimple anchors bolt holes at anchor points.
a. Material: Metallic-coated steel sheet, minimum 0.067 inch thick, with minimum A60 coating.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Face welded.
3. Exposed Finish: Prime.

2.6 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.067 inch

B. Construction: Face welded.

C. Fabricate in 1 piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.7 FRAME ANCHORS

A. Jamb Anchors: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
1. Types:
a. Stud Wall Type: Not less than 0.042 inch thick steel sheet, designed to engage stud.

b. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

2. Quantity: Minimum of 3 anchors per jamb, with 1 additional anchor for frames with no floor anchor. Provide 1 additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8 inch diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors:
1. Provide floor anchors for each jamb and mullion that extends to floor.
2. Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2 inch height adjustment.
a. Terminate bottom of frames at top of underlayment.

C. Material: ASTM A879, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011; hot-dip galvanized according to ASTM A153, Class B.

2.8 AUXILIARY ITEMS

A. Tube-Steel Removable Mullions: Frame manufacturer's standard with malleable-iron top and bottom retainers, and prepared for strikes as follows unless indicated otherwise:
1. Strikes: 2 standard recessed strikes.

B. Fire-Exit Removable Mullions: Removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing in accordance with UL 305 and NFPA 252. Use mullions only with exit devices for which they have been tested.

2.9 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A653, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Foamed-in-Place Insulation: Manufacturer's standard, closed cell, spray-applied polyurethane type.

H. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool.
1. Surface Burning Characteristics: Passes when tested according to ASTM E136 for combustion characteristics
a. Flame Spread: 25.
b. Smoke Developed: 50.

I. Glazing: Comply with requirements in Section 088000 – Glazing and Section 088856 – Security Glazing.

J. Metal Patching Compound: Metal-filled, 2-component epoxy putty designed for use on various metal substrates.

2.10 FABRICATION

A. Fabricate hollow-metal Work to be rigid and free of defects, warp, or buckle.
1. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness.
2. Where practical, fit and assemble units in manufacturer's plant.
3. To ensure proper assembly at Project site, clearly identify Work that cannot be permanently factory assembled before shipment.

B. Provide doors and frames receiving electrified hardware with 1/2 inch flexible steel conduit, including sufficient number of conductor wires, to accommodate electric function specified; connectors, and cover box installed at each location electrified hardware is specified.
1. Properly coordinate installation of mechanical hardware and hook-up of electrified function with company that is licensed by Washington Electricity Board to prevent voiding of manufacturer's warranty and labeling of opening.

C. Hollow Metal Doors:
1. Cores, Interior Doors: 0.042 inch thick vertical steel-stiffener welded in-place at 6 inches on center.
2. Cores, Exterior and Insulated Doors: 0.042 inch thick vertical steel-stiffener welded in-place at 6 inches on center; filled with manufacturer's standard foamed-in-place polyurethane; faces chemically bonded to face sheets.
3. Reinforcement: 1-piece steel channels continuously welded full length to face sheets.
    a. Lock Channel: 0.067 inch thick steel, beveled 1/8 inch in 2 inch.
    b. Hinge Channel: 0.093 inch thick steel, formed and tapered for hinges.
    c. Top and Bottom Channels: 0.053 inch thick steel with flush channel filler cap to close top rail opening.
        1) Snap in caps are not accepted.
        2) Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
    d. Closer Reinforcement Channel: 0.067 inch thick steel.
4. Kraft paper honeycomb cores are not acceptable.

D. Hollow-Metal Frames: Fabricate in 1 piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Provide frames with 1/8 inch integral kerf formed into frame soffit to accept weatherstripping for exterior openings and smoke gaskets for fire-rated openings.
    a. Ship weatherstripping and smoke gaskets loose for installation after frames have been finished painted.
2. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
3. Provide countersunk, flat-, or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Thermal Breaks Fabricate frames with minimum 1/16 inch positive thermal break and integral vinyl weatherstripping as required to meet specified door assembly U-values.

5. Faces: 2 inches.
6. Rabbets: Double 5/8 inch unless indicated otherwise.
7. Backbends:
   a. Wrap-Around Frames: Manufacturer's standard 1/2 inch nominal backbend.
   b. Butted Frames: Custom 1-1/2 inch minimum backbends.
8. Door Silencers: Except on weatherstripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive 3 door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive 2 door silencers.

E. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

F. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior frames and on secure side of interior frames. Provide loose stops and moldings on inside of hollow-metal frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

2.11 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Factory Finish: Clean, pretreat, and apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and electrostatic or thermoset topcoat, complying with ANSI/SDI A250.3.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.12 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020 inch thick, cold-rolled steel sheet set into 0.032 inch thick steel frame.
1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.
   1. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
   2. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
   2. Exterior Frames: After installation of anchor bolts is completed, fill dimpled anchor openings with metal patching compound. Cure and prep patching compound as recommended by patching compound manufacturer; ready for painting.
   3. Fire-Rated Openings: Install frames according to NFPA 80.
   4. Floor Anchors: Secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   5. Fill inside of frames with spray-applied foam insulation.
      a. Locations: Exterior frames and interior frames where indicated.
   6. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with spray-applied insulation or packed mineral-fiber insulation.
      a. Grouting of frames is not allowed.
   7. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   8. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 – Glazing and with hollow-metal manufacturer's written instructions.

3.4 REPAIR

A. Replace doors and frames that are damaged or that do not comply with requirements. Doors and frames may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

B. Touchups:
1. Prime-Coat: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
2. Metallic-Coated Surface: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
3. Painting: Cleaning and touchup painting of abraded areas of paint are specified in Section 099600 – High Performance Coatings.

3.5 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.6 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

3.7 CLEANING

A. Remove temporary coverings and protection of adjacent Work areas.

B. Clean installed products in accordance with manufacturer's instructions prior to Substantial Completion. Remove excess sealants, glazing materials, dirt, and other substances.

3.8 PROTECTION

A. Protect installed products from damage during remainder of construction activities.

END OF SECTION

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Electrically operated sectional doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
   2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's Product Data. Include the following:
   1. Plans, elevations, sections, and mounting details.
   2. Details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. Diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:
   1. Metal for door sections.
   2. Hardware.
   3. Glazing.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For sectional doors, accessories, and components, from manufacturer.

C. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity with a minimum of 5 years of experience installing products specified in this Section that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:
      a. Structural failures including excessive deflection.
      b. Failure of components or operators before reaching required number of operation cycles.
      c. Faulty operation of hardware.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
      a. Delamination of exterior or interior facing materials.
   2. Warranty Periods: From date of Substantial Completion:
      a. Delamination and Rust-Through: 10 years.
      b. Other Components: 1 year.
      c. Electric Door Operator: 2 years.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
   1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE CRITERIA

A. Regulatory Requirements:
   1. Accessibility Standards:
      a. Comply with applicable provisions in current edition of Washington State Building Code, USDOJ's "2010 ADA Standards for Accessible Design," and ICC A117.1.

B. General Performance: Provide sectional doors that comply with performance criteria specified without failure due to defective manufacture, fabrication, installation, or other defects in construction.

C. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward unless indicated otherwise.
   2. Testing: According to ASTM E330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.
   3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
      a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
      b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

D. Fire-Resistance Characteristics: Comply with ASTM E84.
   1. Flame-Spread Index: 75 or less.

2. Smoke-Developed Index: 450 or less.

E. Seismic Performance: Sectional doors shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

2.3 SECTIONAL DOOR ASSEMBLIES, GENERAL

A. Fabricate sectional doors so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

B. Fabricate sectional doors from single sheets, minimum 25 gage, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, with weather- and pinch-resistant seals, and reinforcing flange return.

2.4 INSULATED SECTIONAL DOOR ASSEMBLIES

A. High Performance Steel Sectional Door (SOD-X): Insulated.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Amarr: Amarr 2743.
b. C.H.I. Overhead Doors, Inc.: Model 3236.
c. Clopay Building Products: Model 3730.
d. Overhead Door Corp.: Thermacore AP Model 850.
e. Raynor: ThermaSeal TM300.
f. Wayne-Dalton Corp: ThermoMark 530.
2. Operation Cycles: Door components and operators capable of operating for not less than 50,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
3. Air Infiltration: DASMA 105 or ASTM E283; maximum rate of 0.4 cfm/sq. ft. at 15 mph.
4. R-Value: Minimum 24.
5. U-Value: Minimum 0.041.
6. Steel Door Sections: ASTM A653, zinc-coated (galvanized), cold-rolled, commercial steel sheet with minimum G60 zinc coating.
a. Door-Section Thickness: 3 inches.
b. Section Faces:
1) Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
2) Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
a) Steel Sheet: With minimum nominal coated thickness of 0.020 inch.
b) Surface: Manufacturer's standard, flat.
3) Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
a) Steel Sheet: With minimum nominal coated thickness of 0.019 inch.
c. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064 inch nominal coated thickness and welded to door section.

d. Intermediate Stiles: Provide intermediate stiles formed from not less than 0.064 inch thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.

e. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
   1) Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weather seal).
   2) Hardware Locations: Provide reinforcement for hardware attachment.

f. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:
   1) Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.

2.5 TRACKS AND ACCESSORIES

A. Track: Manufacturer's standard, galvanized-steel, standard-lift, track system in configurations indicated on Drawings. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for specified door type, size, weight, and loading.
   1. Material: Galvanized steel, ASTM A653, minimum G60 zinc coating.
   2. Size: 2 inch or 3 inch as recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
   3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
      a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous reinforcing angle attached to track and wall.
      b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

B. Weatherseals: Replaceable, adjustable, continuous, compressible weatherstripping gaskets of flexible rubber or neoprene fitted to bottom, top, and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.

C. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:
   1. Overall Size: Nominal 24 inch wide by 7 inch high.
   2. Insulating Glass: Manufacturer's standard.
   3. Tint: Clear.

2.6 HARDWARE

A. Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079 inch nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size.
    a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
    b. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.
2. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
3. Roller-Tire Material: Case-hardened steel. Neoprene or bronze. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.

B. Locking Device:
1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
    a. Lock Cylinders: Cylinders specified in Section 087100 – Door Hardware.
    b. Keying: Keyed to building keying system.
    c. Keys: 3 for each cylinder.
3. Chain Lock Keeper: Suitable for padlock.
4. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.7 COUNTERBALANCE MECHANISM

A. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.

B. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
1. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
2. Provide one additional midpoint bracket for shafts up to 16 ft. long and 2 additional brackets at 1/3 points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.
3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to wall and to level shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

2.8 MANUAL DOOR OPERATORS

A. Push-up Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf.

2.9 ELECTRIC DOOR OPERATORS

High-lift, vertical-lift, contour track Low headroom, standard liftElectric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   a. Overhead Door Corp.: Model RSX.
   b. Approved substitution.
   c. Overhead Door Corp.: Model RHX.
   d. Approved substitution.
   e. Overhead Door Corp.: Model RHX.
   f. Raynor: Control Hoist: Standard.
   g. Approved substitution.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. LiftMaster: Model HCTDCUL Series Heavy-Duty Operator.
   b. The Genie Company.
   c. Overhead Door Corp.: Model RSX Standard Duty.
   d. Approved substitution.
3. Comply with NFPA 70.
4. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
5. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. or lower.
6. Usage Classification: Heavy duty, 25 or more cycles/hour and more than 90 cycles/day.
7. Operator Type: Trolley or Jackshaft as required for track configurations.
   a. Jackshaft-Type Operators: Provide at high-lift, vertical-lift tracks, and contour tracks.
   b. Trolley-Type Operators: Provide low headroom and standard lift type tracks.

B. Motors: Continuous-duty, reversible-type motor with controller (disconnect switch) for motor exposure indicated. Use adjustable motor-mounting bases for belt-driven operators.
   1. Electrical Characteristics:
      a. Phase: Single phase
      b. Volts: 115 V.
      c. Hertz: 60.
      d. Horsepower: 1/2.
   2. Control Wiring: Solid state circuitry with provisions for connection of safety edge to reverse, external radio control hook-up and maximum run timer. Provisions for timers to close, monitored reversing devices, mid stop and lock bar sensor capability.
   3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

C. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

D. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

1. Monitored Entrapment Protection: Photoelectric sensor or electric sensor edge on bottom section designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.

E. Control Station: Surface mounted, 3-position (open, close, and stop), momentary-contact type control.
1. Operation: Push button interior and key exterior.
2. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1.
3. Exterior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof type, NEMA ICS 6, Type 4.
4. Features: Provide the following:
   a. Vehicle detection operation.
   b. Radio-control operation.
   c. Card-reader control.
   d. Audible and visual signals that comply with regulatory requirements for accessibility.

F. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.

G. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
1. Portable, Radio-Control System: Digital control, resettable.
2. Portable, Radio-Control System: Consisting of of the following:
   a. 3-channel universal coaxial receiver to open, close, and stop door.
   b. Remote antenna and mounting kit.

2.10 METAL FINISHES

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Steel and Galvanized-Steel Finishes:
1. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and the following minimum dry film thickness:
   a. Prime Coat: Minimum 0.2 mils.
   b. Top Coat: Minimum 0.8 mils.
   c. Color: As selected by Architect from manufacturer's full range.

C. Aluminum Finishes:

1. Anodized Aluminum Finish: Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.
   a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
   b. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
      1) Color: As selected by Architect from manufacturer's full range.
2. Baked-Enamel or Powder-Coat Finish: AAMA 2604. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   a. Color: As selected by Architect from manufacturer's full range.
3. High-Performance Organic Finish: 2-coat PVDF: Fluoropolymer complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
   a. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   b. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports, according to manufacturer's written instructions and as specified.

B. Tracks:
   1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
   2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum windows for exterior locations.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project.
   1. Timing: Schedule meeting a minimum of two weeks prior to starting Work of this Section.
   2. Attendees: Architect, Owner, Contractor, Installer, manufacturer's representative, envelope consultant, and other entities whose Work is related to this Section.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review and discuss finishing of aluminum windows that is required to be coordinated with finishing of other aluminum Work for color and finish matching.
   5. Review, discuss, and coordinate interrelationship of aluminum windows with other exterior wall components. Include provisions for anchorage, flashing, sealing perimeters, and protecting finishes.
   6. Review and discuss sequence of Work required to construct a watertight and weathertight exterior building envelope.
   7. Inspect and discuss condition of substrate and other preparatory Work performed by other trades.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: For aluminum windows.
   1. Include plans, elevations, sections, hardware, accessories, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:
   1. Exposed Finishes: 2 by 4 inches.
   2. Exposed Hardware: Full-size units.
   3. Corner Section: 12 by 12 inches that includes corner construction, accessories, and finishes.
   4. Quantity: 2 Samples of each submittal.

D. Product Certificates: From aluminum window manufacture, submit the following prior to submitting Shop Drawings or starting fabrication:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.

E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Certification of ASHRAE 90.1 Fenestration Rating.

D. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer that specializes in manufacturing aluminum windows comparable to systems specified for this Project with a minimum of 10 years of documented experience.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 10 years of documented experience installing aluminum windows comparable to systems specified of this Project.

C. Mockups: Comply with Section 014339 – Mockups.
1. Build mockups of typical wall area as shown on Drawings to verify selections made under Sample submittals and to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
2. Notify Architect and Owner’s representative a minimum of 7 days in advance of dates and times when in-place mockups will be constructed.
3. Set unit in opening, glaze framing system, install flashing and joint sealants.
   a. Examine flashing of openings prior to installing joint sealant.
4. Perform testing on mockups according to requirements in "Field Quality Control" Article.
5. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Obtain Architect’s approval of mockups before continuing installation of glazed aluminum-windows.
7. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.
8. Maintain mockups during construction in an undisturbed condition as a standard for judging completed Work.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
1. Failures include the following:
   a. Failure to meet performance requirements.
   b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
   c. Faulty operation of movable sash and hardware.
   d. Deterioration of materials and finishes beyond normal weathering.
   e. Failure of insulating glass.
   f. Failure of operating components.

2. Warranty Period:
   a. Window: 5 years from date of Substantial Completion.
   b. Glazing Units: 5 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Window Certification: AAMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440: AW-PG80-FW

C. Deflection of Framing Members: Test according to ASTM E330:
1. Tested under static-air-pressure differential of 80 lbf/sq. ft. at positive and negative direction.
2. Deflection: Not exceeding L/175 of span when tested at any framing member at design load.

D. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 59 (Frame) and 57 (Glass).

E. Air Infiltration: Test according to ASTM E283 for infiltration as follows:
1. Maximum air leakage of 0.10 cfm per square foot at a static-air-pressure differential of 6.24 lbf/sq. ft.

F. Water Penetration Performance Requirements:
1. Static Pressure according to ASTM E331: No uncontrolled water penetration when tested under static-air-pressure differential of 15 lbf/sq. ft., with water application rate of 5 gal/hr./sq. ft.

G. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

H. Sound Transmission Class (STC): Rated for not less than 34 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

2.3 ALUMINUM WINDOWS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   1. Milgard Manufacturing, Inc.: TIE Aluminum Windows, Series 920.Approved substitution from one of the following:
      a. EFCO Corporation. Marlin Windows, Inc.: Series #1505 Fixed.
      c. Oldcastle BuildingEnvelope.Wausau Window and Wall Systems.
      e. Approved substitution.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Fixed.

C. Frames: Manufacturer's extruded- or formed-aluminum framing members.
   1. Construction: Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on 4 sides.
   3. Framing Member Profile: Nominal 2-1/4 inch by 4-1/2 inch.
   4. Framing Member Wall Thickness: Minimum 0.060 inch, but not less than required to meet structural performance requirements.
   5. Finish: Clear anodic finish Color anodic finish
   6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

D. Thermal Break Material: 2-part chemically-curing, high-density polyurethane, mechanically and adhesively joined to aluminum framing sections
   1. Thermal Break Design: Comply with AAMA TIR-A8 and test in accordance with AAMA 505.
   2. Minimum Thermal Separation: 1/4 inch.

E. Glass and Glazing Materials: Comply with requirements of Section 088000 – Glazing.

F. Insulating-Glass Units: ASTM E2190.
   1. Glass: ASTM C 1036, Type 1, Class 1, q3.
      a. Tint: Clear.
      b. Kind: Fully tempered where indicated on Drawings.
   2. Lites: 2.
   3. Interspace Content: Fill space between glass lites with argon.
   4. Interspace Content:
      a. Argon gas: 90 percent.
      b. Air: 90 percent.
   5. Low-E Coating: Pyrolytic or sputtered on second surface.
   6. Integral Louver Blinds: Glass manufacturer's standard, horizontal louver blinds with aluminum slats and polyester fiber cords, located in space between glass lites, and operated by hardware located on inside face of sash.
      a. Color: As selected by Architect from manufacturer's full range.

G. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

H. Hardware, General: Manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
   1. Exposed Hardware Color and Finish: Match finish of sash unit.

I. Thermal Break Material: Comply with AAMA TIR-A8 and test in accordance with AAMA 505.
   1. Polyurethane: 2-part chemically-curing, high-density polyurethane, mechanically and adhesively joined to aluminum framing sections.
   2. Minimum Thermal Separation: 3/8 inch.

J. Weatherstripping: Provide full-perimeter weatherstripping for each operable sash unless otherwise indicated.

K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. Where exposed fasteners are unavoidable, provide exposed fasteners with countersunk Phillips screw heads, fabricated from 300 series stainless steel.
      a. Where framing finish is other than clear anodized, finish exposed fasteners to match framing system.

2.4 ACCESSORIES

A. Integral Ventilating Device (Trickle Vent): Where indicated, provide weatherstripped, adjustable, horizontal fresh-air vent, with a free airflow slot, complying with AAMA/WDMA/CSA 101/I.S.2/A440. Equip vent bar with an integral insect screen, removable for cleaning.
   1. Airflow Slot: Approximately 1 inch high by full width of window sash when open.
   2. Locations: Provide minimum of 1 trickle vent per frame or as indicated on Drawings.

B. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

C. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. Receptor System: 2-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

F. Flashing:
   1. Exposed: 0.032 inch thick aluminum sheet; ASTM B209,finish to match framing members.
   2. Concealed: Dead-soft, 0.018 inch thick stainless steel, ASTM A240 of type recommended by manufacturer.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in factory.

C. Weatherstrip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Complete fabrication, assembly, finishing, hardware application, and other Work in factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by Aluminum Association for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
1. Color: Dark bronze
2. Color: As selected by Architect from full range of industry colors and color densities.

D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

E. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

F. Superior-Performance Organic Finish, 3-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: As selected by Architect from manufacturer's full range.

G. Liquid Strippable Coating: Apply in shop to prefinished surfaces to protect finish during fabrication, shipping, and field handling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
1. Testing and inspecting agency will interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:
   a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
   b. Allowable Air-Leakage Rate: 1.5 times applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
3. Water-Resistance Testing:
   a. Test Pressure: 2/3 times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
   b. Allowable Water Infiltration: No water penetration.
4. Testing Extent: 3 windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust operating sashes and hardware for a tight fit at contact points and weatherstripping for smooth operation and weathertight closure.

3.5 CLEANING

A. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.6 PROTECTION

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Unit skylights.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct meeting at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include product dimensions, construction details, material descriptions, dimensions and profiles of components, and finishes.

B. Shop Drawings:
   1. Include plans, elevations, sections, mounting, and attachment details and methods of structural support.

C. Samples for Verification: For each product, as follows:
   1. Glazing: In manufacturer's standard size and of same thickness indicated for the final Work.
   2. Finishes: For each type and color of factory-applied exposed finish required, in manufacturer's standard size.

D. Product Schedule: For each type of product specified. **Use same designations indicated on Drawings.**

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each type and size of product, for tests performed by a qualified testing agency on specimens equal to or greater than sizes required for Project.

C. Sample Warranty: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For products and accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of unit skylights required for this Project.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of products that fail in materials or workmanship within specified warranty period.

1. Failures include the following:
   a. Failure to meet performance requirements.
   b. Water leakage not controlled by drainage features.
   c. Deterioration of materials and finishes beyond normal weathering.
   d. Yellowing of acrylic glazing.
   e. Breakage of polycarbonate glazing.
   f. Deterioration of insulating-glass units including failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating-glass units contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
2. Warranty Period:
   a. Products and Accessories: 5 years from date of Substantial Completion.
   b. Insulating-Glass Units: 10 years from date of Substantial Completion.

B. Special Aluminum Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of finish deterioration within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, peeling, checking, or chipping.
2. Warranty Period: 1**0**years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Performance Standard: Comply with AAMA/WDMA/CSA 101/1.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Label Requirements: Label each product with names of manufacturer and labeling agency and AAMA/WDMA/CSA 101/1.S.2/A440 product designation, performance grade, and test specimen size equal to or greater than the size of the product.
2. Certification Requirements: Provide **AAMA** certified products, with label attached to each.

B. Water Penetration under Static Pressure:
1. No evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. with water application rate of 5 gal/hr./sq. ft.

C. Air Infiltration:
1. Maximum air leakage of 0.06 cfm/sq. ft. through fixed glazing and framing areas when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

D. Thermal Transmittance: NFRC 100 maximum U-factor of 0.48 Btu/sq. ft. x h x deg F

E. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum SHGC of 0.35.

F. Plastic Glazing:
1. Self-Ignition Temperature: 650 deg F or more for plastic sheets in thickness indicated when tested in accordance with ASTM D1929.

2. Smoke-Production Characteristics: Smoke-developed index of 450 or less when tested in accordance with ASTM E84, and smoke density of 75 or less when tested in accordance with ASTM D2843.
3. Combustibility Characteristics: Tested in accordance with ASTM D635 and classified for burning rate of nominal thickness of 0.060 inch or thickness of plastic glazing indicated for use as follows:
   a. Class CC1: Burning rate of 1 inch per minute or less.
   b. Class CC2: Burning rate of 2-1/2 inches per minute or less.

G. Exterior Fire-Test Exposure: Provide products identical to those of assemblies tested for Class B fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction.

H. Fall Protection Performance: Installed assemblies are capable of safely supporting the greater of 400 lbs or twice the weight of employees, equipment, and materials that may be imposed on any 1 sq. ft. of assembly at any time.

2.2 UNIT SKYLIGHTS

A. Factory-Assembled Skylight: Unit that includes glazing, extruded-aluminum glazing retainers, gaskets, and inner frame.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. DeaMor: Glass Skylights.20Kingspan Light + Air: SkyQuick Skylight.20VELUX America LLC: Model FCM Fixed Curb Mount Skylight.
   d. Wasco Part of the Velux Group: Model CLPC Curb-Mounted Glass Glazed Skylight.
2. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   a. VELUX America LLC: Model FCM Fixed Curb Mount Skylight.
   b. Approved substitution from one of the following:
      1) DeaMor: Glass Skylights.20Kingspan Light + Air: SkyQuick Skylight.20Wasco Part of the Velux Group:

B. Product Type: AAMA/WDMA/CSA 101/1.S.2/A440 SKG, unit skylight - glass glazed
1. Provide fixed (nonoperable) units.

C. Unit Shape and Size: **As indicated.**

D. Polycarbonate-Insulating-Panel Glazing: Manufacturer's standard polycarbonate sheet with cellular cross section that provides isolated airspaces, coextruded with a UV-protective layer, and Class CC2 based on testing in accordance with ASTM D635.
1. Thickness: **Not less than thickness required to meet specified requirements**.
2. Color: As selected by Architect from manufacturer's full range.

E. Glazing Gaskets: Manufacturer's standard EPDM, neoprene, or partially vulcanized butyl tape.

F. Integral Curb: **Extruded-aluminum, ASTM B221, alloy and temper to suit structural and finish requirements but with not less than the strength and durability of Alloy 6063-T52**, self-flashing type.
1. Height: As indicated on Drawings **8 inches**
2. Construction: **Double** wall.
3. Insulation: Manufacturer's standard rigid or semirigid type.
   a. Exposed Insulation: Cover face of insulation exposed to interior of building with **aluminum** liner.

G. Frame Counter Flashing: Manufacturer's standard 1-piece, curb-cap type, not less than 0.060 inch thick, corners joined with corner keys constructed from injection molded Acrylonitrile Styrene Acrylate (ASA)-Luran.

H. Exposed Flashing and Closures: Manufacturer's standard aluminum components.

I. Condensation Control: Fabricate unit skylights with integral internal gutters and non-clogging weeps to collect and drain condensation to exterior.

J. Thermal Break: Fabricate unit skylights with thermal break separating exterior and interior metal framing.

K. Aluminum Finishes:
1. Mill Finish: Manufacturer's standard.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   a. Color: **Black**
   b. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.
4. High-Performance Organic Finish, 3-Coat: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 ACCESSORY MATERIALS

A. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal that is compatible with the materials being fastened and as recommended in writing by manufacturer. Finish exposed fasteners to match material being fastened.
1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil dry film thickness per coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate installation of products and accessories with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of Work performs properly and that combined elements are waterproof and weathertight.

B. Install products and accessories to comply with recommendations in AAMA 1607 and with manufacturer's written installation instructions.

C. Install products true to line and without distortion.

D. Anchor products securely to supporting substrates.

E. Where metal surfaces of products will contact other metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. After completion of installation and nominal curing of sealant and glazing compounds, but before installation of interior finishes, test for water leaks in accordance with AAMA 501.2.
1. Water-Spray Test: Before installation of interior finishes has begun, skylights shall be tested according to AAMA 501.2 and shall not evidence water penetration.
2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E1105.
   a. Test Procedures: Test under uniform **and cyclic** static-air pressure.
   b. Water Penetration: None.
3. Water Penetration: Before installation of interior finishes has begun, test in accordance with ASTM E1105 at minimum uniform and cyclic static-air-pressure differential specified for laboratory testing in "Performance Criteria" Article.
   a. Perform tests in each test area as directed by Architect. Perform at least 3 tests, prior to 10, 35, and 70 percent completion.
   b. Include a minimum of 4 cycles, each lasting a minimum of 5 minutes.
   c. Water Penetration: None.

C. Repair or remove Work where test results and inspections indicate that it does not comply with specified requirements.

D. Perform test for total area of each installed product.

E. Work will be considered defective if it does not pass tests and inspections.

F. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.4 CLEANING

A. Clean exposed product surfaces in accordance with manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect product surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hardware for wood, aluminum and hollow metal doors.

B. Hardware for fire-rated doors.

C. Thresholds.

D. Smoke and draft control seals.

E. Weatherstripping and gasketing.

1.2 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

1.3 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.

C. DHI - Sequence and Format for the Hardware Schedule 2019.

D. DHI - Keying Systems and Nomenclature 2019.

E. DHI - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.

F. DHI WDHS-3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993, also in WDHS-1/WDHS-5 Series 1996.

G. IBC - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

K. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

M. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:
1. Architect.
2. Hardware Supplier’s Architectural Hardware Consultant (AHC).
3. Hardware Installer.
4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:
1. Schedule meeting at project site prior to Contractor occupancy.
2. Attendance Required:
   a. Contractor.
   b. Owner.
   c. Hardware Supplier’s Architectural Hardware Consultant (AHC).
   d. Door Hardware Installer.
   e. Owner's Security Consultant.
   f. Manufacturer’s Representative (if required)
3. Agenda:
   a. Establish keying requirements.
   b. Verify locksets and locking hardware are functionally correct for project requirements.
   c. Verify that keying and programming complies with project requirements.
   d. Establish keying submittal schedule and update requirements.
4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   a. Access control requirements.
   b. Key control system requirements.
5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

1.5 SUBMITTALS

A. See Division 1 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
      a. Submit in vertical format.
   3. List groups and suffixes in proper sequence.
   4. Include complete description for each door listed.
   5. Include manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
   2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
   3. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.
   4. Provide electrical operation technical sheets including product schematics, point to point diagrams, and electrical requirements of all electrified hardware. Completely coordinate with the general contractor, electrical engineer, electrician, security access subcontractor and the installer. Operational descriptions are for demonstration only – verify operational intent with the owner, architect and electrical engineer.

E. Samples for Verification:
   1. Submit samples if requested.
   2. Architect will return full-size samples to Contractor.
   3. Include product description with samples.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
   1. Bitting List: List of combinations as furnished.

H. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

I. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Division 1 - Product Requirements, for additional provisions.
   2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.6 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

D. Regulatory and Operational Requirements:
   1. Provide hardware for all openings, whether specified or not, in compliance with NFPA Standard No. 80, proper operation and local building code requirements. Where required, provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Label hardware, as required, for compliance with pressure testing criteria as dictated in IBC.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.8 WARRANTY

A. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Lifetime, minimum.
   2. Exit Devices: Five years, minimum.
   3. Locksets and Cylinders: Five years, minimum.
   4. Electrical Hardware: One year minimum.
   5. Other Hardware: Two years, minimum.
   6. Provide a letter on the manufacturer’s letterhead that they will comply with the above requirements if not standard.

PART 2 – PRODUCTS

1.9 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Door Pulls and Push Plates:
   1. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.

C. Closers:
   1. Provide door closer on doors as specified, unless otherwise indicated.
   2. Provide door closer on each fire-rated and smoke-rated door.

D. Thresholds:
   1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.
   2. Thermal break.

E. Smoke and Draft Control Seals:
   1. Provide gasketing for smoke and draft control that complies with local codes, requirements of assemblies tested in accordance with UL 1784.

F. Weatherstripping and Gasketing:
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.
   3. Fabricate as continuous gasketing, do not cut or notch gasketing material.

G. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

H. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Provide wall grip inserts for hollow wall construction.
   5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
   6. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated or required per manufacturer's testing requirements.

1.10 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
      a. IBC
      b. NFPA 80
      c. NFPA 101
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

4. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
5. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
6. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified.

1.11 HINGES

A. Manufacturers: Conventional hinges.
   1. Listed in Door Hardware Schedule: Best
   2. Substitutions: As approved per Division 1.

B. Properties:
   1. Butt Hinges: As applicable to each item specified.
      a. Standard Weight Hinges: Minimum of two (2) permanently lubricated non-detachable bearings.
      b. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
      c. Template screw hole locations.
      d. Pins:
         1) Easily seated, non-rising pins
         2) Non removable pins (NRP) as needed.
      e. UL 10C listed for fire-resistance-rated doors.

C. Finishes: See Door Hardware Schedule.

D. Grades:
   1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.

E. Types:
   1. Butt Hinges: Include full mortise hinges.

F. Options: As applicable to each item specified.

G. Quantities:

H.
   1. Butt Hinges: Three (3) hinges per leaves up to 90 inches in height. Add one (1) for each additional 30 inches in height or fraction thereof.

      a. Hinge weight and size unless otherwise indicated in hardware sets:
         1) For doors up to 36 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.134 inch and a minimum of 4-1/2 inches in height.
         2) For doors from 36 inches wide up to 42 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.145 inch and a minimum of 4-1/2 inches in height.
         3) For doors from 42 inches wide up to 48 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.180 inch and a minimum of 5 inches in height.
         4) For custom doors over 48 inches wide provide as specified.

5) For doors greater than 1-3/4 inches thick provide hinges with a minimum thickness of 0.180 inch and a minimum of 5 inches in height.

I. Applications: At swinging doors.
1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

J. Products:
1. Butt Hinges:
a. Concealed or exposed bearing, five (5) knuckle.
b. Plain Bearing, Five (5) Knuckle.

1.12 BOLTS

A. Manufacturers:
1. Listed in Door Hardware Schedule: Trimco
2. Substitutions: As approved per Division 1.

B. Properties:
1. Flush Bolts:
a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
b. Manual Flush Bolts: Manually latching upon closing of door leaf.
1) Bolt Throw: 3/4 inch, minimum.

3. Options:
a. Extension Bolts: In leading edge of door, one bolt into floor, one bolt into top of frame.

4. Products:
a. Manual flush bolts.

E. LOCK CYLINDERS

1. Manufacturers:
2. Listed in Door Hardware Schedule: Best
3. Substitutions: As approved per Division 1.

C. Properties:
1. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
a. Provide cylinders from same manufacturer as locking device.
b. Provide cams and/or tailpieces as required for locking devices.
c. Provide cylinders with SFIC format interchangeable cores.

D. Material:
1. Manufacturer's standard corrosion-resistant brass alloy.

E. Products:
1. Rim/mortise/removable cores

F. MORTISE LOCKS

F. Manufacturers:

1. Listed in Door Hardware Schedule: Best 45H
2. Substitutions: As approved per Division 1

G. Properties:
1. Mechanical Locks: Manufacturer's standard.
   a. Fitting modified ANSI A115.1 door preparation.
   b. Door Thickness Coordination Fitting 1-3/4 inch to 2-1/4 inch thick doors.
   c. Latch: Solid, one-piece, anti-friction, self-lubricating stainless steel or manufacturer's standard anti friction as required.
      1) Latchbolt Throw: 3/4 inch, minimum.
   d. Auxiliary Deadlatch: One piece stainless steel, permanently lubricated.
   e. Backset: 2-3/4 inch.
   f. Lever Trim:
      1) Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
      2) Strength: Locksets outside locked lever designed to withstand minimum 1,400 inch-lbs of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
      3) Spindle: Designed to prevent forced entry from attacking of lever.
      4) Independent spring mechanism for each lever.
      (a) Trim to be self-aligning and thru bolted.
2. Electrified Locks: Same properties as standard locks, and as follows:
   a. Voltage: 24 VDC.
   b. Function: Electrically locked (Fail Safe) or unlocked (Fail Secure), as indicated for each lock in Door Hardware Schedule.

H. Finishes: See Door Hardware Schedule.
1. Core Faces: Match finish of lockset.

I. Products: Mortise locks, including standard and electrified types.

1.13 CYLINDRICAL LOCKS

A. Manufacturers:
1. Listed in Door Hardware Schedule: Best 9K
2. Substitutions: As approved per Division 1

B. Properties:
1. Mechanical Locks:
   a. Fitting modified ANSI A115.2 door preparation.
   b. Door Thickness Fit: 1-3/8 inches to 2-1/4 inches thick doors.
   c. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
      1) Through-bolted anti-rotational studs.
   d. Bored Hole: 2-1/8 inch diameter.
   e. Backset: 2-3/4 inches unless otherwise indicated.
   f. Latch: Single piece tail-piece construction.
      1) Latchbolt Throw: 1/2 inch, minimum.
   g. Cylinders:

1) Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.

h. Lever Trim:

1) Style: See Door Hardware Schedule.

C. Finishes: See Door Hardware Schedule.

1. Core Faces: Match finish of lockset.

D. Material: Manufacturer's standard for specified lock.

1.14 EXIT DEVICES

A. Manufacturers:

1. Listed in Door Hardware Schedule: Precision 2000
2. Substitutions: As approved per Division 1.

B. Properties:

1. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
2. Latch Bolts: Stainless steel deadlocking with 3/4 inch projection using latch bolt.
3. Cylinder: Include where cylinder dogging or locking trim is indicated.
4. Strike as recommended by manufacturer for application indicated.
5. Sound dampening on touch bar.
6. Dogging:
   a. Non-Fire-Resistance-Rated Devices: Cylinder dogging or less dogging (LD) as specified.
   b. Fire-Resistance-Rated Devices: Manual dogging not permitted.
7. Handing: Field-reversible.

C. Grades: Complying with BHMA A156.3, Grade 1.

D. Standards Compliance:

1. Provide UL listed exit device assemblies for fire-resistance-rated doors.
2. Comply with UL 10C..

E. Code Compliance: As required by authorities having jurisdiction.

1.15 DOOR PULLS AND PUSH PLATES

A. Manufacturers:

1. Listed in Door Hardware Schedule: Trimco
2. Substitutions: As approved per Division 1.

B. Properties:

1. Pull Type: Straight, unless otherwise indicated.
2. Push Plate Type: Flat, with square corners, unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: Stainless steel, unless otherwise indicated.

1.16 CLOSERS

A. Manufacturers:
   1. Listed in Door Hardware Schedule: Best EHD9016
   2. Substitutions: As approved per Division 1.
   3. Properties, Surface Mounted Closers: Manufacturer's standard.
      a. Construction: Cast iron.
      b. Covers:
         1) Type: Standard for product selected.
            (a) Full.
         2) Material: Plastic.
         3) Finish: Painted.

B. Grades:
   1. Closers: Comply with BHMA A156.4, Grade 1.
      a. Underwriters Laboratories Compliance:
      b. Testing Standards Compliance: Meeting requirements of UL 10C for positive pressure.

C. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.

D. Types:
   1. Rack-and-pinion, surface-mounted. 1-1/2 inches minimum bore.

E. Installation:
   1. Mounting: Includes surface mounted installations.
   2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
   3. At outswinging exterior doors, mount closer on interior side of door.
   4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
   5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

1.17 PROTECTION PLATES

A. Manufacturers:
   1. Listed in Door Hardware Schedule: Trimco
   2. Substitutions: As approved per Division 1.

B. Properties:
   1. Plates:
      a. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
      b. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.

1. Metal Properties: Stainless steel.

E. Installation:
1. Fasteners: Countersunk screw fasteners

1.18 STOPS AND HOLDERS

A. Manufacturers:
1. Listed in Door Hardware Schedule: Trimco
2. Substitutions: As approved per Division 1.

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:
1. Door Holders, Wall Bumpers, and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types:
1. Wall Bumpers: Bumper, concave, wall stop.
2. Floor Stops: Provide with bumper floor stop.

F. Installation:
1. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.

1.19 THRESHOLDS

A. Manufacturers:
1. Listed in Door Hardware Schedule: National Guard
2. Approved Substitutions: As approved per Division 1..

B. Properties:
1. Threshold Surface: Fluted horizontal grooves across full width.

C. Where there is conflict between scheduled thresholds and details, details shall have precedence. Revise details only if necessary to comply with handicap accessibility requirements. Notify the Architect of such required modifications.

D. Grades: Thresholds: Comply with BHMA A156.21.

E. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.

F. Thermal break.

1.20 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
1. Listed in Door Hardware Schedule: National Guard
2. Approved Substitutions: As approved per Division 1.

B. Grades: Comply with BHMA A156.22.

C. Products:
   1. Weatherstripping/Gaskets: See Door Hardware Schedule.
   2. Door Bottom Seals:
      a. Door Sweeps: See Door Hardware Schedule.
      b. Door Shoes: See Door Hardware Schedule.

1.21 KEYS AND CORES

A. Manufacturers:
   1. Listed in Door Hardware Schedule: Best Cormax patented
   2. Approved Substitutions: As approved per Division 1.

B. Properties: Complying with guidelines of BHMA A156.28.
   1. Provide small format interchangeable core (SFIC).
   2. Provide keying information in compliance with DHI standards.
   3. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
   4. Keying: Master keyed.
   5. Include construction keying and control keying with removable core cylinders.
   6. Do not make brass construction cores and construction control and operating keys a part of Owner's permanent keying system, nor furnish in the same keyway (or key section) as Owner, permanent keying system.
   7. Key to new keying system.
   8. Supply keys in following quantities:
      a. Master Keys: 2 each.
      b. Construction Keys: 10 each.
      c. Construction Control Keys: 2 each.
      d. Control Keys: 2 each.
      e. Change Keys: 4 each for each keyed core.
   9. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
   10. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
   11. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
   12. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

C. Material: Steel.

1.22 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.

1. Finish: 630; satin stainless steel, 652; satin chromium plated over steel, and 689; aluminum painted, with any base material. Aluminum to be anodized satin aluminum as noted.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI recommendations.
   2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
   3. Mounting heights in compliance with operational and ADA Standards:

J. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

K. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.

A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4 ADJUSTING

A. Adjust work under provisions of Section 017700 – Closeout Procedures.

3.5 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

3.6 PROTECTION

A. Protect finished Work under provisions of Section 017700 – Closeout Procedures.

A. Do not permit adjacent work to damage hardware or finish.

B. MAINTENANCE
   1. Approximately six months after the acceptance of hardware in each area, the hardware installer shall:
      a. Return to the project and re-adjust every item of hardware to restore proper function of doors and hardware.
      b. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
      c. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units.
      d. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware and submit to the Architect.

HARDWARE SCHEDULE

Manufacturer’s Abbreviations

AB	ABH	Overhead Stops
BE	Best Access Systems	Locks, Hinges, Cylinders
NA	National Guard	Gaskets, Thresholds
PR	Precision	Exit Devices
TR	Trimco	Stops, Flat Goods

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

Finish List:

626/652	Satin Chrome Plated
630	Satin Stainless Steel
689	Painted Aluminum
GREY	Grey

Option List:

LD	Less Dogging (Precision)
M5	Galvanized Steel Chain (Best)
VIB	Double Occupancy Indicator (Best)
CS	Countersunk Screws – Kick Plates (Trimco)
B4E	Beveled Four Edges – Kickplates (Trimco)
SSMS/EA	Stainless Machine Screws/Expansion Shields (NGP)

Set #1 - Toilet/Shower

Doors: 01A, 02A, 03A, 04A, 07A, 08A, 09A

3	Hinges	CB199 4.5" x 4.5"	630	BE
1	Lockset	45H-7T14H PATD VIB	626	BE
1	Closer	EHD9016 JT90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Wall Bumper	1270CVPV	626	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Door Bottom	36 EV		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Verify threshold application.

Set #2 - Utility/Storage

Doors: 10A, 11A, 101B

3	Hinges	CB199 4.5" x 4.5" NRP	630	BE
1	Lockset	45H-7D14H PATD	626	BE
1	Closer/Stop	EHD9016 SDS90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Verify threshold application.

Set #3 - Cabin

Doors: 01, 06

Set #3 - Cabin

3	Hinges	CB199 4.5" x 4.5" NRP	630	BE
1	Lockset	45H-7T14H PATD	626	BE
1	Closer	EHD9016 SPA90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Floor Stop	1214H	626	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Mount stop out of foot traffic. Verify threshold application.

Set #4 - Restroom

Doors: 02

3	Hinges	CB179 4.5" x 4.5"	652	BE
1	Privacy Set	45H-0L14H VIB	626	BE
1	Overhead Stop	4420 Series	630	AB
1	Gasketing	5050 B Head & Jambs		NA

Set #5 - Mechanical/Storage

Doors: 03, 104B, PH1

6	Hinges	CB199 4.5" x 4.5" NRP	630	BE
2	Manual Flushbolt	3917-12	626	TR
1	Lockset	45H-7D14H PATD	626	BE
2	Overhead Stop	9020 A Series	630	AB
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
2	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Unoccupied storage - auto flush bolts not required. Astragal on inactive leaf by door manufacturer. Verify threshold application.

Set #6 - Mechanical/Storage

Doors: 08

3	Hinges	CB199 4.5" x 4.5" NRP	630	BE
1	Lockset	45H-7D14H PATD	626	BE
1	Overhead Stop	9020 A Series	630	AB
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Verify threshold application.

Set #7 - WC Lobby

Doors: 100A

3	Hinges	CB199 4.5" x 4.5" NRP	630	BE
1	Lockset	45H-7T14H PATD	626	BE
1	Closer/Stop	EHD9016 SDS90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Verify threshold application.

Set #8 - Gate

Doors: 100B

2	Spring Hinges	2060R 4.5" x 4.5"	652	BE
1	Passage Set	9K3-0N14D	626	BE

Set #9 - Office

Doors: 101A

3	Hinges	CB179 4.5" x 4.5" NRP	652	BE
1	Lockset	45H-7A14H PATD	626	BE
1	Wall Bumper	1270CVPV	626	TR
3	Silencer	1229A	GREY	TR

Set #10 - Restroom

Doors: 102A

3	Hinges	CB179 4.5" x 4.5"	652	BE
1	Privacy Set	45H-0L14H VIB	626	BE
1	Closer	EHD9016 SPA90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270CVPV	626	TR
1	Gasketing	5050 B Head & Jambs		NA

Set #10A - Restroom

Doors: 102A.1

3	Hinges	CB179 4.5" x 4.5"	652	BE
1	Privacy Set	45H-0L14H VIB	626	BE
1	Closer	EHD9016 JT90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Wall Bumper	1270CVPV	626	TR
1	Gasketing	5050 B Head & Jambs		NA

Set #10B - Restroom

Doors: B103

3	Hinges	CB179 4.5" x 4.5"	652	BE
1	Privacy Set	45H-0L14H VIB	626	BE
1	Closer/Stop	EHD9016 SDS90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Gasketing	5050 B Head & Jambs		NA

Set #11 - Mud Room/Office/Maintenance

Doors: 104A, B101J, B101K

3	Hinges	CB199 4.5" x 4.5" NRP	630	BE
1	Lockset	45H-7AB14H PATD	626	BE
1	Closer/Stop	EHD9016 SDS90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Verify threshold application.

Set #12 - Mechanical/Storage

Doors: 104A.1

8	Hinges	CB199 6" x 4.5" NRP	630	BE
1	Manual Flush Bolt	3917-12	626	TR
1	Manual Flush Bolt	3917-36	626	TR
1	Lockset	45H-7D14H PATD	626	BE
2	Floor Stop/Holder	1257M	626	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Astragal Gasket	5050 B		NA
2	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Oversize doors. Unoccupied storage - auto flush bolts not required. Astragal on inactive leaf by door manufacturer. Mount stops out of foot traffic. Verify threshold application.

Set #13 - Utility

Doors: 105A

3	Hinges	CB179 4.5" x 4.5" NRP	652	BE
1	Lockset	45H-7D14H PATD	626	BE
1	Floor Stop	1215CKU	626	TR
1	Gasketing	5050 B Head & Jambs		NA

Set #13A - Utility

Doors: B104

3	Hinges	CB179 4.5" x 4.5"	652	BE
1	Lockset	45H-7D14H PATD	626	BE
1	Wall Bumper	1270CVPV	626	TR
1	Gasketing	5050 B Head & Jambs		NA

Set #14 - Control Room

Doors: 101C

3	Hinges	CB179 4.5" x 4.5"	652	BE
1	Passage Set	45H-0N14H	626	BE
1	Closer	EHD9016 SPA90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270CVPV	626	TR
1	Gasketing	5050 B Head & Jambs		NA

Set #15 - Electrical/Control Room

Doors: 103A

3	Hinges	CB179 4.5" x 4.5" NRP	652	BE
1	Lockset	45H-7D14H PATD	626	BE
1	Closer	EHD9016 SPA90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270CVPV	626	TR
1	Gasketing	5050 B Head & Jambs		NA

Set #16 - Electrical

Doors: 103B

3	Hinges	CB199 4.5" x 4.5" NRP	630	BE
1	Exit Device	2103 X 1703A LD	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Closer/Stop	EHD9016 SDS90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

Set #17 - Overhead Door

Doors: B101G, B101H

1	Mortise Cylinder	1E-74 PATD	626	BE
1	Padlock	41B-722L PATD M5	626	BE

Set #17 - Overhead Door

NOTE: Mortise cylinder specified for operation/security. Delete if not required. Verify with the door manufacturer. Balance by door manufacturer.

Set #1A - Toilet

Doors: 05A, 06A

3	Hinges	CB199 4.5" x 4.5" NRP	630	BE
1	Lockset	45H-7T14H PATD VIB	626	BE
1	Closer/Stop	EHD9016 SDS90	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA

NOTE: Verify threshold application.

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Glass products.
2. Insulating glass.
3. **Glazing sealants.**
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

B. Preinstallation Meetings: Conduct meeting at Project site
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: 2 for each type of glass product other than clear monolithic vision glass.
1. Size: Not less than 12 sq. in.

C. Glazing Accessory Samples: For gaskets and colored spacers, in 12 inch lengths.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:
1. For manufacturer of fabricated glass units.
2. For Installer.

B. Product Certificates: For each type of glass and glazing product, from manufacturer.

1.5 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: Qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: Qualified installer who employs glass installers for this Project with minimum 3 years of experience and who is certified under National Glass Association's Certified Glass Installer Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period.
   1. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions.
   2. Defects include peeling, cracking, and other indications of deterioration in coating.
   3. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period.
   1. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions.
   2. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   3. Warranty Period: 5 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period.
   1. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions.
   2. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:
   1. Obtain glass from single source from single manufacturer
   2. Obtain glazing accessories from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE CRITERIA

A. Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E1300.
   1. Design Wind Pressures: As indicated on Drawings.
   2. Maximum Lateral Deflection: For glass supported on all 4 edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times short-side length or 1 inch, whichever is less.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
   1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Criteria" and “Quality Assurance” Articles.
   2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required by AHJ.

D. Thermal Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. Monolithic-glass lites properties are based on units with lites 6 mm thick.
   2. Insulating-glass units properties, properties are based on units of thickness indicated for overall unit and for each lite.
   3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
   4. Solar Heat-Gain Coefficient (SHGC) and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. NGA Publications: **"Laminated Glazing Reference Manual" and** "Glazing Manual."
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
   3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
   4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of SGCC or another certification agency acceptable to authorities having jurisdiction.
   1. Indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies on label.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least 1 component lite of units with appropriate certification label of IgCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 6 mm.

E. Strength: Provide glass types to comply with Performance Criteria Article.
   1. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass (Kind HS), or fully tempered float glass (Kind FT).
   2. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass (Kind HS) or fully tempered float glass (Kind FT).
   3. Where fully tempered float glass is indicated or required by applicable code, provide fully tempered float glass (Kind FT).

2.4 GLASS PRODUCTS

A. Clear, Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
   1. Construction: Laminate glass with polyvinyl butyral interlayer (PVB) to comply with interlayer manufacturer's written instructions.
   2. Interlayer Thickness: 0.060 in. min. or as needed to comply with requirements.
   3. Interlayer Color: Clear.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
   1. Sealing System: Dual seal, with manufacturer's standard polyisobutylene primary and silicone secondary, polysulfide and silicone, or as recommended by manufacturer for application.
   2. Warm-Edge Perimeter Spacer: Spacer manufacturer's system consisting of polypropylene-covered stainless steel, nonmetallic laminate or tube, silicone, with integral desiccant and vapor barrier.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Cardinal Glass Industries: Endur IG.
         2) Quanex Building Products: Super Spacer TriSeal
         3) Technoform North America.: TGI-Spacer.
         4) Thermix; a brand of Ensinger USA; Thermix Spacers.

5) Viracon Inc.: Viracon Thermal Spacer (VTS).
6) Vitro Architectural Glass: Intercept Spacer System.
7) Approved substitution.

b. Spacer Width: 1/2 inch or as required for specified insulating glass unit.
c. Spacer Height: 0.27 inch.
d. Corner Construction: Manufacturer's standard corner construction.
e. Color: Black or as selected by Architect.

3. Desiccant: Molecular sieve, silica gel, or a blend of both.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids, elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. Products: Subject to compliance with requirements, provide one of the following:
a. CR Laurence: GT Series Butyl Tapes.
b. GSSI Sealants: MB-10A or EZ TRIM Sealant Tape.
c. ITW Polymers Sealants: Tacky Tape SM5 Series.
d. Pecora Corp.: Extru-Seal.
e. Tremco: Tremco 440 Tape.
f. Approved substitution.
2. Shore Hardness: ASTM 2240; Type A durometer hardness of 15 to 20.
3. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by [**sealant**] [**or**] gasket manufacturer.

C. Setting Blocks:
1. EPDM or other silicone-compatible material.
2. Shore A Durometer Hardness: ASTM D2240; 85, plus or minus 5.
3. Type recommended in writing by glass manufacturer.

D. Spacers:
1. Neoprene blocks or continuous extrusions.
2. Shore A Durometer Hardness: ASTM D2240; 50 minimum or as required by glass manufacturer to maintain glass lites in place for installation indicated.
3. Type recommended in writing by glass manufacturer.

E. Edge Blocks:
1. EPDM or other silicone-compatible material.
2. Shore A Durometer Hardness: ASTM D2240; as required by glass manufacturer to maintain glass lites in place for installation indicated.
3. Type recommended in writing by glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Minimum required bite.
   5. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing.
   1. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces.
   1. Label or mark units as needed so that exterior and interior surfaces are readily identifiable.
   2. Do not use materials that leave visible marks in completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation.
   1. Remove damaged glass from Project site and legally dispose of off Project site.
   2. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer.
   1. Set blocks in thin course of compatible sealant suitable for heel bead.

D. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

E. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass.

2. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
3. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width.
   a. With glazing tape, use thickness slightly less than final compressed thickness of tape.

F. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

G. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

H. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length.
   1. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs.
   1. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops.
   1. Start gasket applications at corners and work toward centers of openings.

G. Application: Interior glazing conditions unless indicated otherwise.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets:
   1. Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops.

2. Start gasket applications at corners and work toward centers of openings.
3. Compress gaskets to produce a weathertight seal without developing bending stresses in glass.
4. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops:
1. Center glass lites in openings on setting blocks, and press firmly against soft compression gasket.
2. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets.
3. Start gasket applications at corners and work toward centers of openings.
4. Compress gaskets to produce a weathertight seal without developing bending stresses in glass.
5. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

F. Application: Exterior glazing conditions unless indicated otherwise.

3.6 CLEANING

A. Immediately after installation remove nonpermanent labels and clean surfaces.

3.7 PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass.
1. Do not apply markers to glass surface.

B. Protect glass from contact with contaminating substances resulting from construction operations.
1. Examine glass surfaces adjacent to or below exterior concrete [**and other masonry**] surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
2. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
a. Remove and replace glass that cannot be cleaned without damage to coatings.
b. Remove and replace glass that is damaged during construction period.

C. Wash glass on both exposed surfaces not more than 4 days before date scheduled for inspections that establish date of Substantial Completion.
1. Wash glass as recommended in writing by glass manufacturer.

3.8 INSULATED GLAZING SCHEDULE

A. Insulating Glass Type (GL-1): Low-E -coated, clear, insulating glass:
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Annealed float glass.
a. Vitro Architectural Glass: Solarban 70 Glass..
b. Low-E Coating: Sputtered on second surface.
4. Interspace Content: 5 percent air; 95 percent argon gas.
5. Indoor Lite: Annealed float glass.
6. Transmittance:
a. Ultra-Violet Transmittance: 3 percent.
b. Visible Light Transmittance: 54 percent.

c. Total Solar Energy: 19 percent.

7. Reflectance:
   a. Visible Light, Exterior: 10 percent.
   b. Visible Light, Interior: 12 percent.
   c. Total Solar Energy Reflectance: 12 percent.
8. NFRC U-Values:
   a. Winter Nighttime: 0.28 Btu maximum.
   b. Summer Daytime: 0.26 Btu maximum.
9. Shading Coefficient: 0.29.
10. Solar Heat Gain Coefficient (SHGC): 0.26 minimum and 0.40 maximum.
11. Light to Solar Gain (LSG): 2.18.
12. Provide safety glazing labeling where required.
13. Locations:
    a. Aluminum-framed storefronts.

END OF SECTION

SECTION 089000 – LOUVERS – SCHEDULE B ONLY

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This section includes formed and extruded aluminum louvers.

1.2 QUALITY ASSURANCE

A. Performance Requirements: Where louver is indicated to comply with specific performance requirements, provide unit whose performance ratings have been determined in compliance with AMCA Standard 500.

B. Comply with SMACNA Architectural Sheet Metal Manual recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.

C. Field Measurements: Verify size, location, placement, and rough opening size of louver unit prior to fabrication, wherever possible.

D. Shop Assembly: Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints, and field assembly of units. Preassemble units in shop to greatest extent possible and disassemble only as necessary for shipping and handling limitations. Clearly mark unit for reassembly and coordinate.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes. Product data shall include sizes, free area, as well as velocity, pressure drop, acoustic performance (where required), and water penetration at airflow rate specified in louver schedule.

B. Shop Drawings: Submit Shop Drawings for fabrication and erection of louver unit and accessories. Include plans, elevations, and details of sections, and connections to adjoining work. Indicate materials, finishes, fasteners, joinery, and other information to determine compliance with specified requirements.

C. Samples: Submit three samples, 6 inches square, of each required aluminum finish. Prepare samples on metal of the same gage and alloy to be used in work. Where normal color and texture variations are to be expected, include two or more units in each sample showing the limits of such variations.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Stainless Steel Sheet: ASTM A167 and AISI Type 316.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by the metal producer to provide the required finish.

C. Aluminum Extrusions: ASTM B211, Alloy 6063-T52.

D. Interior acoustical material to be fiberglass insulation protected by a woven fire-retardant 100 percent polyester sheeting.

E. Fastenings: Use same material as items fastened, unless otherwise indicated. Fasteners shall be 316 stainless steel. Provide types, gages, and lengths to suit unit installation conditions.

F. Anchors and Inserts: Use nonferrous metal or hot dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance.

G. Bituminous Paint: SSPC-Paint 12 (Cold-applied asphalt mastic).

2.2 FABRICATION, GENERAL

A. Provide louver, and accessories of design, materials, sizes, depth, arrangement, and metal thicknesses indicated, or if not indicated, as required for optimum performance with respect to airflow; water penetration; air leakage, where applicable (for adjustable units, if any); strength; durability; and uniform appearance, as suited to applications shown and intended use.

B. Join frame members to one another and to stationary louver blades by welding, except where indicated otherwise or where field bolted connections between frame members are made necessary by size of louvers. Maintain equal blade spacing including separation between blades and frames at head and sill to produce a uniform appearance.

C. Approved Manufacturers:

1. Greenheck Fan Corporation
   Scholfield, WI
   (715) 359-6171

2. Cecso Products
   Florence, KY
   (859) 538-3450

3. Construction Specialties, Inc.
   San Marcos, CA
   (800) 631-7379

2.3 LOUVER SCREEN

A. General:

1. Provide louvers per Louver Schedule at the end of this section.
2. Provide louver with louver screen complying with the following requirements:

    a. Screen Location: Interior face, unless otherwise indicated.
    b. Screening Type: Bird screening, unless otherwise indicated.
    c. Filters shall be installed on all intake louvers.

        1) See 230000, Heating, Ventilating, and Air Conditioning (HVAC) for filter and housing requirements.

B. Secure screen to louver frames with stainless steel machine screws, spaced at each corner and at 12 inches on center.

C. Louver Screen Frame:

1. Fabricate screen frame with mitered corners to louver size indicated and to comply with the following requirements:

    a. Metal:

        1) Same kind and form of metal as indicated for louver frames to which screens are attached.
        2) Reinforce extruded aluminum screen frames at corners with clips.

2. Finish: Same finish as louver frame to which louver screen is attached.
3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.
4. All intake louvers require air filters and hosing per 230000 2.2 F.

D. Louver Screening for Aluminum Louver:

1. Fit aluminum louver screen frame with screening covering louver opening and complying with the following requirements:

    a. All louvers to be furnished with 3/4-inch flattened expanded mesh, aluminum bird screen with a .051-inch-thick extruded aluminum frame.

2.4 AIRFOIL BLADE ACOUSTIC WALL LOUVER

A. General:

1. Fixed louver shall be Greenheck Model AFA-801 or equal.
2. 8-inch frame depth.

B. Standard Construction:

1. Frame shall be constructed of heavy gauge formed aluminum, 8 inch x 0.080 inch nominal wall thickness.
2. Blades shall be airfoil style, heavy gauge formed aluminum 0.080 inch nominal wall thickness, positioned at 45 degrees on approximately 6 inch centers.
3. Acoustical material shall be fiberglass insulation.

C. Acoustic performance shall comply with the following:

Octave Band Center Frequency, Hz:	2	3	4	5	6	7	STC
Frequency (Hz):	125	250	500	1000	2000	4000	8
Transmission Loss (dB):	4	2	4	8	14	9	
Free Field Noise Reduction (dB):	10	8	10	14	20	15	

D. Where specified in the Louver Schedule at the end of this section, that sound dampening is not required, fiberglass acoustic insulation may be omitted from louver.

E. Louvers shall not allow water penetration below 879 FPM free area velocity.

F. Finish: Louvers finish shall be “Kynar”; color to be selected by the Engineer.

2.5 LOUVER ACCESSORIES

A. Anchors and Fasteners: Stainless steel.

B. Flashings: Match louver frame.

C. Isolation Tape: Tremco 440, 3M EC1202, or Presstite 579.6.

D. Isolation Paint: ASTM D1187, bituminous coating.

E. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

2.6 LOUVER SOURCE QUALITY CONTROL

A. Factory Performance Tests:

1. Air flow versus pressure loss.
2. Rain penetration versus velocity.
3. Air infiltration leakage through closed operating louvers.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Check openings to ensure that dimensions conform to Drawings.

B. Ensure that openings are free of irregularities that would interfere with installation.

C. Do not install louvers until defects have been corrected.

3.2 INSTALLATION

A. Install louvers as shown on approved Shop Drawings.

B. Coordinate with heating or ventilating ductwork to be connected.

C. Follow manufacturer's installation recommendations.

D. Installed Louvers: Capable of resisting a wind load of 30 pounds per square foot.

E. Separate aluminum from other metals with isolation tape or paint.

F. Repair or replace items with finish damage.

3.3 ADJUSTING AND CLEANING

A. Adjust louvers so moving parts operate smoothly.

B. Clean debris from louver after installation.

C. Strip protective finish coverings.

Table 10200-1 Louver Schedule

Room Location	Description	Size (W x H)	Air Flow (cfm)	Velocity (fpm)	Free Area (ft)	Max Static Pressure Drop (in w.c.)	Louver Model	Remarks
Storage Room	Exhaust	24″ x 24″	600	625	.96	.05	Model AFA-801	Does not require acoustic filler
Electrical Room	Intake	16″ x 32″	600	750	.80	.05	Model AFA-801	Does not require acoustic filler
Mechanical Room	Intake	40″ x 32″	2,400	1000	2.4	.10	Model AFA-801	
Mechanical Storage Room	Exhaust	40″ x 32″	2,400	1000	2.4	.10	Model AFA-801	

Note: All louvers shall be Kynar coated aluminum.

END OF SECTION 089000

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed, extruded-aluminum louvers.
   2. Fixed, formed-metal louvers.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., axis of blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., axis of blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing in accordance with AMCA 500-L.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories indicated on Drawings to comply with performance and design criteria. Include the following information:
   1. Analysis data and calculations showing compliance with structural and seismic performance requirements.
   2. Plans, elevations, sections, details, and attachments to other Work.
   3. Frame profiles, blade profiles, angles, and spacing.
   4. Weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
   5. Mullion profiles and locations.
   6. Submit Shop Drawings that have been engineered and certified by professional engineer licensed in the State in which Project is located.
      a. Include seal and signature of professional engineer on Shop Drawings.

C. Samples for Verification: For each type of metal finish required.

D. Delegated-Design Submittal: For fixed louvers, indicating compliance with performance and design criteria.
   1. Include analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For fixed louver manufacturer.
2. For professional engineer indicating experience with providing delegated-design engineering services of the kind indicated.
    a. Include documentation that engineer is licensed in state in which Project is located.

B. Manufacturer's instructions for handling, erection procedures, sequencing, administration of screws and attachments, and recommended tools and tolerances.

C. Sample Warranties: For manufacturer's special warranties.

1.5 QUALITY ASSURANCE

A. Delegated-Design Engineer Qualifications: Professional engineer experienced in providing delegated-design engineering services of the kind indicated and is legally qualified to practice in state where Project is located.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.2.Use welders certified by AWS and State project is located for structural welding, and who have undergone recertification in the last 12 months.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, louvers, and other manufactured items so as not to be damaged or deformed. Package louvers for protection during transportation and handling.

B. Retain strippable protective covering on metal panels during installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of louvers that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
1. Deterioration includes the following:
    a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE CRITERIA

A. Delegated-Design: Engage a qualified professional engineer, as defined in Section 013573 – Delegated-Design Procedures, to design fixed louvers, including attachment to building construction.

B. Structural Performance: Louvers shall withstand effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to face of building.
1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward unless indicated otherwise on Drawings.

C. Seismic Performance: Louvers, including attachments to other construction, shall withstand effects of earthquake motions determined according to ASCE/SEI 7. Refer to structural Drawings for the following:
1. Project Site Class.
2. Project Seismic Risk Zone.
3. Project Seismic Design Category.
4. Project Design Spectral Response Acceleration (Sds).

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

F. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
a. Ruskin Company: Model ELF445DXH.
b. Approved substitution from one of the following:
1) Airline Louvers.Airolite Company, LLC .American Warming and Ventilating.Construction Specialties, Inc.
5) Greenheck Fan Corporation.
6) Industrial Louvers, Inc.Reliable Products, Inc.
8) Ruskin Company..
2. Louver Depth: 4 inches.
3. Blade Profile: Plain blade without center baffle; 45 degree angle.
4. Blade Spacing: 4 inches on center.
5. Frame and Blade Nominal Thickness: Not less than 0.125 inch for blades and frames.
6. Mullion Type: Fully recessed.
7. Louver Performance Ratings:
a. Free Area: Not less than 52 percent for 48 inch by 48 inch louver.
b. Free Area Size: 8.34 sq. ft. nominal.
c. Air Performance:
1) Air Flow Through Free Area: Maximum 1,075 fpm free-area intake velocity.
2) Static Pressure Drop (Intake): Not more than 0.225 inch wg.

3) Water Penetration: Maximum of 0.01 oz./sq. ft. of free area at maximum 1,075 fpm free-area intake velocity when tested for 15 minutes.
4) Air Flow: 8,966 cfm.

8. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. Provide screen at each exterior louver.
1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening, except where insect screening is indicated.

B. Secure screen frames to louver frames with screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches on center.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached.

D. Louver Screening for Aluminum Louvers:
1. Bird Screening: Aluminum, 1/2 inch square mesh, 0.063inch wire.
2. Bird Screening, Flattened, Expanded Aluminum: 3/4 by 0.051 inch thick.
3. Insect Screening: Aluminum, 18 by 16 mesh, 0.012 inch wire.

E. Louver Screening for Galvanized-Steel Louvers:
1. Bird Screening: Galvanized steel, 1/2 inch square mesh, 0.040 inch wire.
2. Insect Screening: Galvanized steel, 18-by-14 mesh, 0.011 inch wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. [Galvanized-Steel Sheet: ASTM A653, G60 zinc coating, mill phosphatized.]

D. Fasteners: Use types and sizes to suit unit installation conditions.
1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
4. For color-finished louvers, use fasteners with heads that match color of louvers.

E. Postinstalled Fasteners for Concrete: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to design load, as determined by testing according to ASTM E488 conducted by a qualified testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.6 FABRICATION

A. Factory-assemble louvers to minimize field splicing and assembly.
1. Disassemble units as necessary for shipping and handling limitations.

a. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
2. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated where indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches on center, whichever is less.
1. Exterior Corners: Provide manufacturer's standard.

G. Provide subsills made of same material as louvers for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 FINISHES, GENERAL

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary, protective covering before shipping.

2.8 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.9 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation:
1. Clean surfaces with nonpetroleum solvent, so surfaces are free of oil and other contaminants.
2. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
3. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A780.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction.
   1. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent Work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required.
   1. Seal louver flanges directly to plane of weather resistant barrier with recommended flashings and sealants.
   2. Comply with Section 079200 – Joint sealants for sealants applied during louver installation.

3.4 REPAIR

A. Restore louvers damaged during installation and construction so no evidence remains of corrective Work. If results of restoration are unsuccessful, as determined by Architect.
   1. Remove damaged units and replace with new units.
   2. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as louvers are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of louver installation, clean exposed louver surfaces as recommended by louver manufacturer to remove fingerprints and soil during construction period.
   1. Maintain in a clean condition during construction.
   2. Do not let soil accumulate during construction period.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gypsum board panels.
   2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other Work.

C. Samples for Verification: For the following products:
   1. Trim Accessories: Full-size Sample in 12 in. long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 3 years of documented experience.

B. Mockups: Comply with Section 014339 – Mockups.
   1. Mockup Sizes:
      a. Minimum 100 sq. ft. in surface area for each level of gypsum board finish that will be exposed to view.
   2. Apply or install final decoration indicated, including painting, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   5. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage.
   1. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.
   1. Wet or moisture damaged panels will be discolored, sagging, or irregular shaped.

2. Mold damaged panels will have fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated per ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated per ASTM E90 and classified per ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X (GYP.BD-11X): ASTM C1396.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. American Gypsum: FireBloc Type X Gypsum Wallboard.
      b. CertainTeed Gypsum; Saint-Gobain: Type X Drywall Panel.
      c. Georgia-Pacific Gypsum LLC: ToughRock Fireguard X.
      d. National Gypsum Company: Gold Bond Brand Fire-Shield.
      e. PABCO Gypsum: PABCO FLAME CURB Type X.
      f. USG Corporation: USG Sheetrock Brand Firecode X or EcoSmart Panels Firecode X.
      g. Approved substitution.
   2. Thickness: 5/8 inch.
   3. Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Gypsum Board, Lightweight, Type X (GYP.BD-11L): ASTM C1396.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. American Gypsum: LightRoc.CertainTeed Gypsum; Saint-Gobain: Easi-Lite 30.Georgia-Pacific Gypsum LLC: ToughRock Lite-Weight Fire-Rated Gypsum Board.
      d. National Gypsum Company: Gold Bond High Strength Fire-Shield 60 Gypsum Board.
      e. USG Corporation: USG Sheetrock Brand Ultralight Panels Firecode X.
      f. Approved substitution.
   2. Thickness: 5/8 inch.
   3. Edges: Tapered and featured (rounded or beveled) for prefilling.
   4. Sustainability:
      a. Greenguard Gold Certified.

C. Mold-Resistant Gypsum Board (GYP.BD-15): ASTM C1396; with moisture- and mold-resistant core and paper surfaces.
   1. Products: Subject to compliance with requirements, provide one of the following:

a. American Gypsum: M-Bloc Type X with Mold and Moisture Resistance.
b. CertainTeed Gypsum; Saint-Gobain: M2Tech Moisture and Mold Resistant Gypsum Board.
c. Georgia-Pacific Gypsum LLC: ToughRock Fireguard X Mold-Guard Gypsum Board.
d. National Gypsum Company: Gold Bond XP Fire-Shield Gypsum Board.
e. PABCO Gypsum: PABCO MOLD CURB.
f. USG Corporation: USG Sheetrock Brand Mold Tough Firecode X Panels.
g. Approved substitution.

2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board (GYP.BD-41): ASTM C1178, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Gypsum; Saint-Gobain: GlasRoc Tile Backer.
b. Georgia-Pacific Gypsum LLC: DensShield Tile Backer.
c. National Gypsum Company: Gold Bond eXP Tile Backer.
d. PABCO Gypsum: PABCO GLASS INTERIOR.
e. USG Corporation: USG Durock Glass-Mat Tile Backerboard.
f. Approved substitution.
2. Core: 5/8 inch, Type X.
3. Mold Resistance: Score of 10 as rated per ASTM D3273.
4. Core: 5/8 inch, Type X.
5. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

B. Cementitious Backer Units (GYP.BD-43): ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:
a. FinPan, Inc.: ProTECH [Util-A-Crete] Concrete Backer Board. James Hardie Building Products, Inc.: Hardiebacker 500 Cement Board. National Gypsum Company: PermaBASE Cement Board. USG Corporation: DUROCK Cement Board. Approved substitution.
2. Thickness: 5/8 inch.
3. Face Finish:
a. Unexposed Face: Smooth.
b. Exposed Face: Cementitious finish.
4. Maximum framing spacing is 16 inches on center.
5. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
a. Cornerbead.
b. Cornerbead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.

d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. As required for other conditions indicated on Drawings.

3. Expansion (Control) Joints:
   a. Application: Interior gypsum board walls and ceilings.
   b. Where fire control joints are indicated, provide fire rated sealant behind control joint.
   c. Where sound control joints are indicated, provide acoustical sealant behind control joint.

B. Expansion (Control) Joints: Galvanized or aluminum-coated steel sheet or rolled zinc control joints. Staple or screw grounds to panel face.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Alabama Metal Industries Corporation (AMICO).
      b. Armstrong World Industries, Inc.
      c. Fry Reglet Corporation.
      d. Gordon Incorporated.
      e. USG Corporation.
      f. Approved substitution.
   2. Application: Interior gypsum board walls and ceilings.
   3. Where fire and sound control joints are indicated, provide fire rated seal behind control joint.

C. Compression-Type Expansion (Control) Joints (DB-1): 2-piece extruded aluminum control joints with compression seal to prevent cracking of drywall joints caused by minor settling of building.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Fry Reglet Corporation: DRM-50-75 2-PC.
      b. Approved substitution.
   2. Reveal Dimension: 3/4 inch.
   3. Ground: 1/2 inch.
   4. Movement: 3/8 inch.
   5. Finish: Manufacturer's standard powder coat.
      a. Color: White or as indicated in Materials Legend on Drawings.
   6. Application: Interior gypsum board walls and ceilings where indicated on Drawings.
   7. Where fire and sound control joints are indicated, provide fire rated seal behind control joint.

D. Exterior Trim: ASTM C1047.
   1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (Control) Joint: 1-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

E. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Flannery, Inc.
      b. Fry Reglet Corporation.
      c. Gordon Interior Specialties Division, Gordon, Inc.
      d. Pittcon Industries.
      e. Approved substitution.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
4. REVEAL-1: F-type reveal molding.
   a. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      1) Fry Reglet: DRMF-625-75.
      2) Approved substitution.
   b. Size: 3/4 inch wide by 5/8 inch deep.
   c. Finish: Clear anodized, medium etch.

2.6 JOINT TREATMENT MATERIALS

A. Comply with ASTM C475.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.
3. Cementitious Backer Units: 2 inch wide, alkali-resistant fiberglass mesh joint reinforcement tape.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
1. Metal Studs: Flat head bugle, self-tapping, fine thread Type S screws that penetrates steel studs a minimum 0.38 in.
   a. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. Wood Studs: Flat head bugle, Type W wood screws, 1 5/8 inch long, that penetrates wood studs a minimum 0.63 in.
3. For fastening cementitious backer units, use screws of type and size recommended by cementitious panel manufacturer.

C. Thermal Insulation: Refer to Section 072100 – Thermal Insulation.

D. Vaper Retarders: Refer to Section 072100 – Thermal Insulation.

E. Sound Attenuation Insulation: Refer to Section 098100 – Acoustical Insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Evaluation and Assessment:
1. After installation of sound control components, and before installation of gypsum board, allow access to Architect to verify installation of control components.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize number of abutting end joints and to avoid abutting end joints in central area of each ceiling.
1. Stagger abutting end joints of adjacent panels not less than 1 framing member.

C. Install panels with face side out.
1. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels.
2. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints.
1. Do not place tapered edges against cut edges or ends.
2. Stagger vertical joints on opposite sides of partitions.
3. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8 inch wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors.

1. Provide 1/4 to 1/2 inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed.
2. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing with floating internal corner construction.
1. Do not attach gypsum panels across flat grain of wide-dimension lumber, including floor joists and headers.
2. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

3.3 INSTALLATION OF STC-RATED ASSEMBLIES

A. Comply with Section 098100 – Acoustical Insulation, for sound attenuation insulation products and installation.

B. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Do not install gypsum panel layers continuous between 2 adjacent rooms.

D. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant.

E. Install acoustical sealant at both faces of partitions at perimeters and through penetrations.

F. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.4 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
1. Standard and lightweight Type X:
   a. Typical at walls, ceilings, and other gypsum board locations unless other types are indicated.
2. Ceiling Type: Ceiling and soffit surfaces unless indicated otherwise.
3. Mold-Resistant Type:
   a. Walls subject to moisture exposure such as kitchens, toilets, behind drinking fountains, utility areas, janitorial rooms, and as indicated on Drawings.

B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence.
2. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least 1 stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
4. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
5. Fastening Methods: Fasten base layers and face layers separately to supports with screws; fasten face layers with adhesive and supplementary fasteners if required to comply with fire-rated assembly design.

3.5 INSTALLATION OF TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels:
1. Comply with manufacturer's written installation instructions.
2. Install with 1/4 inch gap where panels abut other construction or penetrations.
3. Applications:
   a. Tiled walls at showers and where indicated.
   b. Tiled walls subject to moisture exposure where cementitious backer units are not required.
   c. Walls scheduled to receive EP-1 epoxy wall coating.
   d. Restroom wall and ceiling applications.
   e. Ceilings in shower areas.

B. Cementitious Backer Units: ANSI A108.1.
1. Applications:
   a. Tiled walls at showers, tubs, and where indicated.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLATION OF TRIM ACCESSORIES

A. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim per manufacturer's written instructions.

B. Control (Expansion) Joints: Install control joints in accordance with ASTM C840, and in specific locations approved by Architect for visual effect.
1. Minimum Control Joint Spacing: 30 feet on center each way.
2. Minimum Joint Spacing Between Panels: 1/4 inch.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. Bullnose Bead: Use at outside corners or where indicated.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where indicated.
   5. U-Bead: Use at exposed panel edges or where indicated.
   6. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Partition Gap Closures:
   1. Install end cap accessory to ends of gypsum board partitions receiving partition gap closures.
   2. Comply with Finish of Gypsum Board Article for finishing flanges of end cap accessory.
   3. Install at partition gap closure system at vertical junctures between gypsum board partitions and window walls, glazing, or curtain walls as indicated on Drawings.

3.7 FINISHING OF GYPSUM BOARD

A. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
   1. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C840, for applications indicated: Level 0 Applications:
   a. Where taping, finishing, or accessories not required.
   2. Level 1 Applications:
      a. Plenum areas above ceilings.
      b. Areas where assembly would generally be concealed.
      c. Building service corridors, utility areas, and other areas not open to public view.
      d. Panels surfaces receiving plastic paneling (FRP).
      e. Attics.
   3. Level 2 Applications:
      a. Behind cabinetry.
      b. Panels surfaces receiving tile.
   4. Level 4 Applications:
      a. Panels surfaces exposed to view unless indicated otherwise.
      b. Panels surfaces receiving flat paints.
      c. Panels surfaces receiving light-textured finishes.
   5. Leve 5 Applications: Level 5 finish requires a skim coat finish.
      a. Panels surfaces receiving semi-gloss, gloss, and enamel flat paints.
      b. Panels surfaces where critical lighting conditions occur.

E. Primers: Refer to Section 099000 –Painting and Coating for types and application to surfaces.

F. Glass-Mat Faced Panels: Ceramic tile finish

G. Cementitious Tile Backer Units: Finish according to manufacturer's written instructions.

3.8 INSTALLATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage per texture finish manufacturer's written recommendations.

3.9 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before installing gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect 7 days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
      e. Installation of mechanical system control-air tubing.

B. Installation of ceiling support framing.

3.10 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of construction period.

C. Remove and replace panels that are wet, moisture damaged, or mold damaged.

3.11 IDENTIFICATION OF FIRE AND SMOKE PARTITION

A. Provide permanently applied lettering on partitions, either labels or paint with stencils, above suspended ceilings, to identify locations of fire and smoke walls.
   1. Lettering Size: Minimum of 1 inch high and 10 feet on center.
   2. Lettering Identification: On appropriate partitions, provide the following lettering as identified on Code Analysis Drawings:
      a. SMOKE BARRIER – 1 HOUR FIRE RATING
      b. FIRE SEPARATION & SMOKE BARRIER – 2 HOUR FIRE RATING
      c. FIRE WALL – 2 HOUR FIRE RATING
      d. FIRE WALL – 1 HOUR FIRE RATING

END OF SECTION

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ceramic mosaic tile.
2. Porcelain tile.
3. Glazed wall tile.
4. Thresholds.
5. Waterproof and crack isolation membranes.
6. Setting material.
7. Grout materials.
8. Finish and protection strips.

1.2 DEFINITIONS

A. Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Large Format Tile: Tile with at least one edge 15 inches or longer.

D. Module Size: Actual tile size plus joint width indicated.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct meeting at Project site.
1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification:
1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal finish and protection strips in 6 inch lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of product, signed by product manufacturer.

C. Product Test Reports:
1. Tile-setting and -grouting products.
2. Certified porcelain tile.
3. Slip-resistance test reports from qualified independent testing agency.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from same production run as products installed and that are packaged with protective covering for storage and identified with labels describing contents, to Owner.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated, but not less than 1 full carton of each type of unit.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated, but not less than 1 package.
   3. Floor Sealer: Minimum of 1 gallon in manufacturer's unopened, labeled container. Include instructions for use.
   4. Cleaning Agent: Minimum of 5 gallons in unopened container, clearly labeled with manufacturer's logo and instructions for use.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing tile installations and finishing comparable in scope of this Project, with minimum 3 years of documented experience.
   1. Installer employs at least 1 Installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of membranes.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
   1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Thresholds.
   2. Waterproof and crack isolation membrane.
   3. Metal finish and protection strips.
   4. Obtain waterproof and crack isolation membranes, except for sheet products, from manufacturer of setting and grouting materials.

2.2 REGULATORY REQUIREMENTS

A. Accessibility Standard:
   1. Comply with applicable provisions in DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot.
   1. Do not coat unexposed tile surfaces.

2.4 TILE PRODUCTS

A. Ceramic Tile Type (CT-1): Factory-mounted, glazed, ceramic mosaic tile.
   1. Basis-of-Design Products: Subject to compliance with requirements, provide the following:
      a. TL-1 as indicated in Material and Finish Legend on Drawings.
      b. Approved substitution from one of the following:
         1) American Olean Tile Co.
         2) Crossville, Inc.
         3) Daltile Corporation.
         4) Emser Tile LLC.
         5) Royal Mosa.
         6) Summitville Tiles, Inc.
         7) United States Ceramic Tile Company.
   2. Composition: Porcelain Vitreous or impervious natural clay or porcelain.
   3. Certification: Porcelain tile certified by Porcelain Tile Certification Agency.
   4. Module Size: 2 by 2 inches.
   5. Nominal Thickness: 1/4 inch.
   6. Face: Plain with cushion edges.
   7. Surface: Slip resistant, with abrasive admixture.

8. Dynamic Coefficient of Friction: Not less than 0.42.
9. Finish: Mat, opaque glaze.
10. Tile Color and Pattern: Selected by Architect from manufacturer's full range.
11. Grout Color: Selected by Architect from manufacturer's full range.

B. Ceramic Tile Type (CT-2): Glazed wall tile.
1. Basis-of-Design Products: Subject to compliance with requirements, provide the following:
   a. TL-1 as indicated in Material and Finish Legend on Drawings.
   b. Approved substitution from one of the following:
      1) American Olean Tile Co.
      2) Crossville, Inc.
      3) Daltile Corporation.
      4) Emser Tile.
      5) Summitville Tiles, Inc.
      6) United States Ceramic Tile Company.
2. Module Size:
   a. Field Tile: 4-1/4 by 4-1/4 inches.
   b. Accent Tile: 6 by 12 inches
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch.
5. Face: Plain with cushion edges.
6. Finish: Mat, opaque glaze.
7. Tile Color and Pattern: Selected by Architect from manufacturer's full range.
8. Grout Color: Selected by Architect from manufacturer's full range.

2.5 THRESHOLDS

A. Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Solid Surface: Homogeneous-filled plastic resin complying with ISFA-02-01.
1. Type: Provide Standard type.
2. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.6 TILE BACKING PANELS

A. Tile Backer Units: Specified in Section 092900 – Gypsum Board.

2.7 WATERPROOF AND CRACK ISOLATION MEMBRANES

A. Manufacturer's standard products that comply with ANSI A118.10 and ANSI A118.12; and are recommended by manufacturer for applications indicated.
1. Include reinforcement and accessories recommended by manufacturer.

B. Waterproofing Membrane at showers
1. 1) LATICRETE International, Inc; 9235 Waterproofing Membrane: www.laticrete.com/#sle.
2. 2) MAPEI Corporation; Mapelastic HPG: www.mapei.com.

3. 3) Custom Building Products; RedGard Waterproofing and Crack Prevention Membrane: www.custombuildingproducts.com.

C. Thin set installation
   1. Crack Isolation Membrane:
      a. Custom Building Products "Crack Buster Pro" self-adhered Crack Prevention Mat Underlayment
   2. Waterpproof / Cleavage Membrane For Thin-Bed Systems
      a. Dal-Tile Corporation "Dal-Seal TS" 0.030 inch chlorinated poly-ethylene (CPE)
      b. Laticrete 9235" liquid rubber membrane with reinforcing fabric,
      c. TEC Specialty Products "TripleFlex" cement based, trowel applied, waterproofing/crack isolation membrane
   3. Seaming Solvent for Chlorinated Poly-Ethylene Membrane: NobelWeld 100 CPE solvent welding liquid or Xylene

D. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer that complies with ANSI A118.10 as waterproof membrane and ANSI A118.12 as crack isolation membrane.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ARDEX Americas: Ardex S 1-K.
      b. Custom Building Products: RedGard Waterproofing and Crack Prevention Membrane.H. B. Fuller Construction Products Inc: TEC HydraFlex Waterproofing Crack Isolation Membrane.Laticrete International, Inc.: Hydro Ban.
      e. MAPEI Corporation: Mapelastic AquaDefense.
      f. Parex USA, Inc.: Merkrete Hydro-Guard 2000.
      g. PROFLEX Products, Inc.: Hydra-Seal.Approved substitution.
   2. Crack Resistance: In-plane cracks up to 1/8 inch wide.
   3. Application:
      a. Installation of large format tile where waterproofing membrane is indicated.

E. Fluid-Applied Membrane, Fabric-Reinforced: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement that complies with ANSI A118.10 as waterproof membrane, ANSI A118.12 as crack isolation membrane, and IAPMO approved as a shower receptor.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ARDEX Americas: Ardex S 1-K with Ardex SK Mesh.Custom Building Products: 9240 Waterproofing and Anti-Fracture Membrane.
      c. H. B. Fuller Construction Products Inc: TEC HydraFlex Waterproofing Crack Isolation Membrane.Laticrete International, Inc.: 9235 Waterproof Membrane.MAPEI Corporation: Mapelastic AquaDefense with MAPEI Reinforcing Fabric.
      f. Parex USA, Inc.: Merkrete Hydro-Guard 2000 with Merkrete Fabric Type 2.
      g. PROFLEX Products, Inc.: Hydra-Seal.Approved substitution.
   2. Crack Resistance: In-plane cracks up to 1/8 inch wide.
   3. Shower Receptors: Comply with membrane manufacturer's written recommendations for thickness of membrane.
   4. Application:
      a. Restroom floors over conditioned spaces.
      b. Where large format tile is scheduled.
      c. Shower rooms.

2.8 UNCOUPLING MEMBRANE

A. Uncoupling Membrane: Corrugated, high-density polyethylene membrane with a grid structure of square or other shaped cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside.
   1. Products: Subject to compliance with requirements, provide the following:
      a. ARDEX Americas: Ardex UI 740 Flexbone.
      b. Custom Building Products: RedGard Uncoupling Mat.
      c. Laticrete International, Inc.: Laticrete Strata_Mat.
      d. MAPEI Corporation: Mapeguard UM.
      e. Parex USA, Inc.: Merkrete Fracture Guard UCM 200.PROFLEX Products, Inc.: PROFLEX UCM.Schluter Systems L.P.: DITRA.
      h. Approved substitution.
   2. Nominal Thickness: Nominal 0.125 inch.
   3. Description: Allows for separation between membrane and mortar adhering tile to membrane when subjected to excessive substrate movement.
   4. Application:
      a. Installation of large format tile where waterproofing membrane is indicated.

2.9 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ARDEX Americas: Ardex X 5.
      b. Custom Building Products: VersaBond Professional Thin-Set Morta
      c. Laticrete International, Inc.: 4-XLT or LHT.
      d. MAPEI Corporation: Ultraflex 2.Parex USA, Inc.: Merkrete 720 Dustless LHT Mortar.
      f. Approved substitution.
   2. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
   3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.
   4. Applications:
      a. Thin Set Type: 3/16 inch thick application for tile with no edge greater than 15 inches.
      b. Medium Set Type: 1/2 to 5/8 inch thick application for tile with at least 1 edge greater than 15 inches.

B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ARDEX Americas: ARDEX X 65 LITE.
      b. Custom Building Products: ProLite Premium Large Format Tile Mortar.
      c. H. B. Fuller Construction Products Inc.: TEC TotalFlex 150 Universal Polymer-Modified Mortar.
      d. Laticrete International, Inc.: 4-XLT.
      e. MAPEI Corporation: Ultraflex LFT.
      f. Parex USA, Inc.: Merkrete 855 XXL.
      g. Approved substitution.
   2. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site
   3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15.

4. Application:
   a. Medium Set Type: 1/2 to 5/8 inch thick application for tile with at least 1 edge greater than 15 inches.

C. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thinset): ANSI A118.11.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. ARDEX Americas: ARDEX X 77 MICROTEC Fiber Reinforced Tile and Stone Mortar.
   b. Custom Building Products: FlexBond Premium Crack Prevention Thin-set Mortar.Laticrete International, Inc.: 257 Titanium.MAPEI Corporation: Ultraflex RX.Parex USA, Inc.: Merkrete 750 RS Thin Set.
   f. Approved substitution.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. Application:
   1) Setting glass tile in non-submerged applications
   2) Vertical or horizontal applications of building facades
   3) Exterior, horizontal balconies and terraces.

D. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3. 2- or 3-component high solids epoxy.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. ARDEX Americas: ARDEX WA High Performance, 100% Solids Epoxy Grout and Adhesive.Custom Building Products: EBM-Lite Premium Epoxy Bonding Mortar — 100 percent Solids.
   c. Laticrete International, Inc.: Spectralock Pro Premium Grout.
   d. MAPEI Corporation: Kerapoxy.
   e. Parex USA, Inc.: Merkrete Pro Epoxy.Approved substitution.
2. Applications:
   a. Areas subject to moisture such as kitchens and showers.
   b. For moisture-sensitive natural stone, cement, or agglomerate tile.
3. Sustainability:
   a. Greenguard Gold Certified or Red List Free.
4. Verify adhesives have a VOC content of 65 g/L or less.
5. Verify adhesive complies with testing and product requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
6. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F respectively and certified by manufacturer for intended use.

2.10 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6. Polymer modified, cement-based, sanded grout.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. ARDEX Americas: ARDEX FH Sanded Floor and Wall Grout.
   b. Custom Building Products: Prism Ultimate Performance Grout.
   c. Laticrete International, Inc.: Permacolor Grout.MAPEI Corporation: Ultracolor Plus FA.
   e. Parex USA, Inc.: Merkrete ProGrout. Approved substitution.
2. Polymer Type: Contractor may provide either of the following polymer type mortar mixes:

a. Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
b. Acrylic resin or styrene-butadiene-rubber in liquid-latex form for addition to prepackaged dry-grout mix.

3. Color: As selected by Architect from manufacturer's full color range.
4. Joint Widths: 1/8 to 1/2 inch.
5. Applications:
   a. Floor and wall joints in tile not indicated to have unsanded grout.

B. High-Performance Tile Grout: ANSI A118.7. Polymer modified, cement-based, unsanded grout. Products: Subject to compliance with requirements, provide one of the following:
   a. ARDEX Americas: ARDEX FG-C MICROTEC Unsanded Grout.
   b. Custom Building Products: Polyblend Non-Sanded Grout.
   c. Laticrete International, Inc.: Permacolor Select NS Grout Base.MAPEI Corporation: Ultracolor Plus FA.
   e. Parex USA, Inc.: Merkrete Integra. Approved substitution.
2. Polymer Type: Contractor may provide either of the following polymer type mortar mixes:
   a. Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
   b. Acrylic resin or styrene-butadiene-rubber in liquid-latex form for addition to prepackaged dry-grout mix.
3. Color: As selected by Architect from manufacturer's full color range.
4. Joint Widths: Up to 1/8 inch.
5. Applications:
   a. Floor and wall joints in glass tile [natural stone tile].
   b. Floor and wall joints indicated to have unsanded grout.

C. Water-Cleanable Epoxy Grout: ANSI A118.3. 2- or 3-component high solids epoxy grout.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. ARDEX Americas: ARDEX WA High Performance, 100 percent Solids Epoxy Grout and Adhesive.Custom Building Products: CEG-Lite 100 Percent Solids Commercial Epoxy Grout.Laticrete International, Inc.: Spectralock Pro Premium Grout.MAPEI Corporation: Kerapoxy.
   e. Parex USA, Inc.: Merkrete Pro Epoxy.Approved substitution.
2. Applications:
   a. Areas subject to moisture such as kitchens and showers.
   b. For moisture-sensitive natural stone, cement, or agglomerate tile.
3. Sustainability:
   a. Greenguard Gold Certified or Red List Free.
4. Verify adhesives have a VOC content of 65 g/L or less.
5. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F respectively, and certified by manufacturer for intended use.
6. Color: As selected by Architect from manufacturer's full color range.

D. Water-Cleanable Single-Component Grout: ANSI A118.6 premixed, UV-stabile, water-based, mildew-resistant, urethane or polymer modified grout.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bostik, Inc.: TruColor RapidCure Pre-Mixed Grout.
   b. Custom Building Products: Fusion Pro Single Component Grout.
   c. Laticrete International, Inc.: Spectralock 1 Pre-Mixed Grout.

d. MAPEI Corporation: Flexcolor Design.
e. Approved substitutions.
2. Compliance: Meets or exceeds requirements of ANSI A118.3.
3. VOC Content: 65 g/L or less.
4. Joint Widths: 1/16 to 1/2 inch.
5. Applications:
a. Interior floor and wall tile installations

E. Provide other materials, not specifically described but required for a complete and proper installation, subject to approval of Architect.

2.11 MISCELLANEOUS MATERIALS

A. Trowelable Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ARDEX Americas: Ardex SD-P Rapid.
b. Custom Building Products: SpeedSlope Rapid Setting Sloping Mortar.
c. Laticrete International, Inc.: L&M Duracrete.
d. MAPEI Corporation: Planipatch.
e. Parex USA, Inc.: Merkrete Underlay RS
2. Compressive Strength: ASTM C109; 3,500 psi minimum at 28 days.
3. Flexural Strength: ASTM C348; 1,000 psi minimum at 28 days.
4. Set Time: ASTM C191: no more than 1 hour initial.

B. Metal Transition Strips: Angle or L-shaped transition and edging strips, in height to match tile and setting-bed thickness and adjacent material thicknesses, designed specifically for applications indicated below and on Drawings.
1. Basis-of-Design Products: Where manufacturers and products are indicated below, provide those products or comparable products by the following manufacturers if approved by Architect through substitution process.
a. Blanke Corporation.
b. Ceramic Tool Company, Inc.
c. Emser Tile.
d. Schluter Systems LP.
2. Lengths: As indicated on Drawings.

C. Transition, Finish, and Edge Protection Strips: Roll-formed strips designed specifically to provide a transition, finish, or protective edge at tile conditions as indicated below and on Drawings.
1. Basis-of-Design Products: Subject to compliance with requirements, provide the following specified products from:
a. Schluter Systems LP.
b. Approved substitution.
2. Lengths: As indicated on Drawings.
3. EPS-1: Profile with rounded stair nosing design and slip-resistant surface, integrated trapezoid-perforated anchoring leg.
a. Acceptable Product:
1) Schluter Systems, LP: TREP-E.Material and Finish: Roll-formed Type 304 stainless steel with ribbed horizontal surface.
c. Anchoring Leg: Straight.
d. End Caps: Matching nosing.

e. Size: 1-3/16 in. wide exposed surface.
f. Height: As required to match height of installed tile surface.
g. Application: Stair nosing for ceramic tile treads.

4. EPS-2: Profile with rounded stair nosing design and slip-resistant surface, integrated trapezoid-perforated anchoring leg.
   a. Acceptable Product:
      1) Schluter Systems, LP: TREP-EFK.Material and Finish: Roll-formed Type 304 stainless steel with ribbed horizontal surface.
   c. Anchoring Leg: Straight.
   d. End Caps: Matching nosing.
   e. Size: 2-7/32 in. wide exposed surface.
   f. Application: Slip-resistant strip for ceramic tile treads.
5. MTS-X: Profile with sloped, exposed surface, 1/4 inch deep channel below exposed surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   a. Acceptable Product:
      1) Schluter Systems, LP: RENO-TK.Material and Finish: Satin anodized aluminum
   c. Anchoring Leg: Straight
   d. Application: Transitions between tile and carpeting or other flooring lower than tile.
6. MTS-X: Profile with sloped exposed surface, 5/32 inch tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   a. Acceptable Product:
      1) Schluter Systems, LP: RENO-U.Material and Finish: Satin anodized aluminum
   c. Anchoring Leg: Straight
   d. Application: Transitions between tile and carpeting or other flooring lower than tile.
7. MTS-X: Profile with textured, sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   a. Acceptable Product:
      1) Schluter Systems, LP: RENO-RAMP.Material and Finish: Satin anodized aluminum.
   c. Anchoring Leg: Straight
   d. Size: 3/8 inch high, 2-1/2 inch wide.
   e. Application: Transitions between tile and carpeting or other flooring lower than tile.
8. MTS-X: Profile with textured, sloped exposed surface, tapered leading edge, without integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   a. Acceptable Product:
      1) Schluter Systems, LP: RENO-RAMP-K.Material and Finish: Satin anodized aluminum.
   c. Anchoring Leg: Straight
   d. Size: 1/2 inch high, 2-1/2 inch wide.
   e. Application: Transitions between tile and carpeting or other flooring lower than tile.
9. MTS-X: L-shaped profile with 1/8 inch wide top section and vertical wall section that together form exposed surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   a. Acceptable Product:
      1) Schluter Systems, LP: SCHIENE Series. Material and Finish: Type 304 brushed stainless steel
   c. Height: 3/8 inch.
   d. Application: Transitions between tile and other hard surfaces.
10. MTS-X: S-shaped profile with 1/4 inch wide visible surface and integrated trapezoid-perforated anchoring leg.

a. Acceptable Product:
   1) Schluter Systems, LP: DECO. Material and Finish: Type 304 brushed stainless steel
c. Anchoring Leg: Straight
d. Height: 3/8 inch.
e. Application: Transitions between tile and other same-height hard surfaces.

11. MTS-X: Profile with integrated -perforated anchoring leg.
    a. Acceptable Product:
       1) Schluter Systems, LP: DECO-DE. Material and Finish: Type 304 brushed stainless steel
    c. Anchoring Leg: Trapezoid.
    d. Height: 3/8 inch.
    e. Application: Outside corner finishing edge and edge protection between tile with 135 deg. reveal.
12. MTS-X: Profile with square visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
    a. Acceptable Product:
       1) Schluter Systems, LP: QUADEC.Material and Finish: Type 304 brushed stainless steel
    c. Height: 1/2 inch.
    d. Application: Transition between tile to tile walls at outside and inside corners.
13. MTS-X: L-shaped profile with 1/8 inch wide top section and 3/16 to 1/2 inch wide exposed face that together form exposed surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
    a. Acceptable Product:
       1) Schluter Systems, LP: JOLLY Series.
    b. Material: Type 304 brushed stainless steel
    c. Application:
       1) Vertical outside corner for wall-to-wall transitions.
14. MTS-X: Cove-shaped profile with integrated trapezoid-perforated anchoring leg with 3/8 inch radius cove that forms exposed surface.
    a. Acceptable Product:
       1) Schluter Systems, LP: DILEX-AHK.Material: Satin anodized aluminum
    c. Height: 3/8 inch.
    d. Application:
       1) Inside corner for tile-to-tile transitions such as wall-to-wall, wall-to-counter, wall-to-floor, and similar conditions.
    e. Acceptable Product:
       1) Schluter Systems, LP: DILEX-AHKA.Material: Satin anodized aluminum
    g. Height: 3/8 inch.
    h. Application:
       1) Joint transition between wall to be tiled and existing floor finish.
15. MTS-X: Edge protection profile with a 1/8 inch reveal for outside corners of tiled walls, and 135 deg integrated trapezoid-perforated anchoring leg.
    a. Acceptable Product:
       1) Schluter Systems, LP: FINEC-SQ.Material: Satin anodized aluminum
    c. Height: 7/16 inch.
    d. Application: Vertical outside corner for wall-to-wall transitions.

D. Temporary Protective Coating: Product formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

E. Tile Cleaner: Neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
   1. Custom Building Products: Aqua Mix Heavy Duty Tile & Grout Cleaner.

F. Floor Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Custom Building Products: TileLab Grout and Tile Sealer.
      b. Laticrete International, Inc.: STONETECH Stone, Tile & Grout Sealer.
      c. MAPEI Corporation: UltraCare Grout Sealer.
      d. Approved substitution.

2.12 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
   1. Add materials, water, and additives in accurate proportions.

B. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of Work, and similar items located in or behind tile has been completed.
   4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations. If not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect surrounding Work from damage or disfiguration.

B. Vacuum clean existing surfaces and damp clean.

C. Remove coatings, including curing compounds and other substances, that are incompatible with tile-setting materials.

D. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

E. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

F. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

G. Substrate Flatness:
1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

H. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints per ANSI A108.11 and manufacturer's written instructions, and in compliance with Section 092900.

B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

D. Install waterproofing and crack isolation membrane to comply with ANSI A108.13, ANSI A108.17, and manufacturer's written instructions to produce waterproof and crack isolation membrane of uniform thickness and bonded securely to substrate.
1. Allow waterproof and crack isolation membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

E. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
   1. Add materials, water, and additives in accurate proportions.
   2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

F. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, follow procedures in ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
      a. Tile floors in wet areas.
      b. Tile floors composed of tiles 8 by 8 inches or larger.
      c. Tile floors composed of rib-backed tiles.
   2. Extend tile Work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated.
   3. Terminate Work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
   4. Accurately form intersections and returns.
      a. Perform cutting and drilling of tile without marring visible surfaces.
      b. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints.
      c. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
   5. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
   6. Jointing Pattern:
      a. Lay tile in grid pattern unless otherwise indicated.
      b. Lay out tile Work and center tile fields in both directions in each space or on each wall area.
      c. Lay out tile Work to minimize use of pieces that are less than 1/2 of a tile.
      d. Provide uniform joint widths unless otherwise indicated.
   7. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
      a. Ceramic Mosaic Tile: 1/16 inch.
      b. Porcelain Tile: 1/8 inch.
      c. Glazed Wall Tile: 1/16 inch.
   8. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings.
   1. Comply with requirements of TCNA, EJ171.
   2. Form joints during installation of setting materials, mortar beds, and tile.
   3. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   4. Keep joints free of dirt, debris, and setting materials prior to filling with sealants.
   5. Prepare joints and apply sealants to comply with requirements in Section 079200 – Joint Sealers.
   6. Do not saw-cut joints after installing tiles

H. Thresholds: Install thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

I. Metal Finish and Edge Protection Strips: Install at locations indicated, and where the following conditions occur:
   1. Exposed edge of tile flooring meets carpet or other flooring that finishes flush with top of tile.
   2. Exposed edge of tile flooring meets carpet or other flooring that finishes flush with or below top of tile.
   3. Exposed edge of tile meets edge of tile at outside corners.
   4. Transition between floor and wall tile.
   5. Metal edge protection strip finishes edge of tile that does not abut to other materials.

3.4 REPAIR

A. Remove and replace tile that is damaged or that does not match adjoining tile.

B. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

3.5 CLEANING

A. Cleaning: On completion of placement and grouting, clean ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions but no sooner than 10 days after installation.
      a. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned.
      b. Protect metal surfaces and plumbing fixtures from effects of cleaning.
      c. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

3.6 PROTECTION

A. Protect installed tile Work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

SECTION 098100 - ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sound-attenuation blanket insulation.
2. Sound absorbing glass-fiber board insulation.
3. Spray-applied cellulosic acoustic insulation

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate with related Work for sequencing installation of sound-attenuation acoustic insulation.
2. Provide temporary enclosure as required to confine spraying operations and protect environment, and to prevent deterioration of acoustical material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of acoustical material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply acoustical material to metal deck substrates until concrete topping, if any, has been completed.
   a. For metal roof decks without concrete topping, do not apply acoustical material to metal roof deck substrates until roofing has been completed.
   b. Prohibit roof traffic during application and drying of acoustical material.
5. Do not begin applying acoustical material until clips, hangers, supports, sleeves, conduits and other items penetrating spray-applied acoustic insulation are in place.
6. Defer installing ducts, piping, and other items that would interfere with applying material until application of spray-applied acoustic insulation is completed.
7. Do not install enclosing or concealing construction until after acoustical material has been applied and inspected and corrections have been made to defective applications.

B. Preinstallation Meetings: Conduct meeting at Project site.
1. Review the following for spray-applied acoustic insulation system:
   a. Products, exposure conditions, design ratings, thicknesses, bond strengths, and other performance requirements.
   b. Finalize construction schedule and verify sequencing and coordination requirements.
   c. Weather predictions, ambient conditions, and proposed temporary protections during and after installation.
   d. Surface conditions and preparations, including ventilation requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: 2 Samples of spray-applied acoustic insulation, 4 sq. in., indicating color and texture.

1.4 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Product Test Reports: For each product, for tests performed by qualified testing agency.
   2. Research Reports: For spray-applied acoustic insulation, from ICC-ES.
   3. Adhesion Test Reports: For spray-applied acoustic insulation, indicating materials have been tested for bond with substrates.

B. Qualification Statements: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by spray-applied acoustic insulation manufacturer as experienced and with sufficient trained staff to install products according to specified requirements.

B. Mockups: Comply with Section 014339 – Mockups.
   1. Build mockups of a minimum of 100 sq. ft.
   2. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources.
   1. Store inside and in a dry location.
   2. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply spray-applied acoustical insulation when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilate building spaces during and after application of spray-applied acoustical insulation. Use natural means or, if they are inadequate, forced-air circulation until material dries thoroughly.

C. Special Warranty: Manufacturer agrees to repair or replace spray-applied acoustical insulation that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:

a. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of spray-applied acoustical insulation from substrates.
b. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those that would reasonably be expected, and other causes not reasonably foreseeable under conditions of normal use.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of sound attenuation insulation from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to AHJ:
1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 5 or less.
b. Smoke-Developed Index: 35 or less.

2.3 SOUND ATTENUATION INSULATION

A. Sound Attenuation Blankets (SA.INSUL-1): ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed, Saint-Gobain: CertaPRO AcoustaTherm Batts.
b. Johns Manville: Formaldehyde-Free Unfaced Batts.
c. Knauf Insulation: EcoBatt Insulation with ECOSE Technology.
d. Owens Corning: PINK Next Gen Fiberglas Sound Attenuation Batts (SAB).
e. Approved substitution.
2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
3. Applications:
a. Concealed acoustical insulation in non-fire-rated floor and wall assemblies.

B. Mineral-Wool Blanket Insulation, Unfaced (SA.INSUL-2): ASTM C665, Type I; consisting of fibers; passing ASTM E136 for combustion characteristics.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Johns Manville: MinWool Sound Attenuation Fire Batts (SAFB).
b. Rockwool International: Acoustical Fire Batts (AFB) evo.
c. Thermafiber, Inc. (an Owens Corning company): Thermafiber SAFB (Sound Attenuation Fire Blankets).
d. Approved substitution.
2. Nominal Density by Thickness:
a. 1-Inch Thick: 4.0 pcf.
b. Thicker Than 1-Inch: 2.5 pcf.

3. Surface-Burning Characteristics: Comply with ASTM E84.
    a. Flame Spread: Maximum of 0.
    b. Smoke Developed: 0.
4. Sustainability:
    a. Greenguard Gold Certified.
    b. UL Validated formaldehyde-free.
5. Applications:
    a. Concealed acoustical insulation in fire-rated floor and wall assemblies.

C. Cutouts and Apertures: Manufactured for audio speakers, air diffusers, flexible head sprinklers, and certain light fixtures. Not intended for use with smoke detectors.

2.4 SOUND-ABSORBING BOARD INSULATION

A. Sound Absorbing Glass-Fiber Board (SA.INSUL-3): ASTM C612, Type IA, rigid board consisting of brown- or black-dyed glass fibers bonded together with thermoset resin, with durable, black, nonwoven mat adhered to face of board insulation.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. CertainTeed Corporation: CertaPro AcoustaBoard Black with ToughGard Facing.
    b. Johns Manville: Insul-SHIELD Black.
    c. Knauf Insulation: Black Acoustical Board with ECOSE Technology.
    d. Owens Corning Insulating Systems, LLC: SelectSound Black Acoustic Board.
    e. Approved substitution.
2. Minimum Density: 3 pcf.
3. Surface Burning Characteristics: ASTM E84.
    a. Maximum Flame Spread: 25.
    b. Smoke Developed: 50.
4. Thickness: Minimum required to achieve NRC as indicated on Drawings
5. Recycled Content: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 50 percent.
6. Applications:
    a. Suspended wood ceilings for sound abatement.

B. Cutouts and Apertures: Manufactured for audio speakers, air diffusers, flexible head sprinklers, and certain light fixtures. Not intended for use with smoke detectors.

2.5 SPRAY-APPLIED CELLULOSIC ACOUSTIC INSULATION

A. Spray-Applied Acoustical Insulation System: Factory-mixed, dry cement and vermiculite formulation and additives containing no asbestos, mixed with water, spray applied to form a damp, as-applied product.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. International Cellulose Corp.: SonaSpray "fc Dura-K."
    b. Isolatek International Inc.: Cafco Sound-Shield 40.
    c. Pyrok, Inc. Pyrok Acoustement 40.
2. Application Thickness: As indicated on Drawings to achieve specified NRC.
3. Physical Properties:
    a. Bond Strength: ASTM E736; minimum 900 psf cohesive and adhesive strength
    b. Compressive Strength: ASTM E761; minimum 300 psi.
    c. Surface-Burning Characteristics: Comply with ASTM E84; testing by qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 50 or less.

d. NRC: ASTM C423; not less than 0.90 at 1 in. thick.

4. Color: White.

2.6 ACCESSORIES

A. Primer: Product compatible with spray-applied acoustic insulation materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of Work.

B. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of acoustical materials with substrates under conditions of normal use or exposure.

C. Verify that objects penetrating acoustical material, including clips, hangers, support sleeves, conduits and similar items, are securely attached to substrates.

D. Verify that substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with application of spray-applied acoustic insulation material.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of suspended wood ceilings to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width or -length panels at borders, and comply with layout shown on Drawings.

B. Measure each ceiling area and establish layout of gypsum board ceilings receiving sound attenuation blankets to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width or -length panels at borders, and comply with layout shown on Drawings.

C. Spray-Applied Acoustic Insulation:
1. Protect adjoining Work from fallout or overspray of spray-applied insulation during application.
2. Clean substrate of substances that could impair penetration or performance of spray-applied insulation according to manufacturer's written instructions
3. Prime substrates where recommended by spray-applied acoustic insulation manufacturer.
4. Repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of spray-applied insulation.
   a. Remove minor projections and fill voids that would telegraph through acoustical products after application.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.4 INSTALLATION OF SOUND ATTENUATION BLANKET INSULATION

A. Walls: Prior to installation of gypsum board, install SA.INSUL-2 in wall cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than 1 length is required to fill cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3 inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   5. For wood-framed construction, install blankets according to ASTM C1320.

B. Ceilings: Install SA.INSUL-2 above installed acoustical panel ceiling components as installation progresses.
   1. Fit insulation tightly between suspension system grid members.
   2. Maintain 3 inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   3. Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.5 INSTALLATION OF SPRAY-APPLIED ACOUSTIC INSULATION

A. Comply with spray-applied acoustical insulation manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on acoustical material, as applicable to particular conditions of installation.
   1. Install thickness to achieve a minimum NRC as indicated on Drawings.

B. Extend acoustical material in full thickness over entire area of each substrate to be coated.

C. Spray-apply acoustical materials to maximum extent possible.
   1. Following spraying operation in each area, complete coverage by trowel application or other placement method recommended in writing by spray-applied acoustical insulation manufacturer.

2. Install spray-applied acoustical insulation in multiple layers as required by manufacturer allowing each coat to dry per manufacturer's recommendations before proceeding with additional coats.

3.6 ADJUSTING

A. Adjust sags or twists that develop in wall framing and ceiling systems and replace materials which are damaged or faulty.

B. Inspect installation of spray-applied acoustic insulation and patch damaged areas and areas where spray-applied acoustic insulation has been removed.

3.7 CLEANING

A. After Completion of Installation: Clean soiled surfaces.
1. Remove and reinstall improperly installed material.
2. Touch-up moderately damaged wood surfaces with same finish materials as in factory.
3. Remove severely damaged material, discolored material, and moderately damaged material that cannot be properly touch-up finished and replace with new material.

B. Spray-Applied Acoustic Insulation:
1. Immediately after completing spraying operations in each area, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
2. Coordinate application of spray-applied acoustical insulation with other construction to minimize need to cut or remove. As installation of other construction proceeds, inspect spray-applied acoustical insulation and patch any damaged or removed areas.

3.8 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, construction activities, or other causes to ensure spray-applied acoustic insulation is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 099000 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Surface preparation and application of painting and coating systems on exterior and interior substrates indicated in Painting Schedules in Part 3 and indicated on Drawings.
2. Surface preparation and application of specialty, non-bridging coating systems for acoustical panel materials.
3. Items indicated in Specifications to be field-painted.

1.2 DEFINITIONS

A. Paint glosses are defined as sheen ratings of applied paint, according to ASTM D523 and the following MPI values:
1. Gloss Level 3 (Eggshell): 10 to 25 units at 60 deg; 10 to 35 units at 85 deg.
2. Gloss Level 4 (Satin): 20 to 35 units at 60 deg, minimum 35 units at 85 deg.
3. Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 deg.
4. Gloss Level 6 (Gloss): 70 to 85 units at 60 deg.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, include.
1. Printout of current "MPI Approved Products List" for each product category specified, with proposed product highlighted.
2. Preparation requirements and application instructions.
3. VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 in. sq.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with proposed product highlighted.
3. Color designations.
4. VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For applicator.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing type of work of this Section with a minimum of 3 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Acrylic Technologies, Inc.
   2. Benjamin Moore & Co.
   3. Carboline Company.
   4. Cloverdale Paint Inc.
   5. Diamond Vogel Paints.
   6. Glidden Professional.
   7. Kelly-Moore Paint Company Inc.
   8. Miller Paint Company, Inc.
   9. PPG Architectural Finishes, Inc.
   10. Rodda Paint Co.
   11. Rust-Oleum Corporation.
   12. Sherwin-Williams Company (The).
   13. Tnemec, Inc.

B. Products: Subject to compliance with requirements, available products that may be incorporated into Work are listed in other Part 2 Articles for paint category indicated.

C. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and listed in its "MPI Approved Products Lists."
   1. If a manufacturer produces more than one product within an MPI category, provide highest quality product within that category.
   2. Certain specified products are not listed within an MPI category but are approved to be part of the system in which they are specified.

B. Material Quality: Material containers not displaying coating manufacturer's product identification will not be accepted.

C. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
   3. Provide products of same manufacturer for each coat in a coating system.

D. VOC Content: For field applications inside weatherproofing system, verify paints and coatings comply with VOC content limits of AHJ and the following VOC content limits.
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 50 g/L.
   3. Primers, Sealers, and Undercoaters: 100 g/L.
   4. Rust-Preventive Coatings: 100 g/L.
   5. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
   6. Pretreatment Wash Primers: 420 g/L.
   7. Floor Coatings: 50 g/L.
   8. Shellacs, Clear: 730 g/L.
   9. Shellacs, Pigmented: 550 g/L.

E. Low-Emitting Materials: For field applications that are inside weatherproofing system, verify 90 percent of paints and coatings comply with requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. VOC Content: For field applications inside building, verify wall paints comply with VOC content limits of AHJ and the following VOC content limits:
   1. Interior Flat Latex Wall Paint: 50 g/L.
   2. Interior Nonflat Latex Wall Paint: 150 g/L.

G. VOC Emissions: For field applications inside building, verify wall paints contain no more than half of chronic REL of VOCs when tested in accordance with California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   1. Verify building concentration of formaldehyde does not exceed 1/2 of indoor recommended exposure limit, or 33 mcg/cu. M; acetaldehyde concentration does not exceed 9 mcg/cu. m.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4. Products: Subject to compliance with requirements, provide one of the following:

a. Benjamin Moore: Coronado, Super Kote 5000 Latex Prod. Block Filler Flat, 958.
b. Kelly-Moore: Premium Professional, 521 Premium Professional Prime and Fill Acrylic Block Filler, 521-102.
c. PPG Architectural, PPG Paints, Speedhide Int/ Ext Masonry Hi Fill Latex Block Filler, 6-15XI.
d. Sherwin-Williams: PrepRite Interior/Exterior Block Filler, B25W00025.
e. Tnemec, Inc.: Series 54 Masonry Filler.

2.4 PRIMERS/SEALERS

A. Primer, Alkali-Resistant, Water Based: MPI #3. Products: Subject to compliance with requirements, provide one of the following:
a. Benjamin Moore: Ultra Spec, Interior/Exterior Acrylic High-Build Masonry Primer, 609/K609.
b. Kelly-Moore: 247 Acryshield, Acryshield Acrylic Exterior Masonry Primer, 247-100.
c. Miller Paint: PH Surfacer, Alkali Resistant Primer, 620011.
d. PPG Architectural: PPG Paints, Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI Series.
e. PPG Architectural: PPG Paints, Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series.
f. Sherwin-Williams: PrepRite ProBlock, Int/Ext Lates Primer/Sealer, B51W00620.

B. Primer, Bonding, Water Based: MPI #17. Products: Subject to compliance with requirements, provide one of the following:
a. Benjamin Moore: Fresh Start, High Hiding All Purpose Primer, 046/K046.
b. Kelly-Moore: 287 KEL-BOND Adhesion Plus, Adhesion Plus Interior/Exterior Primer/Sealer, 287.
c. PPG Architectural: PPG Paints, Seal Grip Int/Ext Acrylic Universal Primer/Sealer, 17-921XI Series
d. Sherwin-Williams: Multi-Purpose, Multi-Purpose Latex Primer/Sealer, B51W00620.

C. Primer Sealer, Latex, Interior: MPI #50. Products: Subject to compliance with requirements, provide one of the following:
a. Acrylic Technologies: Acrylitex, Acrylitex MPI #50 Primer/Sealer, 296-0-17.
b. Benjamin Moore: Coronado, PVA Primer/Finish, 100.11.
c. Benjamin Moore: Ultra Spec 500, Waterborne Interior Primer Sealer, N534/K534. Kelly-Moore: 971 Acryplex, Acryplex Interior PVA Primer Sealer, 971-100. PPG Architectural: Pure Performance Interior Latex Primer, 9-900. Rodda Paint Co.: Master Painter Zero, Roseal Primer, 403601.] Sherwin-Williams: ProMar 200 Zero, Interior Latex Primer, B28W Series. Primer Sealer, Latex, Interior: MPI #61. Products: Subject to compliance with requirements, provide one of the following:
a. Acrylic Technologies: Acrylitex, Vapor Prime, 293-0-17.
b. Benjamin Moore: Insl-X, Vapor Barrier Primer/Sealer, VB-5000.Kelly-Moore: 971 Acryplex, Interior PVA Primer Sealer, 971-100.
d. PPG Architectural: PPG Paints, Seal Grip Perm Sealer Vapor Barrier, 17-9801.Rodda Paint: Interior Perm Rated Primer/Sealer, Vapor Block, 507901.
f. Sherwin-Williams: Moisture Vapor Barrier, Interior Latex Primer/Sealer, B72W00011.Tnemec, Inc.: PVA Sealer, Series 51.METAL PRIMERS

A. Primer, Galvanized, Water Based, MPI #107. Corrosion-resistant, acrylic primer. Products: Subject to compliance with requirements, provide one of the following:

a. Benjamin Moore: Ultra Spec HP, Acrylic Metal Primer, HP04/FP04.
b. Kelly-Moore: 5725 DTM, DTM Acrylic Primer Finish, 5725-100.
c. Miller Paint: Acrimetal, Acrimetal DTM Primer/Finish Velvet, 310-2-10.
d. PPG Architectural: Protective and Marine Coatings, Pitt-Tech Plus 4020 PF, 4020 Series.
e. Rust-Oleum: Rust-Oleum, ROC Prime, 358063.
f. Sherwin-Williams: Pro Industrial, Pro-Cryl Universal Primer, B66W01310.
g. Tnemec Company, Inc.: Epoxoline WB, Series 1224.

2.6 WATER-BASED PAINTS

A. Latex, Exterior Satin (MPI Gloss Level 3-4), MPI #15. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Ultra Spec EXT, Exterior Satin Finish, N448.
   b. Kelly-Moore: Acryshield, Acryshield 100% Acrylic Exterior Satin Enamel, 1247-121.
   c. Miller Paint: Stratus XT, 100% Acrylic Exterior Satin, 520410.
   d. Sherwin-Williams: A-100, Exterior Latex Satin, A82W00151.

B. Latex, Exterior Semi-Gloss (MPI Gloss Level 5), MPI #11. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Ultra Spec, Waterborne Exterior Gloss, N449.
   b. Kelly-Moore: 1250 Acryshield, 100% Acrylic Exterior Semi-Gloss, 1250-121.
   c. Miller Paint: Stratus XT, Exterior Semigloss, 520510.
   d. Sherwin-Williams: A-100, Exterior Latex Gloss, A08W00116.

C. Light Industrial Coating, Exterior, Water Based, Semi-Gloss (MPI Gloss Level 5): MPI #163. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Ultra Spec HP, D.T.M. Acrylic Semi-Gloss Enamel, HP29/FP29.
   b. Kelly-Moore: 6648 DTM Semi-Gloss, 6648 DTM Semi-Gloss, 6648.
   c. Miller Paint: Acrinamel, Acrimetal DTM Acrylic Semi-Gloss, 310510.
   d. PPG Architectural: Protective and Marine Coatings, Pitt-Tech Plus EP, Interior/Exterior Semi-Gloss DTM Industrial Enamel, 90-1610.
   e. Sherwin-Williams: All Surface Enamel, All Surface Enamel HP Semi-Gloss, A41WQ8051.

D. Latex, Interior, Eggshell (MPI Gloss Level 3), MPI #52. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Ultra Spec 500, Interior Eggshell, T538/F538.
   b. Kelly-Moore: KM Professional, 1010 Premium Professional Latex Interior Eggshell Enamel, 1010-121.
   c. Miller Paint: Premium, Interior Latex Eggshell, 120310.
   d. PPG Architectural: PPG Paints, Speedhide Zero Interior Satin, 6-5410.
   e. Sherwin-Williams: ProMar 200 Zero VOC, Interior Latex Eg-Shel, B20W Series.

E. Latex, Interior, Semi-Gloss (MPI Gloss Level 5), MPI #54. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Ultra Spec 500, Interior Semi-Gloss, T546/F546.
   b. Kelly-Moore: KM Professional, 1050 Premium Professional Latex Interior Semi Gloss Enamel, 1050-121.
   c. Miller Paint: Premium, Interior Acrylic Semi Gloss Wall Finish, 120510.

d. PPG Architectural: PPG Paints, Pure Performance Zero VOC Interior Semi-Gloss, 9510XI Series.
e. Sherwin-Williams: ProMar 200 Zero VOC, Interior Latex Semi-Gloss, B31W Series.

F. Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5), MPI #153. Products: Subject to compliance with requirements, provide one of the following:
a. AkzoNobel, Devoe High Performance Coatings, Devcryl 1448, 1448.
b. Benjamin Moore: Ultra Spec HP, DTM Acrylic Semi-Gloss, HP29/FP29.
c. Benjamin Moore: Corotech, DTM Acrylic Semi-Gloss, V331.
d. Benjamin Moore: Corotech, Pre-Catalyzed Waterborne Epoxy Semi-Gloss, V341.
e. Kelly-Moore: DuraPoxy, 1685 DuraPoxy Interior Semi-Gloss Enamel, 1685.
f. Miller Paint: Acrinamel, Acrimetal DTM Semi-Gloss, 310510.
g. PPG Architectural: High Performance Coatings, Pitt-Tech Plus SG 4216 HP/Devflex 4216 HP, 4216HP.
h. PPG Architectural: High Performance Coatings, Pitt-Glaze WB1 Int. Semi-Gloss Pre-Catalyzed WB Acrylic Epoxy, 16-510.
i. Sherwin-Williams: Pro Industrial Pre-Cat Epoxy Semi-Gloss, K46W01151.

G. Light Industrial Coating, Interior, Water Based, Gloss (MPI Gloss Level 6), MPI #154. Products: Subject to compliance with requirements, provide one of the following:
a. Benjamin Moore: Ultra Spec HP, Acrylic Metal Primer, HP04/FP04.
b. Benjamin Moore: Ultra Spec HP, DTM Acrylic Semi-Gloss, HP28/FP28.
c. Sherwin-Williams: Pro Industrial, Acrylic Gloss Coating, B66W00611.

2.7 WATER-BASED COATINGS

A. Anti-Slip Floor Coating, Water-Based, 100% Acrylic with Integral Grit, Matte or Flat (MPI Gloss Level 1), MPI #60 (mod).
1. Products: Subject to compliance with requirements, provide one of the following:
a. Benjamin Moore: Insl-X, Sure Step 100% Acrylic Latex Anti-Slip Coating, CSU-0XXX.
b. ICP Building Solutions Group: FixAll, Skid Grip Anti-Slip Coating, F065 Series.
c. No Skidding Products: Super Acrylic Slip-Resistant Floor Coating with Integrated Grit, #97300.
d. PPG Architectural: Protective & Marine Coatings, Anti-Slip Safety Flooring Systems, SFT 600.
e. Sherwin-Williams: Protective and Marine Coatings, Armoseal Tread-Plex, B90 Series. Approved substitution.
2. Include coating manufacturer's recommended slip-resistant additive.

2.8 DRY FALL COATINGS

A. Dry Fall, Latex, Flat (MPI Gloss Level 1), MPI #118. Products: Subject to compliance with requirements, provide one of the following:
a. Benjamin Moore: Coronado, Super Kote 5000 Dry Fall Acrylic Latex Flat, N110.
b. Diamond Vogel: Luminance 300, Latex Dri-Mist Flat, MV-1518.
c. Kelly-Moore; Dry Fog II, Dry Fog II Flat Latex Maintenance Finish, 480-100.
d. Miller Paint: Miller Paint, Aqua Fall, 181111.
e. PPG Architectural: PPG Paints, Speedhide Super Tech WB Interior Dry Fog Flat Latex, 6-725XI.
f. Rodda Paint Co.: Professional Maintenance, W.B Dry Fog Coating, 513801.

g. Rust-Oleum: Zinsser, Waterborne Dryfall, 293234.
h. Sherwin-Williams: Pro Industrial, Waterborne Acrylic Dryfall, B42W00181.

B. Acoustic Panel Coating: Acrylic, nonbinding coating designed for application to acoustical ceiling tiles and panels that does not affect acoustical attributes. Products: Subject to compliance with requirements, provide one of the following:
a. ProCoat Products Inc.: ProCoustic Acoustical Tile and Ceiling Coating.
b. ReCeil It International, Inc.: Sav-A-Ceiling Architectural Ceiling Coating.
c. Approved substitution.
2. Physical Description:
a. Color: White, tintable.
b. Solids: Minimum 30 percent.
c. VOC: <50 g/L.

2.9 INTUMESCENT PAINT

A. Water based, latex type, pigmented intumescent coating for interior combustible surfaces, MPI #64.
1. Products: Subject to compliance with requirements, provide products by the following:
a. Benjamin Moore: Insl-X, Fire Retardant Coating Latex Intumescent Flat Finish, FR-210.
b. Cano Coatings Inc.: PinkShield, PinkShield, PS5005.
c. FireFree Coatings, Inc.: Firefree Class A. Flame Control Coatings, Inc.: Flame Control No. 20-20A.
e. Flame Seal Products, Inc.; Flame Seal FX950.
f. PPG Architectural: PPG Paints, Speedhide Interior Fire Retardant Flat Latex, 42-7.
g. Sherwin-Williams: FIRETEX FX5120.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with specified coating.
   1. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Abrasive-blast clean surfaces to comply with SSPC-SP 13/NACE No. 6 or ICRI No. 310.2R CSP 1-3 to achieve minimum surface profile recommended by floor coating manufacturer.
      a. Use apparatus that abrades concrete surface, contains dispensed shot within apparatus, and recirculates shot by vacuum pickup.
   3. Repair damaged and deteriorated concrete according to floor coating manufacturer's written instructions.

E. Masonry Substrates:
   1. Remove efflorescence and chalk.
   2. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. Interior Steel: SSPC-SP 2.
   2. Exterior Steel: SSPC-SP 6 (WAB)/NACE WAB-3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
   1. Scrape and clean knots and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory-finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Apply anti-slip floor coating according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of floor coating system to substrate, and optimum intercoat adhesion.
   2. Cure floor coating components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. Thoroughly mix contents with mechanical mixer until mixed material is uniform in color and appearance, grit is uniformly incorporated, and settlement is removed from bottom of container.
   4. Primer: Apply primer over prepared substrate using 1/8 in. notched squeegee and back roll to yield a wet film thickness of 16 mils.
   5. Topcoat: Apply topcoat, with grit mixed in, using roller method at a rate of not more than wet film thickness of 16 mils.
   6. Finish Floor Thickness: Nominal dry film thickness of 18 mils.

F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following Work where exposed in occupied spaces and equipment rooms:
      a. Uninsulated metal piping.
      b. Uninsulated plastic piping.
      c. Pipe hangers and supports.
      d. Metal and plastic conduit.

e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
f. Other items as directed by Architect.

2. Paint the additional following Work where exposed in equipment rooms:
   a. Switch gear.
   b. Tanks that do not have factory-applied final finishes.
   c. Equipment, including panelboards.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
4. Do not paint sprinkler heads.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces.
   1. Remove spattered paints by washing, scraping, or other methods.
   2. Do not scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect Work of other trades against damage from paint application.
   1. Correct damage to Work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 COLOR SCHEDULE

A. Colors: See Interior Finish Schedule [Legend] on Drawings for selected coating colors.

3.8 EXTERIOR PAINTING SCHEDULE

A. CMU Substrates:
   1. Specified in Section 09 9600 – High Performance Coatings.
   2. Latex over Alkali-Resistant Primer System:
      a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, low sheen, MPI #15.Topcoat: Latex, exterior, semigloss, MPI #11.Application:

a. CMU surfaces schedule for painting.

B. Concrete Substrates, Nontraffic Surfaces:
1. Specified in Section 09 9600 – High Performance Coatings.
2. Latex System:
a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen, MPI #15.Applications:
a. Vertical cast-in-place concrete conditions.
4. Dry Film Thickness: Not less than 10 mils.

C. Steel Substrates:
1. Specified in Section 09 9600 – High Performance Coatings.

D. Wood Substrates:
1. Latex over Latex Primer System:Prime Coat: Primer, latex for exterior wood, MPI #6. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen, MPI #15.Topcoat: Latex, exterior, semigloss, MPI #11.Applications:
a. Exposed, exterior soffit framing at eaves, entries, canopy structure.
b. Plywood panels.
c. Wood frames and jambs.

E. Gypsum Board Substrates:
1. Latex System:
a. Prime Coat: Primer, latex for exterior wood (reduced), MPI #6.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen, MPI #15.Applications:
a. Gypsum board soffits.

F. Plastic Trim Fabrication Substrates:
1. Latex System:Prime Coat: Primer, bonding, water based, MPI #17.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior flat (MPI Gloss Level 1), MPI #10.
d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
e. Topcoat: Latex, exterior semi-gloss (MPI Gloss Level 5), MPI #11.Topcoat: Latex, exterior gloss (MPI Gloss Level 6), MPI #119.
2. Water-Based Light Industrial Coating System:Prime Coat: Primer sealer, latex, exterior, MPI #17.
b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based, low-sheen (MPI Gloss Level 3), MPI #161.
d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.
e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), MPI #164.
3. Application:
a. PVC downspout piping and related brackets.
b. PVC conduit.
c. Plastic and fiberglass items.

3.9 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:
1. Specified in Section 09 9600 – High Performance Coatings.
2. Latex System:
   a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, satin, MPI #43.
   d. Topcoat: Latex, interior, semi-gloss, MPI #54.
3. Application:
   a. CMU surfaces schedule for painting.

B. Concrete Substrates, Nontraffic Surfaces:
1. Latex System:Prime Coat: Primer, alkali resistant, water based, MPI #3.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, semi-gloss, MPI #54.
2. Application:
   a. Vertical concrete surfaces not subject to traffic.

C. Concrete Substrates, Traffic Surfaces:
1. Acrylic Anti-Slip Floor System:Prime Coat: Floor paint, acrylic, matching topcoat.
   b. Topcoat: Floor paint, acrylic, low gloss (MPI Gloss Level 1), MPI #60 (mod).
2. Application:
   a. Horizontal concrete surfaces subject to traffic.

D. Concrete Substrates,:
1. Traffic Marking Acrylic Latex System:
   a. Single Coat: Floor paint, acrylic, MPI #97.
2. Application:
   a. 4 in. wide striping where indicated.
   b. 4 in. wide letters where indicated.
3. Dry Film Thickness: Not less than 9 mils.

E. Steel Substrates:
1. Specified in Section 09 9600 – High Performance Coatings.
2. Latex over water-based, rust-inhibitive primer:
   a. Prime Coat: Water-based, rust-inhibitive, acrylic primer, MPI #107.
   b. Intermediate Coat: Latex, interior, matching topcoat.
   c. Topcoat: Latex, interior, semi-gloss, MPI #54.
3. Application:
   a. Hollow metal doors and frames.
4.
5. Water-Based Dry-Fall System:Prime Coat: Shop primer specified in Section where substrate is specified.
   b. Topcoat: Dry fall, latex, flat, MPI #118.
   c. Applications:
      1) Interior, exposed-to-view, overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, steel joists, and metal fabrications.

F. Gypsum Board Substrates:
1. Latex over Latex Sealer System:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, eggshell, MPI #52.
d. Topcoat: Latex, interior, satin, MPI #43.
e. Topcoat: Latex, interior, semi-gloss, MPI #54.
f. Application:
    1) Interior gypsum board other than exterior wall conditions.
g. Sheen:
    1) MPI #52: Soffits and ceilings.
    2) MPI #43: Walls, soffits, and other vertical conditions unless indicated otherwise.
    3) MPI #54: Walls, soffits, and ceilings in janitorial and maintenance rooms, toilet rooms (restrooms), and other surfaces requiring semi-gloss finish.
    4) Note: Ensure surfaces receiving MPI #54 topcoat have a Level 5 drywall finish.

2. Latex over Latex Sealer System, Low Permeability:
    a. Prime Coat: Primer sealer, low permeability, latex, interior, MPI #61.
    b. Intermediate Coat: Latex, interior, matching topcoat.
    c. Topcoat: Latex, interior, satin, MPI #43.
    d. Applications:
        1) Interior gypsum board at exterior wall conditions and gypsum board partitions schedule to receive wall covering.
        2) Apply only primer on gypsum board partitions schedule to receive FRP or PLAM finishes.
3. Water-Based Light Industrial Coating System:Prime Coat: Primer sealer, latex, interior, MPI #50.
    b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
    c. Topcoat: Light industrial coating, interior, water based , MPI #151.
    d. Topcoat: Light industrial coating, interior, water based, semi-gloss, MPI #153.
    e. Topcoat: Light industrial coating, interior, water based, gloss, MPI #154.

G. Prepainted Steel Substrates:Latex over water-based, rust-inhibitive primer:
    a. Prime Coat: Water-based, rust-inhibitive, acrylic primer, MPI #107.
    b. Intermediate Coat: Latex, interior, matching topcoat.
    c. Topcoat: Latex, interior, semi-gloss, MPI #54.
2. Color: Match color of adjacent ceilings panels.
3. Application:
    a. Existing prepainted ceiling metal suspension systems..

H. Interior of Ducts, Registers, Grilles, and Diffusers:
1. Latex System:
    a. 2 coats latex, interior, flat, MPI #53.
2. Color: Black.
3. Application:
    a. From behind grilles, registers, and diffusers to 12 in. inside of ducts.

I. Exposed Ducts, Grilles, Registers, Diffusers, and Piping:
1. Latex over water-based, rust-inhibitive primer:
    a. Prime Coat: Water-based, rust-inhibitive, acrylic primer, MPI #107.
    b. Intermediate Coat: Latex, interior, matching topcoat.
    c. Topcoat: Latex, interior, eggshell, MPI #52.
    d. Topcoat: Latex, interior, satin, MPI #43
    e. Topcoat: Latex, interior, semi-gloss, MPI #54.

2. Color: Match color and sheen of adjacent walls and ceilings.
   a. Refer to Sheen under Gypsum Board Substrates.
3. Application:
   a. Exposed ducts, grilles, diffusers, and piping on or adjacent to walls and ceilings.
   b. Switchgear.
   c. Tanks with no factory-applied finishes.
   d. Equipment, including panelboards.

4. Institutional Low-Odor/VOC Latex System, MPI INT 5.1S:
   a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
   b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
   c. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5), MPI #147.

J. Cotton or Canvas Insulation-Covering Substrates:
   1. Latex System, MPI INT 10.1A:
      a. Prime Coat: Primer sealer, latex, interior, MPI #50.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, satin, MPI #43.
      d. Application:
         1) Pipe and duct coverings.

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surface preparation and application of high-performance coating systems.

1.2 DEFINITIONS

A. Paint glosses are defined as sheen ratings of applied paint, according to ASTM D523:
   1. MPI Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 deg.
   2. MPI Gloss Level 6 (Gloss): 70 to 85 units at 60 deg.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include Printout of current "MPI Approved Products List" for each product category specified, with proposed product highlighted.
   2. Include preparation requirements and application instructions.
   3. Indicate VOC content.

B. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with proposed product highlighted.
   3. Color designations.
   4. VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For applicator.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing type of work of this Section with a minimum of 3 years documented experience.

B. Field Samples: Comply with Section 014336 – Field Samples.
   1. Architect will select 1 surface to represent surfaces and conditions for application of each coating system specified in Part 3.
      a. Provide samples of at least 100 sq. ft.

b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on field samples.
   a. If preliminary color selections are not approved, apply additional field samples of additional colors selected by Architect at no added cost to Owner.
3. Approval of field samples does not constitute approval of deviations from Contract Documents contained in field samples unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved field samples may become part of completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 deg F and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into Work are listed in other Part 2 Articles for paint category indicated.
   1. Refer to Drawings for paint colors.

2.2 HIGH-PERFORMANCE COATINGS

A. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products Lists."
   1. If a manufacturer produces more than one product within an MPI category, provide highest quality product within that category.
   2. Certain specified products are not listed within an MPI category but are approved to be part of the system in which they are specified.

B. Material Quality: Material containers not displaying coating manufacturer’s product identification will not be accepted.

C. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
   3. Provide products of same manufacturer for each coat in a coating system.

D. VOC Content: For field applications, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits.
   1. Flat Paints and Coatings: 50 g/L.

2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 100 g/L.
4. Rust-Inhibitive Coatings: 100 g/L.
5. Pretreatment Wash Primers: 420 g/L.
6. Floor Coatings: 50 g/L.
7. Shellacs, Clear: 730 g/L.
8. Shellacs, Pigmented: 550 g/L.

E. Low-Emitting Materials: For field applications that are inside weatherproofing system, verify 90 percent of paints and coatings comply with requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
1. Interior Flat Latex Wall Paint: 50 g/L.
2. Interior Nonflat Latex Wall Paint: 150 g/L.

F. VOC Emissions: For field applications inside building, verify wall paints contain no more than half of chronic REL of VOCs when tested in accordance with California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of indoor recommended exposure limit, or 33 mcg/cu. m, and acetaldehyde concentration does not exceed 9 mcg/cu. m.

G. Colors: See Interior Finish Schedule **Legend** on Drawings for selected paint and coating colors.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Coronado, Super Kote 5000 Latex Prod. Block Filler Flat, 958.
   b. **Kelly-Moore: Premium Professional, 521 Premium Professional Prime and Fill Acrylic Block Filler, 521-102**.
   c. **Miller Paint, Stratus XT, Interior/Exterior Block Filler, 481011**.
   d. PPG Architectural, PPG Paints, Speedhide Int/ Ext Masonry Hi Fill Latex Block Filler, 6-15X.
   e. Sherwin-Williams: PrepRite Interior/Exterior Block Filler, B25W00025.
   f. Tnemec, Inc.: Masonry Filler, Series 54.

B. Block Filler, Epoxy, MPI #116.
1. Products: Subject to compliance with requirements, provide one of the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Corotech, Surface Tolerant Epoxy Mastic, V160.
   b. **Cloverdale Paint: High performance, Epoxy Block Filler, 83065**.
   c. PPG Architectural: Protective and Marine Coatings, Amerlock 400 BF, AK400B-x.
   d. Sherwin-Williams, Protective & Marine, Kem Cati-Coat HS Epoxy Filler/Sealer, B42W00400
   e. Tnemec Company, Inc.: Surfacing Epoxy, Series 215.

2.4 PRIMERS/SEALERS

MPI INFO: THE FOLLOWING IS USED ON NEW INTERIOR CONCRETE AND GYPSUM WALLBOARD SURFACES THAT ARE SUBSEQUENTLY PAINTED WITH EPOXY-MODIFIED LATEX FINISH COAT(S). THE PURPOSE OF MPI #50 IS TO REDUCE THE POROSITY OF THE SUBSTRATE FOR FINISH COATS. NOT INTENDED FOR USE ON WOOD OR PREVIOUSLY PAINTED SURFACE.

A. Primer Sealer, Latex, Interior: MPI #50.
   a. Acrylic Technologies: Acrylitex, Acrylitex MPI #50 Primer/Sealer, 296-0-17.
   b. Benjamin Moore: Coronado, PVA Primer/Finish, 100.11.
   c. Benjamin Moore: Ultra Spec 500, Waterborne Interior Primer Sealer, N534/K534.
   d. **Kelly-Moore: 971 Acryplex, Acryplex Interior PVA Primer Sealer, 971-100**.

e. **Miller Paint, Performance Plus, Primer-Sealer, 230011**.
f. PPG Architectural: Pure Performance Interior Latex Primer, 9-900.
g. **Rodda Paint Co.: Master Painter Zero, Roseal Primer, 403601**.
h. Sherwin-Williams: ProMar 200 Zero, Interior Latex Primer, B28W Series.

2. Note: Not intended for use on wood or previously painted surfaces.

2.5 METAL PRIMERS

A. All Other Ferrous Metals: Furnish Tnemec Company, Inc. "Series 394 PerimePrime or Wasser Corporation "MC-Miozinc 100" one-component, moisture-cured, micaceous iron oxide and zinc filled primer, or approved.

B. Primer, Epoxy, Anti-Corrosive, for Metal, MPI #101.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Corotech, Surface Tolerant Epoxy Mastic, V160.
   b. Carboline Company: Carboline, Carboguard 60.
   c. PPG Architectural: Protective and Marine Coatings, Amerlock 600, AK600.
   d. Sherwin-Williams, Protective & Marine, Macropoxy 646 Fast Cure Epoxy, B58W Series.
   e. Tnemec Company, Inc.: Hi-Build Epoxoline, Series 66.
   f. [Tnemec Company, Inc.: F.C. Typoxy, Series 27.]

C. Primer, Rust-Inhibitive, Water Based, MPI #107. Corrosion-resistant, acrylic primer.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore: Ultra Spec HP, Acrylic Metal Primer, HP04/FP04.
   b. **Kelly-Moore: 5725 DTM, DTM Acrylic Primer Finish, 5725-100**.
   c. **Miller Paint: Acrimetal, Acrimetal DTM Primer/Finish Velvet, 310-2-10**.
   d. PPG Architectural: Protective and Marine Coatings, Pitt-Tech Plus 4020 PF, 4020 Series.
   e. **Rust-Oleum: Rust-Oleum, ROC Prime, 358063**.
   f. Sherwin-Williams: Pro Industrial, Pro-Cryl Universal Primer, B66W01310.
   g. Tnemec Company, Inc.: Epoxoline WB, Series 1224.

2.6 EPOXY COATINGS

A. Epoxy-Modified Latex, Interior, Semi-Gloss (MPI Gloss Level 5), MPI #215.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. AkzoNobel, Devoe High Performance Coatings, Tru Glaze WB 4426 Water Borne Epoxy, 4426/4420.
   b. **Cloverdale Paint: Cloverdale Paint, Ecologic Waterborne Epoxy Gloss White, 70503A/70503B.**
   c. PPG Architectural: Protective and Marine Coatings, Aquapon WB EP Epoxy, Semi-Gloss, 98E-1/98E-100 Series.
   d. Sherwin-Williams: Pro Industrial, Water Based Catalyzed Epoxy, B73W311/B73V300.
   e. Tnemec Company, Inc.: Epoxoline WB, Series 1224.

B. Epoxy-Modified Latex, Interior, Gloss (MPI Gloss Level 6), MPI #115.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. AkzoNobel, Devoe High Performance Coatings, Tru Glaze WB 4428 Water Borne Epoxy, 4428/4420.
   b. PPG Architectural: Protective and Marine Coatings, Aquapon WB EP, 98-X/98E-98.
   c. Sherwin-Williams: Pro Industrial, Waterbased Catalyzed Epoxy, B73W311/B73V300.
   d. Tnemec Company, Inc.: Epoxoline WB, Series 1224

C. Epoxy, High-Build, Semi-Gloss (MPI Gloss Level 5), MPI #108.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. AkzoNobel, Devoe High Performance Coatings, Bar Rust 235, 235.
   b. Benjamin Moore: Corotech, Polyamide Epoxy Semi-Gloss, V400-91.

c. Carboline Company: Carboline, Carboguard 60.
d. PPG Architectural: Protective and Marine Coatings, Amerlock 600, AK600.
e. Sherwin-Williams: Protective & Marine, Macropoxy 646 Fast Cure Epoxy, B58W00610.
f. Tnemec Company, Inc.: Epoxoline, Series 22.

2.7 POLYURETHANE COATINGS

A. Polyurethane, Aliphatic Acrylic, 2-Component, Pigmented, Semi-Gloss (Gloss Level 5), MPI #174.
1. Products: Subject to compliance with requirements, provide one of the following:
a. AkzoNobel, Devoe High Performance Coatings, Devthane 378H, 378H.
b. Benjamin Moore: Corotech, Aliphatic Acrylic Urethane Semi-Gloss, V510.
c. **Carboline Company: Carbothane 133 Series.**
d. PPG Architectural: Protective and Marine Coatings, Amercoat 450 HSG, AT450HSG.
e. Sherwin-Williams: Protective & Marine, Acrolon 218 HS Polyurethane, B65W651/B65V600.
f. Tnemec Company, Inc.: Endura-Shield II, Series 1075.

B. Polyurethane, 1- or 2-Component, Pigmented, Water Based, Semi-Gloss (Gloss Level 5), MPI #174 WB.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Carboline Company: Carbocrylic 3359.
b. PPG Architectural: Protective and Marine Coatings, Pitt-Tech Plus 4216 HP.
c. Sherwin-Williams: Pro Industrial, Waterbased Acrolon 100 Polyurethane, B65-520 Series B65W00521.
d. Tnemec Company, Inc.: Endura-Shield, Series 1081.

C. Polyurethane, Aliphatic Acrylic, 2-Component, Pigmented, Gloss (MPI Gloss Level 6), MPI #72.
1. Products: Subject to compliance with requirements, provide one of the following:
a. AkzoNobel, Devoe High Performance Coatings, Devthane 379, 379.
b. Benjamin Moore: Corotech, Aliphatic Acrylic Urethane Gloss, V500.
c. Carboline Company: Carbothane 134 MC.
d. PPG Architectural: Protective and Marine Coatings, Pitthane Ultra Gloss 95-812 Series, 95-8001/95-819.
e. Sherwin-Williams: Protective & Marine, Acrolon 218 HS, B65W661/B65V600 Series.
f. Tnemec Company, Inc.: Endura-Shield II, Series 1074.

D. Polyurethane, 2-Component, Pigmented, Water Based, Gloss (MPI Gloss Level 6), MPI #72 WB.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Benjamin Moore: Corotech, Waterborne Acrylic Urethane Gloss, V540.
b. Carboline Company: Carbothane 134 WB.
c. Sherwin-Williams: Pro Industrial, Waterbased Acrolon 100 Polyurethane, B65W00721.
d. Tnemec Company, Inc.: Endura-Shield, Series 1080.
e. **Tnemec Company, Inc.: Enviro-Glaze, Series 297.**
f. **Tnemec Company, Inc.: Everthane, Series 248.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. **Masonry (Clay and CMUs): 12 percent.**
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted.
   1. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   2. After completing painting operations, use workers skilled in trades involved to reinstall items that were removed.
   3. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with epoxy coating.
   1. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Abrasive-blast clean surfaces to comply with SSPC-SP 13/NACE No. 6 or ICRI No. 310.2R CSP 1-3 to achieve minimum surface profile recommended by epoxy coating manufacturer.
      a. Use apparatus that abrades concrete surface, contains dispensed shot within apparatus, and recirculates shot by vacuum pickup.

E. Masonry Substrates:
   1. Remove efflorescence and chalk.
   2. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
   3. Clean surfaces with pressurized water.
      a. Use pressure range of 100 to 600 psi at 6 to 12 inches.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 6/NACE No. 3.
   2. SSPC-SP 15, Commercial Grade Power-Tool Cleaning.
      a. Use SSPC-SP 15 if commercial blast cleaning is not feasible.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. **Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.**

I. **Aluminum Substrates: Remove loose surface oxidation**.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
   1. Use applicators and techniques suited for coating and substrate indicated.
   2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
   1. Contractor shall touch up and restore coated surfaces damaged by testing.
   2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect Work of other trades against damage from coating operation. Correct damage to Work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.7 COLOR SCHEDULE

A. Colors: See Interior Finish Schedule **Legend** on Drawings for selected coating colors.

3.8 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. CMU Substrates:
   1. Pigmented Polyurethane over High-Build Epoxy System:
      a. Block Filler: Block filler, epoxy, MPI #116.
      b. Intermediate Coat: Epoxy, high build, semi-gloss, MPI #108.

c. Topcoat: Polyurethane, 2 component, pigmented, gloss, MPI #72.
d. Application:
1) Exterior locations and interior wet locations.

2. **Note: Block filler may be eliminated if coating applicator ascertains in writing that existing CMU substrate does not require block filler**.

B. Steel Substrates:
1. Pigmented Polyurethane over High-Build Epoxy System:
a. Prime Coat: Epoxy, high build, semi-gloss, MPI #108.
b. Intermediate Coat: Epoxy, high build, semi-gloss, MPI #108.
c. Topcoat: Polyurethane, 2 component, pigmented, semigloss, MPI #174.
d. **Topcoat: Polyurethane, 2 component, pigmented, gloss, MPI #72.**
e. Applications:
1) Exposed structural steel.
2) **Previously coated steel, with or without light rusting.**
3) Faces, ends, and edges of hollow metal doors and frames.
4) Lintels.
5) Ledgers.
6) **Bollards**.
7) Pipe **and downspout** guards.
8) **Pipe shrouds and covers.**
9) Other ferrous metals unless indicated otherwise.

C. Galvanized-Metal Substrates:
1. Pigmented Polyurethane over High-Build Epoxy System:
a. Prime Coat: Epoxy, high build, semi-gloss, MPI #108.
b. Intermediate Coat: Epoxy, high build, semi-gloss, MPI #108.
c. Topcoat: Polyurethane, 2 component, pigmented, semigloss, MPI #174.
d. **Topcoat: Polyurethane, 2 component, pigmented, gloss, MPI #72.**
e. Applications:
1) Faces, ends, and edges of hollow metal doors and frames.
2) Lintels.
3) Ledgers.
4) Handrails.
5) **Bollards**.
6) Pipe **and downspout** guards.
7) **Pipe shrouds and covers.**
8) Other galvanized metals unless indicated otherwise.

3.9 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. CMU Substrates:
1. Epoxy-Modified Latex System:
a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
c. Topcoat: Epoxy-modified latex, gloss, MPI #115.
d. Application:
1) Interior dry locations.
2.
3. Epoxy-Modified Latex System:
a. Block Filler: Block filler, epoxy, MPI #116.
b. Intermediate Coat: Epoxy-modified latex, exterior, matching topcoat.
c. Topcoat: Epoxy-modified latex, semi-gloss, MPI #215.
d. Topcoat: Epoxy-modified latex, gloss, MPI #115.
e. Application:

1) Exterior locations and interior wet locations.

4. **Note: Block filler may be eliminated if coating applicator ascertains in writing that existing CMU substrate does not require block filler**.

B. Concrete Substrates, Horizontal Surfaces.
1. Epoxy, High-Build System:
   a. Prime Coat: High-build epoxy, matching topcoat (reduced).
   b. Intermediate Coat: High-build epoxy, matching topcoat.
   c. Topcoat: High-build epoxy, semi-gloss, MPI #108.
   d. Application:
      1) Interior concrete floors.

C. Concrete Substrates, Horizontal Surfaces.
1. Epoxy- Polyurethane System:
   a. Prime Coat: Modified polyamine epoxy.
   b. Intermediate Coat: Modified polyamine epoxy coating, matching topcoat.
   c. Topcoat: Polyurethane, aliphatic, moisture-cured.

A. Concrete Substrates, Horizontal Surfaces.
1. Waterborne Polyurethane System:
   a. Intermediate Coat: Modified aliphatic polyaspartic urethane matching topcoat.
   b. Topcoat: Modified aliphatic polyaspartic urethane, moisture-cured.
2. Two 5 mil WFT coats. Add slip-resistant material. Aluminum oxide

B. Concrete Substrates, Horizontal Surfaces.
1. Low VOC, 2-Component, Fast-Curing Polyurethane System:
   a. Intermediate Coat: Modified aliphatic polyaspartic urethane matching topcoat.
      1) S-W Elladur 4844
      2) Tnemec Excellathane Series 256
   b. Topcoat: Modified aliphatic polyaspartic urethane.

C. Steel Substrates:
1. Pigmented, Water-Based, Polyurethane over Waterborne, Rust-Inhibitive Primer:
   a. Prime Coat: Rust-Inhibitive, water based, MPI #107.
   b. Intermediate Coat: Polyurethane, 2 component, pigmented, matching topcoat.
   c. Topcoat: Polyurethane, 2 component, pigmented, semigloss, MPI #174 WB.
   d. Topcoat: Polyurethane, 2-component, pigmented, gloss, MPI #72 WB.
   e. Applications:
      1) Exposed structural steel.
      2) Faces, ends, and edges of hollow metal doors and frames.
      3) **Ladders.**
      4) Handrails.
      5) **Guard rails.**
      6) Lintels.
      7) Ledgers.
      8) **Pipe shrouds and covers.**
      9) Other ferrous metals unless indicated otherwise.

D. Gypsum Board Substrates:
1. Epoxy, High-Build System:
   a. Prime Coat: Primer sealer, latex, interior, MPI #50.
   b. Intermediate Coat: High-build epoxy, matching topcoat.
   c. Topcoat: High-build epoxy, semi-gloss, MPI #108.
2. Epoxy-Modified Latex System:
   a. Prime Coat: Primer sealer, latex, interior, MPI #50.
   b. Intermediate Coat: Epoxy-modified latex, matching topcoat.

c. Topcoat: Epoxy-modified latex, semi-gloss, MPI #215.
d. **Topcoat: Epoxy-modified latex, gloss, MPI #115.**

E. Vertical Surfaces and Ceilings:
1. Epoxy- Polyurethane System:
a. Prime Coat: Epoxy, rust-inhibitive, waterborne, matching topcoat.
b. Intermediate Coat: Modified polyamide epoxy coating, matching topcoat.
c. Topcoat: Polyurethane, aliphatic, ceramic-modified, waterborne.
d. Applications:
1) Interior, exposed structural steel, hollow metal doors and frames, beds, no-climb covers, and other ferrous metals.
2) Interior walls other than CMU, ceilings.

END OF SECTION 09 9600

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 099623 - GRAFFITI-RESISTANT COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Graffiti-resistant coating with water repellent.
   2. Graffiti removal products.

B. Related Requirements:
   1. Section 071900 – Water Repellents.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct meeting at Project site.
   1. Require attendance of parties directly affecting Work of this Section, including Contractor, Owner’s Representative, applicator, and manufacturer's representative.
   2. Review environmental regulations, test panel procedures, protection of surrounding areas and non-masonry surfaces, surface preparation, application, field quality control, final cleaning, and coordination with other Work

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include the following manufacturer's information:
   1. Printed statement of VOC content.
   2. Standard colors.
   3. Printed application instructions.
   4. Recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For each type of water repellent.

C. Preconstruction Test Reports: For water-repellent-treated substrates.

D. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than 5 years of experience in actual production of specified products.

B. Installer's Qualifications: Firm trained and certified by coating manufacturer, with not less than 5 years of experience installing systems similar in complexity to those required for this Project, including specific requirements indicated.
   a. Size: 6 ft. by 6 ft. for each type of coating and each type of substrate indicated.
   2. Apply coatings to test surfaces according to coating manufacturer's instructions.

a. Overlap coatings to illustrate appearance differences due to build-up at run-downs and overlapping coatings at adjacent applications on same wall.
b. Allow coating to cure properly, apply graffiti as directed by Owner or Architect, then remove graffiti.
c. Repeat tests as needed to determine acceptability based upon performance and appearance criteria

3. Approval of field samples does not constitute approval of deviations from Contract Documents contained in field samples unless Architect specifically approves such deviations in writing.
4. Retain and maintain field samples during construction in undisturbed condition as a standard for judging completed Work.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing of graffiti-resistant coating on field samples.
1. In addition to verifying performance requirements, use field samples to verify manufacturer's written instructions for application procedure and optimum rates of product application to substrates.
2. Propose changes to materials and methods to suit Project.
3. Notify Architect 7 days in advance of the dates and times when field samples will be tested.

B. Absorption Testing:
1. Perform absorption tests using RILEM Test No. II.4, water absorption under low pressure (pipe method).
2. Test surfaces scheduled for water repellent coatings prior to and 5 days following application.
3. The following results will be the basis for acceptable performance:
a. Architectural concrete block/concrete brick surfaces:
1) No less than 60 mph wind-driven rain minimum after 20 minutes.
b. Clay brick, natural stone, cast-in-place concrete and precast concrete surfaces:
1) 1.0 mil or less loss in 20 minutes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site In manufacturers original, unopened containers and packaging, bearing manufacturer's name label with the following information:
1. Name of material.
2. Manufacturer's stock number and date of manufacture.
3. Manufacturer's name.
4. Contents by volume for major pigment and vehicle constituents.
5. Application Instructions.
6. Color name and number (if applicable)

B. Store materials not in use in tightly covered containers. Maintain containers used in storage of coating materials in a clean condition, free of foreign materials and residue.

C. Protect materials from freezing where necessary.
1. Keep storage area neat and orderly. Remove flammable rags and waste daily.
2. Take precautions to ensure that workers and Work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing, and application of coatings.

1.8 FIELD CONDITIONS

A. Comply with manufacturer's recommendations regarding environmental conditions under which materials can be stored and applied.

B. Proceed with application only when existing and forecasted weather and substrate conditions permit coatings to be applied according to manufacturers' written instructions and warranty requirements

C. Environmental Requirements:
1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
5. Rain or snow is not predicted within 24 hours.
6. Not less than 24 hours have passed since surfaces were last wet unless longer period is required by repellent manufacturer.
7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace graffiti-resistant coatings that fail within specified warranty period.
1. Retreat defective areas by system manufacture as determined by Architect.
2. Manufacturer shall be responsible for providing labor and material to reseal areas where coating effectiveness does not meet specified limits.
3. Warranty Period: 10 years from date of Substantial Completion.

1.10 MAINTENANCE

A. Extra Materials:
1. Provide extra graffiti stripper material in quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
a. Graffiti Removal Quantity: 1 gallon per 2,500 square feet ounce of covered area.
b. Removal Agent: Packaged in 16 to 32 ounce bottles and boxed for storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain graffiti-resistant coatings from single source from single manufacture.

2.2 PERFORMANCE CRITERIA

A. Performance: Graffiti-resistant coatings shall meet the following performance requirements as determined by preconstruction testing on substrates representing those indicated for this Project.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:

1. Cast-in-Place Concrete: ASTM C642.
2. Concrete Masonry Units: ASTM C140.

C. Water-Vapor Transmission: Comply with one or both of the following:
1. Maximum 10 percent reduction water-vapor transmission of treated compared to untreated specimens, according to ASTM E96.
2. Minimum 80 percent water-vapor transmission of treated compared to untreated specimens, according to ASTM D1653.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, according to ASTM E514.

E. Durability: Maximum 5 percent loss of water-repellent performance after 2,500 hours of weathering according to ASTM G154, or comparable test standard, compared to water-repellent-treated specimens before weathering.

2.3 MATERIALS

A. Graffiti-Resistant Coating with Water Repellent: Clear, water-based, non-sacrificial, silicone elastomer, water and graffiti-resistant coating.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Diedrich Technologies, Inc.: 333 VOC Compliant Series Omegaseal.Evonik Corporation: Protectosil ANTIFRAFFIT.Professional Products of Kansas, Inc.:Professional Water Sealant & Anti-Graffitiant.First Coat: PWS-15 Super.Second Coat: **PWS-15 Super**.
d. ProSoCo, Inc.: Sure Klean Weather Seal Blok-Guard & Graffiti Control WB 15.**Wasser Advanced Coatings Technology: MC-Antigraffiti 100.**Approved substitution.
2. Performance Requirements:
a. VOC Content: 100 g/L or less.
b. Solids: Maximum 15 percent.
c. Surface Appearance: No appreciable difference compared to non-coated surface.
d. Excellent ultraviolet light stability.
e. Cleanability: Level 3 when tested according to ASTM D6578.

B. Graffiti Removal Product: Product approved or recommended by graffiti-resistant coating manufacturer and containing benzyl alcohol, designed to remove graffiti from anti-graffiti coating.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Franmar: Blue Bear 680HS Hard Surface Graffiti Remover.
b. Professional Products of Kansas, Inc.: Phase II Cleaner.ProSoCo, Inc.: Defaser Eraser.
d. Rust-Oleum: Krud Kutter Graffiti Remover.
e. Approved substitution.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
1. Surface to be treated is clean, dry and contains no frozen water.
2. Environmental conditions are appropriate for application.

3. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect shrubs, metal, wood trim, glass, asphalt, and other building hardware during application from over-spray. Do not permit spray mist or liquid to drift onto surrounding properties.

B. Ensure surfaces are free of cracks, dust, dirt, oil, grease, paint, laitance, and other surface contaminants that may affect appearance or performance of water repellent material using mid-pressure water (1,500 psi) and commercial paint strippers.
1. Pressure washing is minimum cleaning that will be accepted. Methods such as blastracking, mobile power scrubbing, and sandblasting, may be submitted for approval.

C. Check compatibility of installed sealants and patching materials to be used with anti-graffiti coating.

3.3 APPLICATION

A. Comply with manufacturer's recommendations applying at rates indicated on container label. Apply at temperature and weather conditions recommended manufacture.

B. Apply coating to poured concrete walls**,** standard CMU**, ground-faced CMU,** and **split-faced CMU**.

C. Thoroughly brush out surface residue until material completely penetrates into surface.

D. Protect treated areas from rain and other surface water for a period of not less than 4 hours after application.

E. Provide adequate ventilation and follow governmental safety regulations.

3.4 REPAIR

A. Correct Work that does not conform to specified requirements or replace as directed by Owner at no additional cost or extension of time to Owner.

3.5 CLEANING

A. Remove protective coverings from adjacent surfaces and other protected areas.

B. Immediately clean over-sprayed coating from adjoining surfaces and surfaces soiled by sacrificial graffiti coating application as Work progresses.

C. At completion, remove from site excess material, debris, and waste resulting from this Work. Dispose of water repellent containers per state and local environmental regulations.

3.6 CLOSEOUT ACTIVITIES

A. Demonstration: Manufacturer’s representative shall provide demonstration of cleaning procedure to Owner after completion of application and surface has properly cured. Coordinate demonstration meeting with Owner and Owner’s personnel.

END OF SECTION

SECTION 101401 – REGULATORY SIGNAGE - SITEWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work herein shall include furnishing and installing all project regulatory (MUTCD) signs and signposts for the parking areas, and temporary signage for the Borrow Pit Haul Route.

1.2 REFERENCES

A. Americans with Disabilities Act of 1990

B. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction current edition

C. American Welding Society (AWS) Standard Welding Procedure Specifications

D. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction current edition

E. ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products

F. ASTM B209 - 10 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

G. ASTM D4956 - 11a Standard Specification for Retroreflective Sheeting for Traffic Control

H. ASTM A500 / A500M - 10a Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

I. ASTM A666-10 Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.

J. ASTM A588/A588M-10 Standard Specifications for High-Strength Low-Alloy Structural Steel, up to 50 ksi (345 MPa) Minimum Yield Point, with Atmospheric Corrosion Resistance.

K. ASTM A606/A606M-09a Standard Specifications for Steel, Sheet and Strip, High Strength, Low Alloy, Hot Rolled and Cold Rolled, with Improved Atmospheric Corrosion Resistance.

L. ASTM B209M - 10 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

M. ASTM D1730 - 09 Standard Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting

N. ASTM D3451-05 Standard Guide for Testing Coating Powders and Powder Coatings

O. ASTM D7378-10 Standard Practice for Measurement of Thickness of Applied Coating Powders to Predict Cured Thickness

P. ASTM D7396 - 08 Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting

1.3 SUBMITTALS

A. Submit under provisions of Section 013300 – Submittal Procedures.

B. Shop Drawings: Show materials, dimensions, fasteners, blockings, joints, assembly and installation details for:

1. Regulatory MUTCD Signs for parking areas.
2. Temporary Signage for the Borrow Pit Haul Route

C. Samples: Actual material illustrating thickness, color, and finish:

1. Regulatory MUTCD Signs: 4”x4” Sample of powder coated aluminum with vinyl letter attached.

D. Graphic Proofs

1. Submit graphic proof for each sign to be fabricated indicating overall dimensions, text size, spacing, font, colors, and attachments.

E. Installer qualifications

1. Submit firm profile and references from three projects of similar size and complexity as this project.

1.4 QUALITY ASSURANCE

A. Fabricator/installer qualifications: Engage an installer with a minimum of 5 years of experience fabricating and installing signs of similar scope and complexity to this project.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.5 STORAGE AND HANDLING

A. Protect signs from damage during transportation. Store all materials off ground under protective covering.

PART 2 - PRODUCTS

2.1 POSTS

A. Galvanized Steel: Hollow Steel Sections, in sizes indicated on drawings with closed top, drilled to accept fasteners, hot dip galvanized.

2.2 REGULATORY SIGNS

A. All signage graphics shall conform to the latest edition of Manual for Uniform Traffic Control Devices and WSDOTSS 8-21 and 9-28.

B. Traffic, and ADA Signs:

1. Aluminum alloy: T6061-T6 Meeting ASTM B209
2. Facing Materials:

a. Traffic signs (Stop):

1) Face: Reflective, weatherproof, adhesive sheeting meeting ASTM D4956, Scotchlite High Intensity sheeting series 3930 or approved equivalent
2) Back: Powder coated
3) 0.125-Inch-Thick Flat Sheet Aluminum per WSDOTSS 9-28.
4) Graphic/symbols: machine-cut vinyl-3M Scotchcal #3470.
5) All signage graphics shall conform to the latest edition of Manual for Uniform Traffic Control Devices and WSDOTSS 8-21 and 9-28.

b. ADA Signs:

1) Face: Reflective, weatherproof, adhesive sheeting meeting ASTM D4956, Scotchlite Engineer Grade sheeting series 3430 or approved equivalent
2) Back: Powder coated
3) 0.125-Inch-Thick Flat Sheet Aluminum per WSDOTSS 9-28.
4) Graphic/symbols: machine-cut vinyl-3M Scotchcal #3470.
5) All signage graphics shall conform to the latest edition of Manual for Uniform Traffic Control Devices and WSDOTSS 8-21 and 9-28.

C. Temporary Borrow Pit Haul Route Signage Sandwich Sign

1. Plywood Placard: APA B-C, Exposure Durability Classification; Exterior; ½" thick.
2. Hinges shall be Galvanized Broad Utility Hinge with Galvanized 1" bolts size to fit hinge opening and two washes and nut per hinge opening.
3. Placard shall be vinyl coated canvas with 1" edges and grommets with message screen printed on.

PART 3 - EXECUTION

3.1 GENERAL

A. Fabricate and install per Plans. Verify Sign location and orientation prior to fabrication and installation.

3.2 REGULATORY SIGNS

A. Fabrication

1. Fabricate from sheet material with thickness per WSDOT Standard Specifications 9-28.8
2. Fabricate signs with smooth edges and rounded corners.
3. Connect metal plates with continuous, watertight fillet welds, ground smooth for architectural finish per AWS standards.
4. Clean signs, prepare metal, and powder coat by electrostatic process.

    a. Galvanized and zinc coated metal surfaces: Galvanize and apply thermosetting polyester/epoxy resin-based powdercoat.
    b. Aluminum surfaces: Pre-treat per ASTM D1730 using a multi-stage chromate process or an approved chrome-free pretreatment process approved by Powder coating manufacturer for optimized weather resistance.
    c. Apply coating materials to clean surfaces to minimum 2.5 - 3.5 mil dry film thickness or as specified by manufacturer.

B. Preinstallation review: Stake locations of signs and obtain approval from WSP prior to installation.

C. All signs shall be installed level and plumb as indicated per Drawings.

D. Posts

1. Install plumb and rotated so that face of sign is turned 3% toward direction of travel.
2. Crown top of concrete footing to shed water.

E. Signs

1. Install plumb and level with face of sign turned perpendicular to travel direction.
2. Attach signs to posts with tamper-proof stainless-steel fasteners. Install nylon or dielectric washers to separate dissimilar metal types. Apply Locktite on bolt threads before tightening nuts.

F. Accessible Parking Signs

1. Sign shall read “Van Accessible”. Attach sign face to steel post with galvanized u-bolts, washers, and nuts. Install post sleeve in 12 inch diameter by 2 foot deep concrete footing. Insert a minimum of 12 inches of sign post into sleeve and secure tightly with corresponding bolt, washer and nut. Mount bottom of sign face 5 feet from finish grade. Locate sleeve/footing per detail.

END OF SECTION

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rigid panel wall sign assemblies.

B. Related Requirements:
   1. Section 101423.16 – Room-Identification Signage.

1.2 DEFINITIONS

A. Accessible: In accordance with referenced accessibility standard.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct meeting at Project.
   1. Timing: Schedule meeting a minimum of 1 week prior to starting Work of this Section.
   2. Attendees: Architect, Owner, Contractor, and Installers of panel signage and dimensional letter signage.
   3. Review and discuss sequence of Work required to construct final signage.
   4. Inspect and discuss condition of substrate and other preparatory Work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Panel sign material.
   2. Panel mounting rail system.

B. Shop Drawings: For panel sign assemblies.
   1. Include fabrication and installation details and attachments to other Work.
   2. Show sign mounting heights, locations of supplementary supports, and accessories.

C. Samples for Verification: For resin panel and mounting rail components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:
   1. Resin Panel: 2 by 4 inches indicating surface texture, exposed edge finish and corner.
   2. Mounting Rail: 6 in. long including base and cover profiles, end cap, mounting hardware, and other components required for a completed rail system. Indicate finish of exposed surfaces.
   3. Panel Signage Assembly: 12 in. sq. that includes resin panel with indicating surface and end finishes mounted in mounting rail. Include finished end, accessories, and finishes.

D. Product Schedule: For panel signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Product Test Reports: For each type and class of panel assembly, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tools: 1 sets of specialty tools for assembling signs.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications:
   1. Company specializing in fabricating specified types of signage with a minimum 3 years of experience of comparable scale and scope as this Project.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install panel signage until spaces are operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:
      a. Deterioration of finishes beyond normal weathering.
   2. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Fabricators: Engage a qualified signage firm that complies with the following:
   1. Is capable of fabricating and installing signage for entire Project.
   2. Meets requirements of these Specifications.
   3. Assumes undivided responsibility for production and installation of following:
      a. Section 101423 – Panel Signage.
      b. Section 101423.16 – Room-Identification Signage.
   4. Is acceptable to Owner and Architect.
      a. Do not engage signage firm without written approval from Owner and Architect.

B. Source Limitations: Obtain panel signage from single source from single manufacturer or fabricator.

2.2 PERFORMANCE CRITERIA

A. Structural Performance: Signs and supporting elements shall withstand effects of gravity and other loads within limits and under conditions indicated.
   1. Uniform and concentrated loads need not be assumed to act concurrently.

B. Accessibility Standard: Comply with current edition of Washington State Building Code, DOJ's "2010 ADA Standards for Accessible Design," and ICC A117.1.

2.3 PANEL SIGNS

A. Panel Signs, General: Signs with smooth, uniform surfaces; with uniform faces, sharp corners, and precisely formed lines and profiles.
   1. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

B. Refer to architectural Drawings for signage types, colors, fonts, messages, and locations.

C. Refer to Appendix A - Pierce County Interior Signage Guidelines – 2019 for complete signage materials, fabrication, mounting accessories, installation, and other requirements.

2.4 FABRICATION

A. Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs in shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
   5. Apply graphics to second surface of clear face-sheet material to produce precisely formed image.
   6. Image shall be free of rough edges.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANEL SIGNAGE

A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Install signs so they do not protrude or obstruct according to accessibility standard.
   3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
   4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

3.2 ADJUSTING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements.

B. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films as signs are installed.

B. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish.

C. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Room-identification signs.

B. Related Requirements:
   1. Section 101423 – Panel Signage.

1.2 DEFINITIONS

A. Accessible: In accordance with referenced accessibility standard.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification panel signs.
   1. Include fabrication and installation details and attachments to other Work.
   2. Show sign mounting heights and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least 1/2 size.

C. Samples for Verification: For each type of sign assembly showing components and required finishes, in manufacturer's standard size unless otherwise indicated and as follows:
   1. Room-Identification Panel Signs: Full-size Sample.
   2. Variable Component Materials: 8-inch Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
   3. Exposed Accessories: Full-size Sample of each accessory type.
   4. Full-size Samples, if approved, will be returned to Contractor for use in Project.

D. Product Schedule: Use same designations indicated on Signage Detail Sheet.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating specified types of signage with a minimum 3 years of experience of comparable scale and scope as this Project.

1.8 FIELD CONDITIONS

A. Ambient Conditions: Do not deliver or install room identification signage until spaces are enclosed and weathertight, wet Work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Separation or delamination of sheet materials and components.
   2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Fabricators: Engage a qualified signage firm that complies with the following:
   1. Is capable of fabricating and installing signage for entire Project.
   2. Meets requirements of these Specifications.
   3. Assumes undivided responsibility for production and installation of following:
      a. Section 101423 – Panel Signage.
      b. Section 101423.16 – Room-Identification Panel Signage.
   4. Is acceptable to Owner and Architect.
      a. Do not engage signage firm without written approval from Owner and Architect.

B. Source Limitations: Obtain room-identification panel signage from single source from single manufacturer or fabricator.

2.2 PERFORMANCE CRITERIA

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 75 or less.
   2. Smoke-Developed Index: 120 or less.

B. Accessibility Standard: Comply with current edition of Washington State Building Code, DOJ's "2010 ADA Standards for Accessible Design," and ICC A117.1.

2.3 INTERIOR ROOM-IDENTIFICATION PANEL SIGNAGE

A. Provide signs with smooth, uniform surfaces; with messages and characters having uniform faces, sharp corners, and precisely formed lines and profiles.

B. Braille: Grade 2 with accompanying text.

1. Coordinate messages in conjunction as indicated.
2. Braille copy indicated on Drawings is for size and position only. Do not use for full message.
3. Do not provide Braille for non-ADA signage.

C. Symbols of Accessibility: Use international symbol of accessibility where required to identify accessible facilities.

D. Raised Letters, Numbers, Symbols, and Pictograms:
1. Precisely formed raised characters free from burrs and cut marks.
2. Raised a minimum 1/32 inch from surface of sign panel.
3. Letters: Upper case unless indicated otherwise, accurately reproduced font, with spacing determined by manufacturer.
4. Pictograms:
   a. Of various sizes indicated, but not less than 3 by 3 inch.
   b. Toilet Rooms and Restrooms: Provide appropriate international gender and accessibility symbols.

E. Refer to architectural Drawings for signage types, colors, fonts, messages, and locations.

F. Refer to Appendix A - Pierce County Interior Signage Guidelines – 2019 for complete signage materials, fabrication, mounting accessories, installation, and other requirements.

2.4 FABRICATION

A. Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Preassemble signs and assemblies in shop to greatest extent possible.
2. Disassemble signs and assemblies only as necessary for shipping and handling limitations.
3. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
4. Mill joints to a tight, hairline fit.

B. Sign Panel Perimeter:
1. Edge Conditions: Square cut, with smooth edges.

C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable slide-in messages.
1. Inserts: Furnish initial changeable insert. Subsequent changeable inserts are by Owner.
2. Fabrication:
   a. Fabricate slots without burrs or constrictions that inhibit function.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Verify that sign-substrates are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ROOM-IDENTIFICATION PANEL SIGNAGE

A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Install signs so they do not protrude or obstruct according to accessibility standard.
   3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to accessibility standard.

3.3 ADJUSTING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

3.4 CLEANING

A. Remove temporary protective coverings and strippable films as signs are installed.

B. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish.

C. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 101424 – PANEL SIGNAGE – SITEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rigid panel signs.
2. Field-applied, vinyl-character signs.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Panel signs.
2. Field-applied, vinyl-character signs.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other Work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign in size acceptable to Architect.

C. Samples for Verification: For each type of sign assembly showing components and required finishes in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Not less than 12 inches square, including corner.
2. Field-Applied, Vinyl-Character Signs: Full-size Sample of characters on glass.
3. Variable Component Materials: Minimum 8 inch Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
4. Exposed Accessories: Full-size Sample of each accessory type.
5. Full-size Samples, if approved, will be returned to Contractor for use in Project.

D. Product Schedule: For panel signs. Use same designations indicated on Drawings or as specified.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Variable Component Materials: 12 replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.
2. Tools: 1 sets of specialty tools for assembling signs and replacing variable sign components.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating specified types of signage with a minimum 3 years of experience of comparable scale and scope as this Project.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install panel signage until spaces are enclosed and weathertight, wet Work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Fabricators: Subject to compliance with requirements, provide products from one of the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation.
3. ASI Sign Systems, Inc.
4. Bunting Graphics, Inc.
5. Nelson-Harkins Industries.
6. Approved substitution.

B. Source Limitations: Obtain each specified sign type from one source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

C. Structural Performance: Signs and supporting elements shall withstand effects of gravity and other loads within limits and under conditions indicated.

1. Uniform and concentrated loads need not be assumed to act concurrently.

2.3 PANEL SIGNS

A. Panel Signs, General: Signs with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as indicated below.

1. Solid-Sheet Signs: Signs fabricated from sheet material indicated below, with finish specified in "Surface Finish and Applied Graphics" Subparagraph.
2. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
3. Laminated and sandblasted photopolymers, added-on characters, chemically-welded, characters, and engraved characters are not acceptable.

B. Solid-Sheet Sign, Acrylic: Provide signs that are uniform in color and translucence.

1. Thickness: Match existing panel signs.
2. Surface-Applied, Flat Graphics: Applied vinyl film.
3. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
4. Translucence: Match existing panel signs.

5. Color: As selected by Architect from manufacturers color range.
6. Edges: Square-cut and finished with no visible saw marks.
7. Mounting: Surface mounted to wall with countersunk, security, flathead through-fasteners.

C. Surface Finish and Applied Graphics:

1. Integral Acrylic Sheet Color: Match existing panel signage.
2. Text and Typeface: Accessible raised characters and Braille, typeface matching existing panel signage, and variable content as scheduled.

    a. Finish raised characters to contrast with background color.
    b. Finish Braille to match background color.

2.4 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802; 1/16 inch thick, clear, non-glare, Type UVF; category as standard with manufacturer for each sign.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Provide concealed fasteners and anchors unless indicated to be exposed.
2. Provide stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners: Tamper-proof type devices.

    a. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

4. Inserts: Furnish inserts to be set by other installers into concrete or masonry Work.

2.6 FABRICATION

A. Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs in shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
5. Apply graphics to second surface of clear face-sheet material to produce precisely formed image.
6. Image shall be free of rough edges.

B. Shop- and Subsurface-Applied Vinyl:

1. Align vinyl film in final position and apply to surface.
2. Firmly press film from middle outward or as recommended by film manufacturer to obtain good bond without blisters or fishmouths.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template.

    a. Countersink holes in sign if required.
    b. Place sign in position and flush to surface.
    c. Install through fasteners and tighten.

D. Field-Applied, Vinyl-Character Signs:

1. Clean and dry substrate.
2. Align sign characters in final position before removing release liner.
3. Remove release liner in stages, and apply and firmly press characters into final position.
4. Press from middle outward or as recommended by film manufacturer to obtain good bond without blisters or fishmouths.
5. Remove carrier film without disturbing applied vinyl film.

E. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 102613 - CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Corner guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type of exposed finish on the following products, 12 in. long.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of exposed plastic material.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of corner guard product to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store corner guards in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during period plastic materials are stored.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two 48 inch long units.
   2. Mounting and Accessory Components: Amounts proportional to quantities of extra materials. Package mounting and accessory components with each extra material.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of corner guard units that fail in materials or workmanship within specified warranty period.
   1. Failures include manufacturing defects in metals, metal finishes, and workmanship.
   2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain corner guard products from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

2.3 METAL CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards (CG-X): Fabricated as 1-piece, formed or extruded metal with formed edges; with turn to match wall condition.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. American Floor Products Company, Inc.: Lunar CG-2143 Style L-Series.
      b. Construction Specialties, Inc.: CO-8 Series.
      c. IPC Door and Wall Protection Systems, InPro Corporation: Model **SAS-181124X-304** Series.
      d. J. L. Industries, Inc.: **CGSS90-1.5E Series**Koroseal Wall Protection Systems: Korogard **GS15** Series.
      f. Pawling Corporation: Model **CG-52**Series.
      g. Approved substitution.
   2. Material: Stainless steel, Type 304.
      a. Thickness: Minimum 0.050 inch
      b. Height: 48 inches unless indicated otherwise on Drawings.
      c. Finish: Directional satin, No. 4.
   3. Wing Size: Nominal 2 by 2 inches
   4. Height: 48 inches unless indicated otherwise on Drawings.
   5. Corner Radius: 1/8 inch.
   6. Mounting: Adhesive
   7. Application: Typical 90 deg. corner guard throughout building unless indicated otherwise.

2.4 MATERIALS

A. Extruded Aluminum Retainer: ASTM B221, Alloy 6063-T6, min. 0.062 inch thick.

B. Adhesive: As recommended by protection product manufacturer.
   1. Adhesives shall have a VOC content of 70 g/L or less.

C. Fasteners: Stainless-steel metal screws compatible with items being fastened. Use security-type fasteners where exposed to view.

2.5 FABRICATION

A. Fabricate corner guards according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Quality: Fabricate components with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Examine walls to which corner guards will be attached for blocking and other solid backing that have been installed in locations required for secure attachment of support fasteners.

C. Examine walls to which corner guards are attached with adhesive to verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing corner guards.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install corner guards according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in finished Work.

B. Mounting Heights: Install corner guards in locations indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
   1. Provide anchoring devices suitable to substrates and locations to withstand imposed loads.
   2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along run, but no closer than 12 inches apart.
   3. Adjust end and top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 102623 - PROTECTIVE WALL COVERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Abuse-resistant wall coverings.

B. Related Requirements:
   1. Section 102613 – Corner Guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
   1. Wall Guards: 12 inches long.
   2. Impact-Resistant Wall Covering: 6 by 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of handrail.

B. Material Certificates: For each type of exposed plastic material.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall protection product to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during period plastic materials are stored.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Mounting and Accessory Components: Amounts proportional to quantities of extra materials. Package mounting and accessory components with each extra material.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include manufacturing defects in metals, metal finishes, and workmanship.
2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall protection products from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

2.3 ABUSE-RESISTANT WALL COVERINGS

A. Abuse-Resistant Wall Coverings (ARWC): Fabricated from semirigid, plastic sheet wall-covering material. Basis-of-Design Products: Subject to compliance with requirements, provide the following:
   a. IPC Door and Wall Protection Systems, InPro Corporation: Palladium Rigid Vinyl Sheet.
   b. Approved substitution from one of the following:
      1) Construction Specialties, Inc.: Acrovyn 4000.
      2) Koroseal Wall Protection Systems: Korogard Protective Wallcovering.
      3) Pawling Corporation: Pro-Tek WC-60.
   2.
   3. Products: Subject to compliance with requirements, provide one of the following:
      a. Construction Specialties, Inc.: Acrovyn 4000.
      b. IPC Door and Wall Protection Systems, InPro Corporation: Palladium Rigid Vinyl Sheet.
      c. Koroseal Wall Protection Systems: Korogard Protective Wallcovering.
      d. Pawling Corporation: Pro-Tek WC-60.
      e. Approved substitution.
   4. Size: 48 by 96 inches for sheet unless indicated otherwise.
   5. Sheet Thickness: Nominal 0.060 inch
   6. Color and Texture: See Interior Finish Schedule on Drawings for selected impact-resistant wall covering (IRWC) products As selected by Architect from manufacturer's full range.
   7. Height: As indicated
   8. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
   9. Mounting: Adhesive.

B. FRL Abuse-Resistant Wall Protection (ARWP): Fabricated from fiber-reinforced laminate sheet wall-protection material. Products: Subject to compliance with requirements, provide the following:
   a. Nevamar; a Panolam Industries International, Inc. brand: FRL Wall Protection Panels.
   b. Approved substitution from one of the following:
      1) Formica Corporation: HardStop Decorative Protection Panels.
      2) Marlite: Induro FRP Panels.
   2. Size: 48 by 96 inches for sheet unless indicated otherwise.
   3. Sheet Thickness: Nominal 0.075 inch.
   4. Color and Texture: As selected by Architect from manufacturer's full range.

5. Height: As indicated.
6. Trim and Joint Moldings: Panel manufacturer's standard rigid PVC:
   a. End Cap: Panolam Industries XSC-0000.
   b. Flat Division Bar: Panolam Industries XFB-0000.
   c. Color: As selected by Architect from manufacturer's full range.
7. Mounting: Surface mounted with adhesive.
8. Physical Properties:
   a. Flexural Strength: ASTM D790; 22,000 psi.
   b. Flexural Modulus: ASTM D790; 2,000 ksi.
   c. Tensile Strength: ASTM D638; 16,000 psi.
   d. Tensile Modulus: ASTM D638; 2,000 ksi.
   e. Tensile Elongation: ASTM D638; 0.67 percent.
   f. Water Absorption: ASTM D570; 0.90 percent.
   g. Fire-Rating: ASTM E84; Class A.
9. Sustainability:
   a. Greenguard Gold Certified.

2.4 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, in thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D256, Test Method A (Izod).

C. Adhesive: As recommended by protection product manufacturer.
   1. Adhesives shall have a VOC content of 70 g/L or less.

D. Fasteners: Stainless-steel metal screws compatible with items being fastened. Use security-type fasteners where exposed to view.

2.5 FABRICATION

A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Quality: Fabricate components with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Examine walls to which wall protection will be attached for blocking and other solid backing that have been installed in locations required for secure attachment of support fasteners.

C. Examine walls to which wall is attached with adhesive to verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in finished Work.

B. Mounting Heights: Install wall protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
   1. Provide anchoring devices suitable to substrates and locations to withstand imposed loads.
   2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
   3. Adjust end and top caps as required to ensure tight seams.

D. Impact-Resistant Wall Covering: Install top and edge moldings, corners, end caps, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 102813 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Washroom accessories.
2. Shower and bath accessories.
3. Private-use bathroom accessories.
4. Custodial accessories.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate accessory locations with other Work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
2. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other Work and substrate preparation.
3. **Include electrical characteristics**.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
1. Approved full-size Samples will be returned and may be used in Work.

C. Product Schedule: Indicate types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet and bath accessories designated as accessible.

2.2 MANUFACTURERS

A. Basis-of-Design Products: Subject to compliance with requirements, provide specified products or comparable products by one of the following:
   1. American Dryer, Inc.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
   5. Excel Dryer Corporation.
   6. Frost Products Ltd.
   7. Gamco Commercial Restroom Accessories; a division of Bobrick Washroom Equipment, Inc.
   8. Tubular Specialties Manufacturing, Inc.
   9. World Dryer Corporation.

B. Source Limitations: Obtain toilet and bath accessories from single source from single manufacturer.

2.3 OWNER-PROVIDED PRODUCTS

A. Owner-Provided Products: Where indicted on Drawings as OFOI, Owner will provide the following accessories:
   1. Computers
   2. Printers
   3. Telephones

B. Verify with Owner for specific products to ensure proper blocking and preparation for installation.

2.4 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Products: Where indicted on Drawings as OFCI, Owner will furnish the following accessories for installation by Contractor:Toilet seat cover dispensers.

B. Verify with Owner specific products to ensure proper blocking and preparation for installation.

2.5 TOILET TISSUE DISPENSERS

A. Toilet Tissue Holder, Multi-Roll (TA-01): Surface-mounted, high capacity, toilet tissue dispenser. Products: Subject to compliance with requirements, provide one of the following.
      a. American Specialties, Inc.: Model No. 0039.
      b. Bobrick Washroom Equipment, Inc.: Model No. B-2892.
      c. Bradley Corporation: Model 5425.
      d. Approved substitution.
   2. Size: Nominal 20 inch wide by 11-3/8 inch high, with 5-5/16 inch projection.
   3. Materials: 18-8, Type 304 stainless steel.
      a. Door: Drawn, 1-piece seamless 0.0500 inch thick with wide viewing slot.

b. Cabinet: 0.0375 inch thick equipped with concealed, full-length, stainless steel piano hinge and 1 tumbler lock.
   1) Provide cabinet with a sliding access panel to allow dispensing from one roll at a time.
c. Finish: No. 4 satin

4. Toilet Paper Capacity: 2 minimum 9 inch diameter rolls of 2-1/4 or 3 inch diameter core tissue.
5. Spindles: High impact ABS plastic.

2.6 WASTE RECEPTACLES

A. Large Capacity Waste Receptacle (WR-X): Surface-mounted stainless steel waste container with removable liner; satin finish. Provide vinyl liner for waste and equip steel waste container with hanger hooks for vinyl liner.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. American Specialties, Inc.: Model #0458.
      b. Bobrick Washroom Equipment, Inc.: No. B-275.
      c. Bradley Corporation: Model 355.
   2. Waste Container Capacity: 20 gallons.

2.7 PAPER TOWEL DISPENSERS

A. Paper Towel Cabinet (PTC-1): Surface mounted cabinet.Products: Subject to compliance with requirements, provide one of the following:
      a. American Specialties, Inc.: No 0210.
      b. Bobrick Washroom Equipment, Inc.: No. B-262.
      c. Bradley Corporation: Model 250-15.
      d. Approved substitution.
   2. Materials: 18-8 S, Type 304 stainless steel, 0.0312 inch thick.
      a. Cabinet: 1-piece, all-welded, seamless construction, with hemmed edges at openings.
      b. Door: Provide doors with concealed, full-length, stainless steel piano hinge, and semi-concealed tumbler locks.
      c. Finish: No. 4 satin.
   3. Size: Nominal 11 inches wide, 14 inches high, 4 inches deep.
   4. Projection: Nominal 4 inches.
   5. Towel Dispenser Capacity: 400 C-fold or 525 multi-fold.

2.8 HANDS-FREE SOAP DISPENSERS

A. Liquid Soap Dispenser, Automatic (S.DSP-X): Battery-powered, sensor-activated, wall-mounted, top-fill bulk soap, automated, liquid soap dispenser.
   1. Product: Subject to compliance with requirements, provide the following:
      a. GOJO Industries, Inc.: GOJO LTX Dispenser SKU 1919-12.
      b. Approved substitution.
   2. Container: ABS plastic cover and hygienic internal components.
   3. Container Size: Nominal 6 inch wide, 4 inch deep, 10.5 inch high.
   4. Container Window: Clear polycarbonate for checking refill level.
   5. Dispensing Capacity: 1200 mL.
   6. Operation: Automated touchless dispenser with adjustable portion control.
      a. Requires 4 D batteries, not included with unit.

2.9 SANITARY NAPKIN DISPOSALS

A. Sanitary-Napkin Disposal Unit (SND-X) : Surface-mounted napkin/tampon disposal unit.Product: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: Roval Collection Model No. 20852.
   b. Bobrick Washroom Equipment, Inc. ConturaSeries No. B-270.
   c. Bradley Corporation: Diplomat Series Model 4A10
   d. GAMCO Commercial Restroom Accessories: Model ND-1.
   e. Approved substitution.
2. Material and Finish: 0.0312 inch thick 18-8, Type 304 stainless steel with No. 4 finish (satin), all-welded, seamless construction, with radius side edges of container and cover.
3. Container: Provide with integral finger depression for opening cover.
4. Cover: Matches radius as container, with full-length concealed stainless steel piano hinge.
5. Nominal Size: 7 to 8 inch wide, 10 inch high, 3-7/8 inch deep.
6. Capacity: 1.5 gallons.
7. Receptacle: Removable.

2.10 SEAT-COVER DISPENSERS

A. Toilet Seat Cover Dispenser (LTSCD) : ADA-compliant, surface-mounted toilet seat cover dispenser formed from 1-piece, seamless construction, with radius corners and edges.
1. Product: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: Roval Collection Model No. 20477-SM.
   b. Bobrick Washroom Equipment, Inc. ConturaSeries No. B-4221.
   c. Bradley Corporation: Diplomat Series Model 5A40.Approved substitution.
2. Material: 0.0375 in. thick 18-8, Type 304 stainless steel.
3. Size: Nominal 15-3/4 in. wide, 11-1/4 in. high, with 2-3/16 in. projection.
4. Cabinet Doors: Secured to cabinet with full length stainless steel piano hinges, and equipped with tumbler lock.
5. Dispenser Opening: 13-1/2 in. wide by 3 in. high.
6. Dispensing Mechanism: Spring-loaded clip.
7. Finish: No. 4 satin.
8. Minimum Capacity: 250 single or half-fold seat covers.

2.11 MIRROR UNITS

A. Mirror Unit: Channel frame type unit with shelf. Products: Subject to compliance with requirements, provide products by one of the following:
   a. American Specialties, Inc.: Model #0605.
   b. Bobrick Washroom Equipment, Inc.: No. B-166 Series.
   c. Bradley Corporation: Model 7815 Series.
   d. Approved substitution.
2. Back of Mirror: Provide full-size, shock absorbing, water-resistant, nonabrasive, 3/16 inch thick polyethylene padding.
3. Frame: Type 430 stainless-steel channel, 0.0500 inch (18 ga.) thick.
   a. Size: 1/2 inch by 1/2 inch by 3/8 inch, with 1/4 inch return at backside.
   b. Corners: 90 deg mitered and mechanically interlocked.
4. Integral Shelf: 5 inch deep, 18-8, Type 304, 0.0500 inch (18 ga.) thick stainless steel, with hemmed exposed edges.
5. Hanging Brackets: Heavy-gage galvanized-steel brackets at top and bottom of unit for mounting on concealed wall hangers that prevents mirror from pulling away from wall.

6. Size: As indicated on Drawings.

2.12 GRAB BARS

A. Grab Bars (GB-X): Concealed mounting with snap flanges. Products: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: Model No. 3800 Series
   b. Bobrick Washroom Equipment, Inc.: No. B-6806 Series
   c. Bradley Corporation: Model 812 Series
   d. GAMCO Commercial Restroom Accessories: Model 150S Series
   e. Approved substitution.
2. Materials: 18-8, Type 304, 0.0500 in. thick stainless steel tubing. Ends of grab bar pass through flanges and are heliarc welded to flanges to form 1 structural unit.
   a. Finish: Smooth, ASTM A480 No. 4 finish (satin) on ends and slip-resistant texture in grip area.
3. Outside diameter 1-1/2 in.
4. Concealed Mounting Flanges: 18-8, Type 304, 0.1250 in. thick stainless steel plate.
   a. End Flanges: 2 in. by 3-1/8 in., with 2 holes for attachment to wall.
   b. Intermediate Flanges: 2-5/8 in. by 3-1/8 in. by 3-1/8 in. diameter.
5. Snap Flange Covers: 18-8 S, Type 304, 0.0312 in. thick stainless steel, satin finish. 3-1/4 in. diameter by 1/2 in.deep; snap over mounting flange to conceal mounting screws.
6. Configuration and Lengths: Horizontal or vertical placement as indicated on Drawings.
   a. GB-1: Straight, 18 in.
   b. GB-1: Straight, 24 in.
   c. GB-3: Straight, 36 in.
   d. GB-4: Straight, 42 in.
   e. GB-5: Straight, 48 in.
7. Where grab bars are mounted on dissimilar adjacent surfaces that do not meet on an equal plane, modify end post lengths as required to mount grab bars plumb and true.

2.13 COAT AND ROBE HOOKSRobe Hook (RHK-X): Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Specialties, Inc.
   b. Basco, Inc.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. Brey-Krause Manufacturing Co.
   f. Delta Faucet Company.
   g. Franklin Brass by Liberty Hardware Manufacturing Corporation; a Masco company.
   h. GAMCO; a Division of Bobrick.
   i. Tubular Specialties Manufacturing, Inc.
   j. Approved substitution.
2. Description: Single-prong unit.
3. Mounting: Flanges with concealed exposed fasteners.
4. Material and Finish: Stainless steel, No. 4 finish (satin)

C. Shower Curtain Rod, Heavy Duty, Exposed Mounting (SCR): Products: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: Model #1214 Series.Bobrick Washroom Equipment, Inc.: No. B-6107 Series.Bradley Corporation: Model 953 Series.

d. GAMCO Commercial Restroom Accessories: Model SR100SQ.Approved substitution.

2. Curtain Rod: Type 304 stainless steel tubing, 0.0375 inch thick, 1 inch diameter.
3. Flanges: 1-piece, minimum 0.0375 inch thick, die formed mounting flanges, with satin finish.
4. Flange Shape: Nominal 2-1/2 in. sq. or 3 in. dia.
5. Length: As indicated on Drawings.

D. Shower Curtain Hooks (SHCH): Products: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: Model #1200-SHU hooks.
   b. Bobrick Washroom Equipment, Inc.: No. 204-1 hooks.
   c. Bradley Corporation: Model 9536 hooks.
   d. GAMCO Commercial Restroom Accessories: Model 100-CH.
   e. Approved substitution.
   2. Material: 18-8, Type 304, stainless steel, 0.093 inch thick, with hook snap opening for placement on 1 inch and 1-1/4 inch diameter shower curtain rods.

E. Shower Curtain (SHC): Products: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: **1200-V72**.
   b. Bobrick Washroom Equipment, Inc.: No. **204-3**.
   c. Bradley Corporation: Model 9533 Series.
   d. GAMCO Commercial Restroom Accessories: Model **100SC-72X72**.
   e. Approved substitution.
   2. Material: Minimum 9 ounce, reinforced vinyl sheet treated with antibacterial and flame-retardant agents.
   3. Thickness: Minimum 0.008 inch thick.
   4. Grommets: HDPE or corrosion-resistant metal at minimum 6 in. on center through top hem.
   5. Size: Minimum 6 in. wider than opening by 72 inches high.
   6. Color: Opaque white.

F. Shower Seat (SH.SEAT-X): Folding, molded plastic shower seat in "L" or "R" shape configuration. Products: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: Model #8206-L or No. 8206-R.
   b. Bobrick Washroom Equipment, Inc.: No. B-5181, left hand or right hand.
   c. Bradley Corporation: Model 9569 Reversible Phenolic Shower Seat.
   d. Approved substitution.
   2. Size: Nominal 33 inch wide by 21 inch deep.
   3. Configuration: Left or right handed, as indicated on Drawings.
   4. Seat: 1/2 inch thick, solid phenolic with integral slots for water drainage, secured to frame with steel carriage bolts and acorn nuts.
   5. Frame: 18-8, Type 304 stainless steel with No. 4 finish (satin), 0.0625 inch thick, 1-1/4 inch square tubing and 0.050 inch thick, 1 inch diameter seamless tubing.
   6. Mounting Flange: 18-8, Type 304 stainless steel with No. 4 finish (satin), 3/16 inch thick, with mounting screw holes.
   7. Base Plate: 18-8, Type 304 heavy-gauge stainless steel.
   8. Spring: 17-7, Type-301, 0.0250 inch thick stainless steel, spot-welded to baseplate.
   9. Guide Bracket: 0.050 inch thick stainless steel with No. 4 finish (satin).

G. Shower Shelf: Surface mounted shelf fabricated from Type 304, 0.050 inch stainless steel with satin finish, and hemmed front edge.
   1. Mounting Brackets: Welded to shelf, 0.063 inch stainless steel.

2. Size: 16 inches long by 6 inches wide with 3/4 inch return edges.

2.14 TOWEL ACCESSORIES

A. Single Towel Bar (TWL.BAR-X): Concealed mounting.
1. Products: Subject to compliance with requirements, provide the following:
   a. American Specialties, Inc.: Model No. 7360-S Series.
   b. Bobrick Washroom Equipment, Inc.: No. B-6737 Series.
   c. Bradley Corporation: Model 9054
   d. Approved substitution.
2. Material: 18-8 S, Type 304 stainless steel.
   a. Flange and Support Arm: 0.0312 inch thick.
   b. Concealed Wall Plate: 0.0625 inch thick.
   c. Towel Bar: 3/4 in. square, min. 0.0312 inch thick, lockseam rolled.
3. Finish: Satin.
4. Provide manufacturer's standard mounting fasteners and stainless steel set screws.

2.15 CUSTODIAL ACCESSORIES

A. Surface-Mounted Utility Shelf (U.SHELF-X):
1. Product: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: Model #0692 Series.
   b. Bobrick Washroom Equipment, Inc. No. B-296 Series.
   c. Bradley Corporation: Model 756 Series.
   d. Tubular Specialties Manufacturing, Inc.:
   e. Approved substitution.
2. Materials: 18-8 S, Type 304 stainless steel.
   a. Shelf: 0.0500 inch thick with nominal 1/2 inch return edges, hemmed front edge.
   b. Mounting Brackets: 0.0625 inch thick, secured inside front hem of shelf and welded to back return of shelf.
3. Finish: Satin.
4. Size: 6 in. deep, **48** in. long.

B. Mop and Broom Holder (MBH-2): Surface-mounted mop/broom holders.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. American Specialties, Inc.: 8215-3
   b. Bobrick Washroom Equipment Inc.: No. B-223x24
   c. Bradley Corporation: Bradex Model No. 9953
   d. GAMCO Commercial Restroom Accessories: Model # MS-1
   e. Approved substitution.
2. Materials: 18-8 S, Type 304 stainless steel.
   a. Mounting Base: 0.031 inch thick min., secured inside front hem of shelf and welded to back return of shelf.
3. Finish: Directional satin finish No. 4.
4. Mop/Broom Holders: Spring-loaded rubber cams with anti-slip coating designed to accommodate handles between 5/8 and 1 inch diameter.
5. Size:
   a. Length: **36** inches.
   b. Overall Height: 4-1/2 to 5 inches.
   c. Projection: 2-1/2 to 3 inches.

2.16 MATERIALS

A. Stainless Steel: ASTM A240 or ASTM A666, Type 304, nominal thickness as indicated.

B. Steel Sheet: ASTM A1008, Designation CS (cold rolled, commercial steel), 0.0359 in. minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A653, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and of galvanized steel where concealed unless indicated otherwise. Provide the following:
1. Appropriate types and quantities for properly mounting each accessory.
2. Tamper-and-theft resistant where exposed.
3. Stainless steel set-screws unless indicated otherwise.
4. Plugs and expansion shields where required.

F. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.17 CORROSION TREATMENT

A. Coat exposed stainless steel surfaces with clear, hard-coat resin.
1. Products: Subject to compliance with requirements, provide one of the following:
a. HBI, Inc.: Nyalic.
b. Approved substitution.

2.18 FABRICATION

A. Fabricate units with tight seams and joints, and exposed edges rolled.
1. Hang doors and access panels with full-length, continuous hinges.
2. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Mirror Frame Filler:
1. Where framed mirrors are mounted on wainscot surfaces of FRP, ceramic tile, or other materials not flush with gypsum board wall surface above wainscot, provide fillers at void above wainscot between back of mirror and upper wall surface.
2. Fabricate fillers from same material and finish as mirror frame, contoured to conceal void behind mirror at sides and top.
a. Solid, 1/4 in. thick tempered hardboard may be used with Architect’s written approval.
3. Ensure back of mirror frame tightly abuts and is completely supported by filler material.
4. Finish side and top edges of backing material with joint sealant SLNT.AL1 or SLNT.STP2 in color matching adjacent painted wall surfaces.

C. Keys:
1. Provide universal keys for internal access to accessories for servicing and resupplying.
2. Provide minimum of 6 keys to Owner.

D. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer.

B. Install units level, plumb, and firmly anchored in locations and at heights indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

D. Coat exposed stainless steel surfaces with accessory manufacturer’s corrosion treatment after assembly and installation.

3.2 ADJUSTING

A. Adjust accessories for unencumbered, smooth operation.

B. Replace damaged or defective items.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films as toilet accessories are installed.

B. On completion of installation of accessories, clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire-protection cabinets for portable fire extinguisher.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
   2. Coordinate sizes and locations of fire protection cabinets with wall depths.

B. Preinstallation Meetings: Conduct meeting at Project.
   1. Review methods and procedures related to fire protection cabinets, including schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semi-recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Samples for Verification: 6 by 6 inch square Samples of each type of exposed finish required.

C. Product Schedule:
   1. For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted.
   2. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.
   3. Use same designations indicated on Drawings if indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, fire extinguishers, and accessories from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINETS

A. Provide fire protection cabinets as suitable for fire extinguisher.Cabinet Type-FEC: Semi-recessed cabinet with 1-piece combination, square-edge trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Products: Subject to compliance with requirements, provide one of the following:

a. J. L. Industries, Inc.: Cosmopolitan Series 1036.
b. Larsen's Manufacturing Company: Architectural Series SS2409-R7.
c. Potter Roemer Fire Pro, Morris Group Int'l.: Alta 7062.
d. Approved substitution.

2. Square-Edge Trim: 1-1/2 to 2 inch backbend depth.
3. Projection: Nominal 1-1/2 inches.
4. Nominal Cabinet Size: Verify rough openings once product has been selected.
   a. Height: 24 to 27-3/16 inches.
   b. Width: 9-1/2 to 13-11/16 inches.
   c. Depth: 5-3/4 to 6-1/2 inches.
5. Cabinet Construction: Non-rated.
6. Cabinet Material: Cold-rolled steel sheet.
7. Cabinet Trim Material: Stainless steel sheet.
8. Door Material: Stainless steel sheet.
9. Door Style: Vertical duo panel with frame.
10. Door Glazing: Tempered float glass (clear)].

C. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide manufacturer's recessed door pull where required by ADA Accessibility Guidelines.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

D. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Non-Break Glass Cabinet Lock: Safety-type cam lock that allows door to be opened during emergency by pulling sharply on door handle.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) JL Industries, Inc.; a division of Activar Construction Products Group: Saf-T-Lok.
         2) Larsen's Manufacturing Company: Larsen-Loc.
         3) Potter Roemer LLC. Break Rite.
         4) Approved substitution.
      b. Above door lock, provide manufacturer's factory applied lettering reads: "IN CASE OF FIRE ONLY – PULL FIRMLY ON HANDLE".
   3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1) Application Process: Pressure-sensitive vinyl letters applied to cabinet glazing.
         2) Lettering Color: Black.
         3) Orientation: Vertical.

E. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B.
      a. Finish: Baked enamel or powder coat.
      b. Color: Manufacturer's standard white.
   2. Stainless Steel: ASTM A240 or ASTM A666, Type 304.
      a. Finish: ASTM A480 No. 4 directional satin finish,

3. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Miter corners and grind smooth.
   3. Provide factory-drilled mounting holes.
   4. Prepare doors and frames to receive locks.
   5. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
   1. Fabricate door frames with minimum 1/2 inch thick tubular stiles and rails and hollow-metal design.
   2. Fabricate door frames of one-piece construction with edges flanged.
   3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in 1 piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:
   1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide semi-recessed fire-protection cabinets.
   2. Provide inside latch and lock for break-glass panels.
   3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:
   1. Apply vinyl lettering at locations indicated.

3.4 REPAIR

A. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

B. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.5 ADJUSTING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

3.6 CLEANING

A. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

B. Preinstallation Meeting: Conduct meeting at Project site.
   1. Review methods and procedures related to fire extinguishers including schedules and coordination requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers.
   1. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.
   2. Use same designations indicated on Drawings if indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers, General: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Valves: Manufacturer's standard.
   2. Handles and Levers: Manufacturer's standard stainless steel.
   3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container (FE-1): UL-rated, with monoammonium phosphate-based dry chemical in enameled-steel container.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Amerex Corporation: B402.
      b. Babcock-Davis: BEX-3005-3.
      c. JL Industries, Inc.: Model Cosmic 5E.Kidde Residential and Commercial Division: Model ProPlus 5 MP.
      e. Larsen's Manufacturing Company: MP Series MP5-A.
      f. Nystrom, Inc. Model EX-3005-3.
      g. Potter Roemer LLC. Model Number 3005-3.
      h. Approved substitution.
   2. Nominal Capacity: 5 lb.
   3. UL Rating: 3A:40B:C.
   4. Locations:
      a. Interior common areas.
      b. Corridors.
      c. Other conditioned areas where indicated, and where required by local fire official.

2.4 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
   1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of AHJ.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
   1. Mounting Bracket Height: Install brackets to ensure top of fire extinguisher is 42 inches above finished floor.

END OF SECTION

SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleaning appliances.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate appliance locations with other Work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of appliances.

B. Preinstallation Meeting: Conduct meeting at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Cleaning appliances.

B. Product Data Submittals: For each type of product.
   1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

D. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of appliance.

C. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains, within 25 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

1.7 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period except as qualified below:
   1. Warranty Period: **2** years from date of Substantial Completion.
   2. Provide manufacturer's standard written limited 1 year warranty for each type of appliance specified.
   3. Provide manufacturer's standard written limited parts warranty for each type of appliance specified.

B. Clothes Washer: Full warranty, including parts and labor, for on-site service on product.
   1. Warranty Period: From date of Substantial Completion.
      a. First Year: Parts that fail due to defect in materials or workmanship.
      b. Years 2 through 5: Suspension strut assembly, motor, and motor controls that fail due to defect in materials or workmanship. Replacement of top, front, and service panels if panels rust under normal operating conditions. This does not cover labor or related service costs.
      c. Years 2 through 10: Outer tub and driven pulley that fail due to defect in materials or workmanship. This does not cover labor or related service costs.
      d. Lifetime: Washer basket that fails due to defect in materials or workmanship. This does not cover labor or related service costs.

C. Clothes Dryer: Full warranty including parts and labor for on-site service on product.
   1. Warranty Period: From date of Substantial Completion.
      a. First Year: Parts that fail due to defect in materials or workmanship.
      b. Second Year: parts that fail due to defect in materials or workmanship. This does not cover labor or related service costs.
      c. Years 2 through 5: Dryer drum and main electronic control board that fails due to defect in materials or workmanship. This does not cover labor or related service costs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer, unless indicated otherwise.

2.2 PERFORMANCE CRITERIA

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.3 CLOTHES WASHERS AND DRYERS

A. Clothes Washer, Standard: Complying with AHAM HLW-1.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. GE Appliances; a Haier Company: Model #GTW500ASNWS.
      b. Approved substitution:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amana; Whirlpool Corporation.
   b. Frigidaire.
   c. GE Appliances; a Haier Company.
   d. Kenmore; Transformco SR Brands LLC.
   e. Maytag; Whirlpool Corporation.
   f. Whirlpool Corporation.
   g. Approved substitution.
3. Type: Freestanding, top-loading unit.
4. Dimensions:
   a. Width: 27 inches.
   b. Depth: 27 inches.
   c. Height: 44 inches.
5. Drum: Perforated stainless steel.
   a. Capacity: 4.6 cu. ft.
6. Controls: Rotary-dial controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
   a. Wash Cycles: 13 wash cycles, including regular, delicate, and permanent press.
   b. Wash Temperatures: 6 settings.
   c. Speed Combinations: Variable.
7. Electrical Power: 120 V, 60 Hz, 1 phase, 10 A.
8. Motor: Manufacturer's standard with built-in overload protector.
9. Features:
   a. Agitator: Impeller (without spindle).
   b. Self-cleaning lint filter.
   c. Unbalanced-load compensator.
   d. Inlet Hoses: Minimum length 60 inches.
   e. Drain Hoses: Minimum length 48 inches.
   f. Self-leveling legs.
   g. Automatic dispenser for bleach.
   h. Spin-cycle safety switch.
   i. End-of-cycle signal.
   j. Extra-rinse option.
   k. Delay-wash option.
   l. Electronic temperature control.
   m. Water levels automatically set.
10. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
11. Appliance Finish: Enamel.
    a. Color: White.
12. Front-Panel Finish: Porcelain enamel.
    a. Panel Color: White.

B. Clothes Dryer, Standard: Complying with AHAM HLD-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   a. GE Appliances; a Haier Company: Model #GTX33EASKWW.
   b. Approved substitution:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amana; Whirlpool Corporation.
b. Frigidaire.
c. GE Appliances; a Haier Company.
d. Kenmore; Transformco SR Brands LLC.
e. Maytag; Whirlpool Corporation.
f. Whirlpool Corporation.
g. Approved substitution.

3. Type: Freestanding, frontloading, electric unit.
4. Dimensions:
   a. Width: 27 inches.
   b. Depth: 26.75 inches.
   c. Height: 44 inches.
5. Drum: Perforated stainless steel.
   a. Capacity: 6.2 cu. ft.
6. Controls: Rotary-dial.
7. Electric-Dryer Power: 208 V, 60 Hz, 4,400 W, 22 A.
8. Features:
   a. Removable lint filter.
   b. Electronic temperature and moisture-level-sensor controls.
   c. End-of-cycle signal.
   d. Interior drum light.
   e. Self-leveling legs.
   f. Antibacterial cycle.
   g. Auxiliary drying rack.
   h. Built-in electrical power fuse.
9. Appliance Finish: Enamel.
   a. Color: White.
10. Front-Panel Finish: Porcelain enamel.
    a. Panel Color: White.

2.4 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work:
   1. Noticeable variations in same piece are not acceptable.
   2. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where dryer vent will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment:
1. Securely anchor units to supporting cabinets or countertops with concealed fasteners.
2. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment:
1. Place units in final locations after finishes have been completed in each area.
2. Verify that clearances are adequate to properly operate equipment.

D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Plastic-laminate-clad countertops.
   2. Fire-retardant-treated materials.
   3. Accessories.

B. Related Requirements:
   1. Division 26 Sections for electrical fixtures and fittings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad countertops.
   1. Show materials, finishes, edge and backsplash profiles, and methods of joining.
   2. Include plans, sections, details, and attachments to other Work.
      a. Detail fabrication and installation, including field joints.
   3. Show locations and sizes of cutouts and holes for items installed in countertops.

C. Samples for Verification: As follows:
   1. Plastic Laminates: For each type, color, pattern, and surface finish required, 6 in. sq.
   2. Fabrication Sample: For each type and profile of countertop required, 8 by 10 inch plastic-laminate-clad countertop section, including core material, with front edge and backsplash, of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator and Installer.

B. Product Certificates: For the following:
   1. Composite wood and agrifiber products.
   2. High-pressure decorative laminate.
   3. Chemical-resistant, high-pressure decorative laminate.
   4. Adhesives.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program (QCP) or WI Certified Compliance Program (CCP).

D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plastic-laminate-clade countertops to include in maintenance manuals.
   1. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop with minimum 5 years of documented experience that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   1. Shop Certification: AWI's Quality Certification Program accredited participant or WI's Certified Compliance Program licensee.

B. Installer Qualifications: Fabricator of products and AWI's Quality Certification Program accredited participant or WI's Certified Compliance Program licensee.

C. Mockups: Comply with Section 014339 – Mockups.
   1. Build mockup of typical countertop as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas.

B. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

C. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

D. Keep surfaces of countertops covered with protective covering during handling and installation.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet Work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during remainder of construction period.

B. Do not install casework materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include fuzzy or splotchy surface contamination and discoloration.

C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 FABRICATORS

A. Engage woodworking firm acceptable to Owner and Architect and complies with the following:
   1. Meets requirements of these Specifications.
   2. Assumes undivided responsibility for production of plastic-laminate-clad countertops and the following"
      a. Section 064023 – Interior Architectural Woodwork.
   3. Do not engage woodworking firm without written approval from Owner and Architect.

2.2 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Standards" or WI's "North American Architectural Woodwork Standards" for grades of architectural cabinets indicated for construction, finishes, installation, and other requirements.
   1. Contract Documents may contain requirements that are more stringent than referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom

C. Certified Wood: Wood products shall be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004.

D. High-Pressure Decorative Laminate (HDPL): ISO 4586-3, Grade HGS, or as required by woodwork quality standard.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Formica Corporation.
      b. Lab Designs Architectural Laminates.
      c. Lamin-Art, Inc.; a Wilsonart company.
      d. Nevamar; a Panolam Industries International, Inc. brand.
      e. Pionite; a Panolam Industries International, Inc. brand.
      f. Wilsonart LLC; Decorative Plastic Laminates.
   2. Colors, Patterns, and Finishes: As selected by Architect from manufacturer's full range.

E. Chemical-Resistant, High-Pressure Decorative Laminate (CRHDPL): ISO 4586-3, Grade HGP, and as follows:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. CiFLAB Solutions: Q-Line Laminate.
      b. Formica Corporation: Lab Grade 840 Black.
      c. Panolam Industries International, Inc.: Pionite Chemguard.
      d. Wilsonart Contract.: Chemsurf.
   2. Laminate has the following ratings when tested with indicated reagents according to ISO 4586-3, Test Procedure 3.9.5:
      a. Nitric Acid (30 Percent): Moderate effect.
      b. Sulfuric Acid (77 Percent): Moderate effect.
      c. Hydrochloric Acid (37 Percent): Moderate effect.
      d. Phosphoric Acid (75 Percent): No effect.
      e. Acetic Acid (98 Percent): No effect.
      f. Formaldehyde: No effect.

g. Ethyl Acetate: No effect.
h. Ethyl Ether: No effect.
i. Phenol (85 Percent): Moderate effect.
j. Benzene: No effect.
k. Xylene: No effect.
l. Butyl Alcohol: No effect.
m. Furfural: No effect.
n. Methyl Ethyl Ketone: No effect.
o. Sodium Hydroxide (25 Percent): No effect.
p. Sodium Sulfide (15 Percent): No effect.
q. Ammonium Hydroxide (28 Percent): No effect.
r. Zinc Chloride: No effect.
s. Gentian Violet: No effect.
t. Methyl Red: No effect.

3. Colors, Patterns, and Finishes: As selected by Architect from manufacturer's full range.

F. Edge Treatment: Same as laminate cladding on horizontal surfaces

G. Core Material: MDF

H. Core Material at Sinks: MDF made with exterior glue

I. Core Thickness: 3/4 inch or as indicated on Drawings.
1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top where indicated.

J. Backer Sheet: Provide plastic-laminate backer sheet, ISO 4586-3, Grade BKL, on underside of countertop substrate.

K. Paper Backing: Provide paper backing on underside of countertop substrate.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
1. Recycled Content of MDF: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 90 percent.
2. Composite Wood Products: Provide products made using ultra-low-emitting formaldehyde resins or made with no added formaldehyde.
3. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
a. Products: Subject to compliance with requirements, provide one of the following:
1) ampine; Div. of Timber Products Company: Apex MDF.
2) ARAUCO North America: Trupan Standard MDF.
3) Del-Tin Fiber, LLC: Solidium Ultra MDF.
4) Georgia-Pacific Wood Products LLC: UltraStock Premium MDF.
5) Roseburg Forest Products Co.: Medite II.
6) Timber Products Company: Masisa Ultralight MDF.
7) West Fraser Timber Co., Ltd.: WestPine EcoGold MDF.

8) Weyerhaeuser Company: Super-Refined MDF2.

2.4 INSTALLATION MATERIALS

A. Adhesives for Bonding Plastic Laminate: Type as selected by fabricator to comply with requirements.
1. Type II Water-Resistant Type: Use for general adhesive.
2. Type I, Waterproof Type: Use for countertops with sinks.
3. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
4. Where through-color laminates are schedules, use adhesive that will not affect laminate finish.
5. Verify adhesives have a VOC content of 70 g/L or less.

B. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.
1. Verify adhesives have a VOC content of 70 g/L or less.

C. Sealant for Countertops: Comply with applicable requirements in Section 079200 – Joint Sealants.
1. SLNT.S3 or SLNT.STP1: Joints between plumbing fixtures and countertops, and between and adjoining walls and countertops subject to moisture.
2. SLNT.AL1 or SLNT.STP2: Perimeter of countertops at walls not subject to moisture

2.5 MISCELLANEOUS MATERIALS

A. Grommets: Grommet sets for wire management, recessed power supplies, and openings for trash, paper, and recycling are specified in Section 064100 – Architectural Wood Cabinets.

B. Countertop Supports: Concealed brackets for mounting countertops are specified in Section 055000 – Metal Fabrications.

C. Vanity Supports: Concealed, ADA-compliant, vanity brackets for mounting vanities are specified in Section 055000 – Metal Fabrications.

2.6 FABRICATION

A. Fabricate countertops according to plastic-laminate manufacturer's written instructions and to AWI's "Architectural Woodwork Standards" or WI's "North American Architectural Woodwork Standards" (NAAWS)
1. Grade: Custom

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect 7 days in advance of dates and times countertop fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.

D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical Work, and similar items.

1. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
2. Sand edges of cutouts to remove splinters and burrs.
3. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation of countertops:
   1. Condition countertops to average prevailing humidity conditions in installation areas.
   2. Examine shop-fabricated Work for completion and complete Work as required, including removal of packing.

3.2 INSTALLATION OF COUNTERTOPS

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication to extent that it was not completed in shop.
   1. Provide cutouts for appliances, plumbing fixtures, electrical Work, and similar items.
   2. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
   3. Sand edges of cutouts to remove splinters and burrs.
   4. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer.
   1. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required.
   2. Locate field joints where shown on Shop Drawings.
   3. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining Work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor countertop securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8 inch in 96 inches variation from a straight, level plane.
   2. Secure backsplashes to tops with concealed metal brackets at 16 inches on center and to walls with adhesive.
   3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

F. Apply sealant to gaps at walls; comply with Section 079200 – Joint Sealants.

3.3 ADJUSTING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

3.4 CLEANING AND PROTECTION

A. Clean countertops on exposed and semi-exposed surfaces.

B. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches on center. Remove protection at Substantial Completion.

END OF SECTION

SECTION 130541 – SEISMIC RESTRAINT REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies the anchorage and bracing for equipment and seismic anchoring and bracing for suspended equipment and equipment over 200 pounds.

1.02 QUALITY ASSURANCE

A. Reference Standards: This section incorporates by reference the latest revisions of the following documents. These documents are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
IBC 2018	International Building Code
ASCE/SEI 7-16	Minimum Design Loads for Buildings and Other Structures

1.03 SUBMITTALS

A. Procedures: Section 013300 – Submittal Procedures.

B. List of freestanding equipment weighing 200 pounds or more.

C. Anchorage details for equipment and freestanding items weighing between 200 and 400 pounds.

D. Sway bracing for elevated or suspended items such as ceiling systems, ducting, conduits, cable trays, and piping.

E. No less than 4 weeks in advance of equipment installation, for items weighing over 400 pounds. Required anchorage and bracing drawings and calculations bearing the stamp of a Professional Engineer; show the criteria used to determine seismic coefficients and forces applied to the equipment, including seismic zone, soil profile type, and importance factors.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. In accordance with IBC, all equipment shall be anchored and braced to resist seismic forces prescribed in the code and ASCE/SEI 7, Chapter 13 or 15. All equipment includes equipment which is free standing, supported by stand frames, suspended, anchored to walls, and anchored to floors or slabs.

B. Seismic anchorage and bracing for equipment shall be designed by a State of Washington Registered Structural Engineer using the site-specific seismic criteria.

1.05 SITE SEISMIC CRITERIA

A. Short Periods, Sds = 0.811.

B. Importance Factor, Ip = 1.25.

C. Site Class = D.

D. Occupancy Risk Category: III.

E. Seismic Design Category: D.

F. Response Modification Coefficient and Amplification Factors: In accordance with ASCE/SEI 7-16 Section 13.5 or 13.6.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 131147 – FIBERGLASS LIFE RING ENCLOSURES **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work consists of furnishing all labor, materials and equipment for the installation of one (1) life ring enclosure and accessories, installed on two Fiberglass (FRP) posts (posts shall be sized for wind load) mounting location as shown on the Drawings.

1.02 PERFORMANCE REQUIREMENTS

A. Life ring must be United States Coast Guard approved 30-inch size.

B. Comply with Chapter 296-24 WAC.

1.03 SUBMITTALS

A. In accordance with Section 013300 – Submittal Procedures:

1. Product Data: Indicate type, materials, sizes, individual components, and means of fastening to other work including hardware types. Provide samples for initial selection of color by Architect.
2. Shop Drawings: Details showing means of fastening, mounting locations and heights.
3. Certificate: Signed by manufacturer certifying that enclosure, life ring and line comply with United States Coast Guard guidelines and Chapter 296-24 WAC.

Commented [PUBS1]: Will this section with this title be included in the specs package?

1.04 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Deliver materials in manufacturer's original, unopened, undamaged container with identification labels intact.

C. Store all hardware in a clean, dry, and secure room to prevent hardware from damage and loss.

1.05 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Warranty Period: Ten (10) years from Date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Materials, equipment, and accessories specified under this section shall be products of:

Cheyenne Manufacturing and Product Inc.
P. O. Box 25
Brush Prairie, WA 98606
1-800-424-7575

2.02 MATERIALS AND PRODUCTS

A. The following products have been selected to establish a level of quality, design, and function. Furnish either the designated items and quantities or the approved alternate.

1. Provide one fiberglass life ring enclosure with T-handle entry and post mounting hardware.
2. Provide one 30-inch life ring United States Coast Guard approved.
3. Provide one 90-foot line attached to life ring. Line shall be a minimum of 1/4 inch in diameter and have minimum breaking strength of 500 pounds.

B. Related items: Provide all necessary fastenings, brackets, clips, and other items necessary to install the life ring enclosures in the best manner.

C. Mechanical fasteners are to be provided as required by the manufacturer. All fasteners shall be either aluminum or stainless steel.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Mount life ring enclosure units at locations and heights determined by Engineer.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations.

C. Set enclosures plumb and true to locations specified in the installation instructions.

END OF SECTION

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural-steel framing.
2. Metal roof panels.
3. Metal wall panels.
4. Foamed-insulation-core metal wall panels.
5. Metal soffit panels.
6. Thermal insulation.
7. Accessories.

B. Related Requirements:
1. Section 083613 – Sectional Doors for sectional doors in metal building systems.
2. Section 079513 – Expansion Joint Cover Assemblies

1.2 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 – Cast-in-Place Concrete.
2. Coordinate metal panel assemblies with rain drainage Work, flashing, trim, and construction of supports and other adjoining Work to provide a leakproof, secure, and noncorrosive installation.

B. Preinstallation Meeting: Conduct meeting at Project site.
1. Review methods and procedures related to metal building systems including the following:
   a. Condition of foundations and other preparatory Work performed by other trades.
   b. Structural load limitations.
   c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
   d. Required tests, inspections, and certifications.
   e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
2. Review methods and procedures related to metal roof panel assemblies including the following:
   a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
   b. Structural limitations of purlins and rafters during and after roofing.
   c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

d. Temporary protection requirements for metal roof panel assembly during and after installation.
e. Roof observation and repair after metal roof panel installation.

3. Review methods and procedures related to metal wall panel assemblies including the following:
   a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
   b. Structural limitations of girts and columns during and after wall panel installation.
   c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
   d. Temporary protection requirements for metal wall panel assembly during and after installation.
   e. Wall observation and repair after metal wall panel installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
      a. Metal roof panels.
      b. Metal wall panels.
      c. Foamed-insulation-core metal wall panels.
      d. Metal soffit panels.
      e. Thermal insulation and vapor-retarder facings.

B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
   1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation Work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
   2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
      a. Show provisions for attaching mezzanines.
   3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled Work; show locations of exposed fasteners.
      a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
      b. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and lighting fixtures.
      c. Show translucent panels.
   4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 in. per 12 inches:
      a. Flashing and trim.
      b. Gutters.
      c. Downspouts.
      d. Service walkways.

C. Samples for Verification: For the following products:

1. Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
3. Vapor-Retarder Facings: Nominal 6 inch square Samples.
4. Windows: Full-size, nominal 12 inch long frame Samples showing typical profile.
5. Accessories: Nominal 12 inch long Samples for each type of accessory.

D. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

E. Delegated-Design Submittal: For metal building systems, indicating compliance with performance and design criteria.
1. Include analysis data and calculations signed and sealed by qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For erector manufacturer

B. Welding certificates.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
1. Name and location of Project.
2. Order number.
3. Name of manufacturer.
4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

D. Erector Certificates: For qualified erector, from manufacturer.

E. Material Test Reports: For each of the following products:
1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control reports.

G. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Delegated-Design Engineer Qualifications: Professional engineer experienced in providing delegated-design engineering services of the kind indicated and is legally qualified to practice in state where Project is located.

B. Manufacturer Qualifications: A qualified manufacturer.
1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

C. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1.AWS D1.3.Use welders certified by AWS and the State in which Project is located for structural welding, and who have undergone recertification in the last 12 months.

E. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.

F. Mockups: Comply with requirements in Section 014339 – Mockups.
1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for typical wall metal panel including accessories.
   a. Size: 48 in. long by 48 in wide.
3. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water.

Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect foam-plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal building system that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace metal building system components that fail to remain weathertight, including leaks, without monetary limitation within 20 years from date of Substantial Completion
1. Warranty Period: 20 years from date of Substantial Completion.

C. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Buildings Company; a Nucor company.
2. Butler Manufacturing Company; a BlueScope Steel company.
3. CBC Steel Buildings; a Nucor company.
4. Ceco Building Systems; part of Cornerstone Building Brands family.
5. Chief Buildings; Division of Chief Industries, Inc.
6. Kirby Building Systems; a Nucor company.
7. Mesco Building Solutions; an NCI Company.
8. Metallic Building Company; an NCI Company.
9. Nucor Building Systems.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Butler Manufacturing Company; a BlueScope Steel company or comparable product by one of the following:
1. A&S Building Systems, Inc.; an NCI Company.
2. Alliance Steel, Inc.
3. American Buildings Company; a Nucor company.
4. American Steel Building Co., Inc.
5. Arco Building Systems, Inc.
6. BC Steel Buildings, Inc.
7. Behlen Mfg. Co.
8. Bigbee Steel Buildings, Inc.
9. BlueScope Buildings North America.Butler Manufacturing Company; a BlueScope Steel company.
11. CBC Steel Buildings; a Nucor company.
12. Ceco Building Systems; part of Cornerstone Building Brands family.
13. Chief Buildings; Division of Chief Industries, Inc.
14. Elite Structures, Inc.
15. Garco Building Systems; an NCI Company.
16. Gulf States Manufacturers, Inc.; Division of Magnatrax Corp.
17. Inland Buildings; Subsidiary of Behlen Mfg. Co.
18. Kirby Building Systems; a Nucor company.
19. Mesco Building Solutions; an NCI Company.
20. Metallic Building Company; an NCI Company.
21. Metco Metal Supply.
22. Mid-West Steel Building Company; an NCI Company.
23. Nucor Building Systems.
24. Pinnacle Structures, Inc.
25. Robertson Building Systems; part of Cornerstone Building Brands family.
26. Ruffin Building Systems, Inc.
27. Schulte Building Systems, LLP.
28. Spirco Manufacturing.
29. Star Building Systems; part of Cornerstone Building Brands family.
30. Steel Systems; an NCI Company.
31. Trident Building Systems, Inc.
32. Tyler Building Systems, L.P.
33. United Structures of America, Inc.
34. USA, Inc.
35. Varco-Pruden Buildings; a division of BlueScope Buildings North America, Inc.
36. Vulcan Steel Structures, Inc.
37. Whirlwind Building Systems.

C. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. As determined by metal building system manufacturer. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
2. Rigid Modular: Solid-member, structural-framing system with interior columns.
3. Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.
4. Truss-Frame Modular: Truss-member, structural-framing system with interior columns.
5. Lean-to: Solid- or truss-member, structural-framing system, designed to be partially supported by another structure.

C. Endwall Framing:
1. Manufacturer's standard, for buildings not required to be expandable, consisting of load-bearing endwall and corner columns and rafters primary frame, capable of supporting one-half of a bay design load, and endwall columns.
2. Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and endwall columns.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and partially inset-framed flush-framed exterior-framed (bypass) girts.

E. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings

F. Bay Spacing: As indicated on Drawings or as determined by manufacturer

G. Roof Slope: Manufacturer's standard for frame type required 3in./12 inches.

H. Roof System: Manufacturer's standard standing-seam, vertical-rib, standing-seam, trapezoidal-rib metal roof panels..
1. Liner Panels: Tapered rib.

I. Exterior Wall System: Manufacturer's standard exposed-fastener, reverse-rib, foamed-insulation-core metal wall panels with exposed fasteners.
1. Liner Panels: Tapered rib.

2.3 PERFORMANCE CRITERIA

A. Delegated-Design: Engage a qualified professional engineer, as defined in Section 013573 – Delegated-Design Procedures, to design metal building system.

B. Structural Performance: Metal building systems shall withstand effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
1. Design Loads: Comply with the following unless stricter requirements are indicated on Drawings:
a. Wind Loads: 100 mph (ultimate) with Exposure.
b. Snow Loads: 25 psf minimum.
2. Collateral Loads:
a. Roof Load: 2 psf, distributed.
b. Support for sectional overhead coiling door tracks, mechanical equipment, electrical equipment, and other specified equipment and hardware.
3. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
4. Deflection and Drift Limits: No greater than the following unless stricter tolerances are indicated on Drawings:
a. Purlins and Rafters: Vertical deflection of 1/240 of the span.

b. Girts: Horizontal deflection of 1/180 of the span.
c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
d. Metal Wall Panels: Horizontal deflection of 1/180 of the span.
e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
f. Lateral Drift: Maximum of 1/400 of the building height.

C. Seismic Performance: Metal building system shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.

F. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.

G. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

H. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592.
1. Wind Loads: As indicated on Drawings.

I. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft.

J. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft.

K. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft.Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft.Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 90

N. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
   1. Fire/Windstorm Classification: Class 1A-90
   2. Hail Resistance: MH

O. Solar Reflectance Index: ASTM E1980; not less than 78

P. Energy Star Listing: Roof panels that are listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for steep-slope roof products.

Q. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:
   1. 3-year, aged, solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
   2. 3-year, aged, Solar Reflectance Index of not less than 64 when calculated according to ASTM E1980.

R. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
   1. Roof:
      a. U-Factor: 0.027
      b. R-Value: R-38, Continuous Insulation
   2. Walls:
      a. U-Factor: 0.050
      b. R-Value: R-25 + R-22 Linear System

2.4 STRUCTURAL-STEEL FRAMING

A. Recycled Content of Steel Products: Postconsumer recycled content plus 1/2 of preconsumer recycled content not less than 25 percent.

B. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."

C. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

D. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

E. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, beams~~,~~ sidewall, intermediate, endwall, and corner columns; and wind bracing.
   1. Provide frames with attachment plates, bearing plates, and splice members.
   2. Factory drill for field-bolted assembly.
   3. Provide frame span and spacing indicated.
      a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
   4. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
   5. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

6. Truss-Frame, Clear-Span Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
7. Truss-Frame Modular Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
8. Long-Bay Frames:
   a. I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
   b. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
9. Frame Configuration: Single gable
10. Exterior Column: Uniform depth or tapered.
11. Rafter: Uniform depth or tapered.

F. Endwall Framing: Manufacturer's standard primary Endwall framing fabricated for field-bolted assembly to comply with the following:
   1. Endwall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
   2. Endwall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

G. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
   1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2 inch wide flanges.
      a. Depth: As indicated on Drawings or as needed to comply with system performance requirements.
   2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2 inch wide flanges.
      a. Depth: As indicated on Drawings or as needed to comply with system performance requirements.
   3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
   4. Flange Bracing: Minimum 2 by 2 by 1/8 inch structural-steel angles or 1 inch diameter, cold-formed structural tubing to stiffen primary-frame flanges.
   5. Sag Bracing: Minimum 1 by 1 by 1/8 inch structural-steel angles.
   6. Base or Sill Angles: Manufacturer's standard base angle or C-shaped sections fabricated from zinc-coated (galvanized) steel sheet.
   7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
   8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.

9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

H. Bracing: Provide adjustable wind bracing using any method as follows:
1. Rods: ASTM A36; ASTM A572, Grade 50; or ASTM A529, Grade 50; minimum 1/2 inch diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
2. Cable: ASTM A475, minimum 1/4 inch diameter, extra-high-strength grade, Class B, zinc-coated, 3-strand steel; with threaded end anchors.
3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
5. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.

I. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

J. Materials:
1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
3. Plate and Bar: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.
4. Steel Pipe: ASTM A53, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
7. Metallic-Coated Steel Sheet: ASTM A653, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A755.
   Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
   a. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, SS, Grade 50or 80; with Class AZ50 coating.
9. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for primary framing.
10. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for secondary framing.

11. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.
    a. Finish: Plain
12. High-Strength Bolts, Nuts, and Washers, Grade A325: ASTM F3125, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
    a. Finish: Plain
13. High-Strength Bolts, Nuts, and Washers, Grade A490: ASTM F3125, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
14. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, Type 1, heavy-hex-head steel structural bolts with spline ends.
    a. Finish: Plain
15. Unheaded Anchor Rods: ASTM F 1554, Grade 55
    a. Configuration: Straight.
    b. Nuts: ASTM A563 heavy-hex carbon steel.
    c. Plate Washers: ASTM A36 carbon steel.
    d. Washers: ASTM F436 hardened carbon steel.
    e. Finish: Plain
16. Headed Anchor Rods: ASTM F 1554, Grade 55.
    a. Configuration: Straight.
    b. Nuts: ASTM A 563 heavy-hex carbon steel.
    c. Plate Washers: ASTM A 36/A 36M carbon steel.
    d. Washers: ASTM F 436 hardened carbon steel.
    e. Finish: Plain
17. Threaded Rods: ASTM A 36/A 36M.
    a. Nuts: ASTM A 563 heavy-hex carbon steel.
    b. Washers: ASTM F 436 hardened carbon steel.
    c. Finish: Plain.

K. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
1. Clean and prepare in accordance with SSPC-SP2.
2. Coat with single-component, rust-inhibitive, waterborne acrylic primer.
3. Apply primer to primary and secondary framing to a minimum dry film thickness between 2.0 mils and 4.0 mils.
    a. Color: Primer manufacturer's standard gray.
    b. Sheen: Eggshell.

2.5 METAL ROOF PANELS

A. Standing-Seam, Vertical-Rib, Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.
    a. Exterior Finish: 2-coat fluoropolymer
    b. Color: As selected by Architect from manufacturer's full range.
2. Clips: 2-piece floating to accommodate thermal movement.

3. Joint Type: Mechanically seamed
4. Panel Coverage: 16 inches.
5. Panel Height: 2 inches.

B. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
   1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.
      a. Exterior Finish: 2-coat fluoropolymer
      b. Color: As selected by Architect from manufacturer's full range.
   2. Clips: 2-piece floating to accommodate thermal movement.
   3. Joint Type: Mechanically seamed
   4. Panel Coverage: 24 inches
   5. Panel Height: 3 inches

C. Exposed Fastener, Tapered-Rib, Metal Roof Panels : Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
   1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.
      a. Exterior Finish: 2-coat fluoropolymer
      b. Color: As selected by Architect from manufacturer's full range.
   2. Major-Rib Spacing: 12 inches on center.
   3. Panel Coverage: 36 inches.
   4. Panel Height: 1.5 inches

D. Exposed-Fastener, Tapered-Rib, Metal Liner Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
   1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755.
      a. Exterior Finish: 2-coat fluoropolymer
      b. Color: As selected by Architect from manufacturer's full range.
   2. Major-Rib Spacing: 12 inches on center.
   3. Panel Coverage: 36 inches.
   4. Panel Height: 1.5 inches

E. Exposed Coil-Coated Finish:
   1. 2-Coat Fluoropolymer: AAMA 621; fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Finish consists of the following:
      a. Prime Coat: Minimum total dry film thickness of 0.15 to 0.20 mils.
      b. Finish Coat: Minimum total dry film thickness of 0.70 to 0.80 mils.

c. Total Dry Film Thickness: 0.85 to 1.00 mils.
d. Secular Gloss: ASTM D523; 8 to 15 at 60 deg.

2. 3-Coat Fluoropolymer: AAMA 621; fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat
   a. Total Dry Film Thickness: Minimum 0.50 mils.

2.6 METAL WALL PANELS

2.7 FOAMED-INSULATION-CORE METAL WALL PANELS

A. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
   1. Panel Thermal-Resistance Value (R-Value): R-13 + R-14 Continuous Insulation
   2. Facing Material: Fabricate panel with exterior and interior facings of same material and thickness. Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755.
      a. Exterior Surface: Smooth, flat.
      b. Exterior Finish: Two-coat fluoropolymer.
      c. Color: As selected by Architect from manufacturer's full range.
   3. Panel Coverage: 36 inches nominal.
   4. Panel Thickness: 2 inches.
   5. Insulation Core: Modified polyisocyanurate or polyurethane foam using a non-CFC blowing agent, foamed-in-place or board type, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
      a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
      b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
      c. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
      d. Shear Strength: 26 psi when tested according to ASTM C273.
   6. Fire-Test-Response Characteristics: Class A according to ASTM E108.
   7. Surface-Burning Characteristics: Flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

2.8 METAL SOFFIT PANELS

A. Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal panels.
   1. Finish: As indicated on Drawings.

C. Exposed-Fastener, Tapered-Rib-Profile, Metal Soffit Panels: Formed with raised, trapezoidal major ribs and flat pan between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755.
   a. Exterior Finish: Two-coat fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.
2. Major-Rib Spacing: 12 inches o.c.
3. Panel Coverage: 36 inches.
4. Panel Height: 1.5 inches.

D. Concealed-Fastener, Flush-Profile, Metal Soffit: Formed with vertical panel edges and flush surface; with flush joint between panels; with 1 inch wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755.
   a. Exterior Finish: Fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.
2. Panel Coverage: 12 inches.
3. Panel Height: 1.5 inches.

2.9 THERMAL INSULATION

A. Faced Metal Building Insulation: ASTM C991, Type II, glass-fiber-blanket insulation; minimum 0.5 lb/cu. ft. density; 2 inch wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.

B. Mineral-Fiber-Blanket Insulation: ASTM C665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.
1. Nonreflective Faced: Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
2. Reflective Faced: Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
3. Unfaced: Type I (blankets without membrane covering), passing ASTM E136 for combustion characteristics.

C. Retainer Strips: For securing insulation between supports, 0.025 inch nominal thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

D. Vapor-Retarder Facing: ASTM C1136.
1. Composition: 0.0015 in. thick, UV-stabilized, white metallized-polypropylene film facing laminated to 14 lb. kraft-paper backing with fiberglass scrim reinforcement.
   a. White polypropylene or vinyl film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.
2. Vapor Permeance: ASTM E96, Desiccant Method (Procedure A); max. 0.02 perms.
3. Water Vapor Permeance: ASTM E96; 0.02 to 0.05 perm.
4. Surface-Burning Characteristics: Comply with ASTM E84.
   a. Flame Spread: 25.

E. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.10 ACCESSORIES

A. Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
   1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
   2. Clips: Manufacturer's standard, formed from steel or stainless-steel sheet, designed to withstand negative-load requirements.
   3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   4. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
   5. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1 inch standoff; fabricated from extruded polystyrene.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018 inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
   1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
   2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018 inch nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

E. Gutters : Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018 inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96 inch long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
   1. Gutter Supports: Fabricated from same material and finish as gutters.
   2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018 inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
   1. Mounting Straps: Fabricated from same material and finish as gutters.

G. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
   1. Circular-Revolving Type: Minimum 20 inch diameter throat opening; zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024 inch nominal uncoated steel thickness, with coil coating; finished to match metal roof panels; with matching base and rain cap.
      a. Type: Stationary revolving.
      b. Bird Screening: Galvanized steel, 1/2 inch square mesh, 0.041 inch wire; or aluminum, 1/2 inch square mesh, 0.063 inch wire.
      c. Dampers: Spring-loaded, butterfly type; pull-chain operation; with pull chain of length required to reach within 36 inches of floor.
      d. Reinforce and brace units, with joints properly formed and edges beaded to be watertight under normal positive-pressure conditions.
      e. Mount ventilators on square-to-round bases for ridge or on-slope mounting, designed to match roof pitch and roll formed to match metal roof panel profile.
   2. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018 inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot-long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
      a. Bird Screening: Galvanized steel, 1/2 inch square mesh, 0.041 inch wire; or aluminum, 1/2 inch square mesh, 0.063 inch wire.
      b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches of floor.
      c. Throat Size: as standard with manufacturer, and as required to comply with ventilation requirements.

H. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048 inch nominal uncoated steel thickness; finished to match metal wall panels. Form blades from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.036 inch nominal uncoated steel thickness; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.
   1. Blades: Fixed.
   2. Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.
   3. Free Area: Not less than 7.0 sq. ft. for 48 inch wide by 48 inch high louver.

4. Bird Screening: Galvanized steel, 1/2 inch square mesh, 0.041 inch wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.
   a. Mounting: Interior face of louvers.
5. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches o.c., whichever is less.

I. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

J. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
   a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
   b. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
   c. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with EPDM sealing washers bearing on weather side of metal panels.
   d. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
   e. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
   f. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30 minute working time.
4. Metal Panel Sealants: As recommended by building system manufacturer for intended use.
5. Metal Panel Sealants:
   a. Sealant Tape: Pressure-sensitive, 100 percent solids, butyl-based sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
   b. Joint Sealant: ASTM C920; 1 part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.11 FABRICATION

A. Design components and field connections required for erection to permit easy assembly.
1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
   1. Make shop connections by welding or by using high-strength bolts.
   2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
   3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
   4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
   5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
   1. Make shop connections by welding or by using non-high-strength bolts.
   2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
   1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.12 SOURCE QUALITY CONTROL

A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
   1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by AHJ to perform such Work without special inspection.
      a. After fabrication, submit copy of certificate of compliance to AHJ, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Before erection proceeds, survey elevations and locations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
   1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates:
1. Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
2. Clean bottom surface of plates.
3. Set plates for structural members on wedges, shims, or setting nuts as required.
4. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
5. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening.
1. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing.
2. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
3. Level and plumb individual members of structure.
4. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls:
1. Erect framing level, plumb, rigid, secure, and true to line.
2. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts.
3. Use grout to obtain uniform bearing and to maintain a level base-line elevation.
4. Moist-cure grout for not less than 7 days after placement.
5. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
    a. Joint Type: Snug tightened or pretensioned as required by manufacturer.

G. Secondary Framing:
1. Erect framing level, plumb, rigid, secure, and true to line.
2. Field bolt secondary framing to clips attached to primary framing.

3. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
4. Locate and space wall girts to suit openings such as doors and windows.
5. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Steel Joists: Install joists, girders, and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated or required by metal building manufacturer.
5. Joist Installation: Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
6. Joist Installation: Weld joist seats to supporting steel framework.
7. Install and connect bridging concurrently with joist erection before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical Work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

D. Anchor metal panels and other components of Work securely in place, with provisions for thermal and structural movement.
1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 – Joint Sealants.

3.5 INSTALLATION OF METAL ROOF PANELS

A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge caps as metal roof panel Work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
6. Provide metal closures at peaks, rake walls and each side of ridge caps.

C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.

1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
4. At metal panel splices, nest panels with minimum 6 inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.6 INSTALLATION OF METAL WALL PANELS

A. Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel Work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches on center., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.
1. Install clips to supports with self-tapping fasteners.

2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.

D. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.7 INSTALLATION OF METAL SOFFIT PANELS

A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.

B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.8 INSTALLATION OF THERMAL INSULATION

A. Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:
1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
3. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
    a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
    a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
   1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
   2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

D. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.
   1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.9 INSTALLATION OF ACCESSORIES

A. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install Work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.
   1. Provide elbows at base of downspouts to direct water away from building.

2. Tie downspouts to underground drainage system indicated.

E. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.

F. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.

G. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent Work.
1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 – Joint Sealants for sealants applied during louver installation.

H. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.10 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 ADJUSTING

A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

C. Roof Ventilators and Adjustable Louvers: After completing installation, including Work by other trades, lubricate, test, and adjust units to operate easily, free of warp, twist, or distortion as needed to provide fully functioning units.
1. Adjust louver blades to be weathertight when in closed position.

3.12 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
   1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

D. Touchup Painting: Cleaning and touchup painting are specified in Section 099600 – High-Performance Coatings.

E. Metal Panels:
   1. Remove temporary protective coverings and strippable films, if any, as metal panels are installed.
   2. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer.
   3. Maintain in a clean condition during construction.
   4. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

F. Louvers:
   1. Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period.
   2. Do not let soil accumulate until final cleaning.
   3. Restore louvers damaged during installation and construction period so no evidence remains of corrective Work.
      a. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units at no cost to the Owner.
   4. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 210500 – GENERAL FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General Fire Suppression Requirements.

B. Fire Suppression Submittals.

C. Motors.

D. Equipment and Fire Suppression System Identification.

E. Commissioning.

1.2 GENERAL

A. Includes, but not limited to, furnishing labor, materials, and equipment for completion of work unless indicated or noted otherwise. See Division 1 for sequence of work.

B. All work included in Division 21 shall be the responsibility of a single Fire Suppression Subcontractor. This Contractor shall obtain and pay for all permits required by State and local authorities governing the installation of the mechanical work. It is the Contractor's responsibility to contact all utility organizations serving the building, prior to bid, and to include all charges for inspections, installation of materials, equipment and connection of all required utilities.

C. Furnish exact location of electrical connections and complete information on motor controls to Division 26

D. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

E. The ductwork and accessibility to HVAC equipment shall take precedence over all other equipment in the ceiling interstitial spaces or other mechanical areas. Fire sprinkler piping shall route around ducts and HVAC.

F. All Fire Suppression equipment and devices furnished or installed under other Divisions of this specification (or by the Owner) which require connection to any mechanical systems (i.e., plumbing systems or duct systems, or controls) shall be connected under this division of the Specifications

G. The Contractor shall be responsible for checking field conditions and verifying all measurements and relationships indicated on the drawings before proceeding with the work.

1.3 ELECTRICAL

A. All electrical work, conduit, boxes and devices in connection with control wiring as required to install the control equipment as specified herein or shown on the drawings shall be furnished and installed complete by the Division 21 Contractor.

B. All electrical work performed under this section of the Specifications shall conform to all applicable portions of the Division 26 specifications and shall conform to all governing codes.

C. All equipment shall be factory wired to a junction box for connection to electrical service.

D. Where a piece of equipment specified includes an electric motor, the motor shall be furnished and mounted by this Contractor. Motor starter, disconnect switches and wiring from the electrical panel to the motor control devices and to the motor shall be provided by the Division 26 Contractor unless stated otherwise in the mechanical specification and on the mechanical equipment schedule.

1.4 SYSTEMS DESCRIPTION

A. Site Inspection:

1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.
2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

B. Drawings:

1. Mechanical drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
2. Consider electrical drawings part of this work insofar as these drawings furnish information relating to design and construction of building.
3. Because of small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

1.5 SUBMITTALS

A. All material used on the project shall be new and free of defects. The Engineer reserves the right to reject any material, the appearance of which has been damaged on the site or in shipment. The material shall be of approved equal quality to that which is specified. Should the make and type of material differ from that specified, the Contractor may be required to submit catalog and engineering data (samples if requested) necessary to make a comparison and determine its suitability. The Contractor shall also bear the cost of any changes to the electrical design made necessary by any approved substitutions. Such request for approval shall be made two weeks in advance of the bid opening to allow time to assess its suitability. Failure to obtain approval prior

to bid shall require the successful bidder to furnish materials and equipment only as specified herein.

B. The Contractor shall submit to the Engineer, for approval, complete information on all equipment and materials to be provided on the project including six copies of the manufacturer's catalog and engineering data, shop drawings of shop fabricated equipment and instruction data for each item included under this section of the specifications. Submittals shall be presented to the Engineer within 30 calendar days from the date of the contract signing in complete indexed and bound sets. The Contractor shall submit a typed, signed list including all items to be furnished on the project. The signature on the aforementioned list shall indicate that the contractor has examined the suitability of all material and equipment with respect to compliance with these specifications. The Contractor's approval shall also indicate that physical dimensions of the equipment have been verified with the installation requirements and were found to cause no interference therewith.

C. Review of submittal data by the Engineer or Engineer does not relieve the Contractor of responsibility for quantities, measurements, and compliance with the intent of all contract documents.

D. Furnish submittals on the following equipment in a hard-back, three-ring binder:

1. Pipe
2. Valves
3. Pipe Hangers
4. Fire Sprinkler Specialties
5. Fire Sprinklers
6. Fire Suppression Equipment

E. The Contractor shall submit the fire suppression cost breakdown including all sub-contractors costs.

1.6 OPERATION AND MAINTENANCE MANUAL FOR FIRE SUPPRESSION SYSTEMS

A. Bind Operation & Maintenance Manual for Fire Suppression Systems in three-ring, hard-backed binder with clear plastic pocket on spine. Spine of each binder shall have following typewritten lettering inserted:

OPERATION AND MAINTENANCE MANUAL
FOR FIRE SUPPRESSION SYSTEMS

B. Provide master index at beginning of Manual showing items included. Use plastic tab indexes for sections of Manual.

C. First section shall consist of name, address, and phone number of Engineer, General Contractor, and Mechanical, Plumbing, Sheet Metal, Refrigeration, Temperature control, and Electrical subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.

D. Provide section for each type of item of equipment.

E. Submit copies of Operation & Maintenance Manual to Engineer for approval.

F. Include descriptive literature (Manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.

G. Operating Instructions shall include:

1. General description of each fire suppression system.
2. Step-by-step procedure to follow in putting each piece of fire suppression equipment into operation.

H. Maintenance Instructions shall include:

1. Manufacturer's maintenance instructions for each piece of fire suppression equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists operation instructions of equipment, and maintenance and lubrication instruction.
2. Summary list of equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
3. List of fire suppression equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.

1.7 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform work in accordance with applicable Codes.
2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern.

B. Product Approvals: See paragraphs elsewhere in this specification.

C. Manufacture: Use domestic made pipe, pipe fittings, valves, sprinklers and motors on project.

D. Identification: Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

1.8 CODES AND STANDARDS

A. Codes and agencies having jurisdictional authority over Fire Suppression installation.

1. International Building Code -- Latest Approved Edition
2. International Mechanical Code -- Latest Approved Edition
3. Uniform Plumbing Code -- Latest Approved Edition
4. Local Sewer and Water District Requirements

5. State and County Department of Health
6. NFPA
7. Uniform Fire Code
8. Occupational Safety and Health Administration (OSHA)
9. Washington Industrial Safety and Health Act (WISHA)

1.9 PRODUCT HANDLING AND PROTECTION

A. Contractor is responsible for protection of all material, equipment and apparatus provided under this section from damage, water, corrosion, freezing and dust, both in storage and when installed, until final project acceptance.

B. Provide temporary heated and sheltered storage facilities for material and equipment.

C. Completely cover motors and other moving machinery to protect from dirt and water during construction.

D. Handle and protect equipment and/or material in manner precluding unnecessary fire hazard.

E. Equipment requiring rotation and/or lubrication during storage shall have records maintained and witnessed on a monthly basis and forwarded to the Engineer prior to acceptance.

F. Material or equipment damaged because of improper storage or protection will be rejected.

G. Equipment finish that is damaged by handling, storage, etc. shall be corrected by the Contractor at no additional cost to the Owner.

1.10 WARRANTIES

A. In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

B. In order to be protected, secure proper guarantees from suppliers and subcontractors.

C. Provide certificates of warranty for each piece of equipment. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

1.11 ABBREVIATIONS

1.	AFF	Above Finish Floor
2.	AMCA	Air Moving & Conditioning Association
3.	ANSI	American National Standards Institute
4.	APWA	American Public Works Association
5.	ARI	Air Conditioning and Refrigeration Institute

6.	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
7.	ASME	American Society of Mechanical Engineers
8.	ASTM	American Society of Testing & Materials
9.	AWWA	American Water Works Association
10.	BFF	Below Finish Floor
11.	BHP	Brake Horsepower
12.	BTU	British Thermal Unit
13.	CFC	Chloro - Flurocarbon
14.	CFM	Cubic Feet per Minute
15.	DOT	US Department of Transportation
16.	EPA	Environmental Protection Agency
17.	fpm	feet per minute
18.	FS or Fed. Spec.	Federal Specifications
19.	HP	Horsepower
20.	IEEE	Institute of Electrical and Electronics Engineers
21.	KW	Kilowatt
22.	MBH	One Thousand British Thermal Units per Hour
23.	MS or Mil.Spec.	Military Specifications
24.	MSS	Manufacturers Standardization Society
25.	NEC	National Electrical Code
26.	NEMA	National Electrical Manufacturers Association
27.	per	in accordance with
28.	PVC	Polyvinyl Chloride
29.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
30.	SP	Static Pressure
31.	UL	Underwriter's Laboratories
32.	w.g.	Water Gauge (inches of water)
33.	WQA	Water Quality Association

34. Additional abbreviations are as listed on the drawings or elsewhere in these specifications.

1.12 DEFINITIONS

A. Finished Spaces: Spaces used for habitation or occupancy where rough surfaces are plastered, panelled, or otherwise treated to provide a pleasing appearance.

B. Unfinished Spaces: Spaces used for storage or work areas where appearance is not a factor.

C. Concealed Spaces: Spaces out of sight. For example, above ceilings; below floors; between double walls; furred-in areas; pipe and duct shafts; and similar spaces.

D. Exposed: Open to view. For example, pipe running through a room and not covered by other construction.

E. Outside: Open to view up to 5 feet beyond the exterior side of walls, above the roof, and unexcavated or crawl spaces.

F. Conditioned Space: An area, room or space normally occupied and being heated or cooled for human habitation by any equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Any reference to the specifications or on the drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

B. The manufacturer listed as Acceptable Manufacturers are approved for the items indicated without obtaining prior approval. Other manufacturers require prior approval.

C. The listing of a manufacturer as an Acceptable Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which may be capable of manufacturing, or have in the past manufactured, items equal to those specified, and is intended to aid the Contractor in identifying manufacturers.

D. Products provided by Acceptable Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the plans and specifications. The Engineer shall be the final judge as to whether an item meets these requirements or not. If a manufacturer is not certain that his product meets these requirements or not, then the manufacturer shall submit data as required to obtain the Design Consultant's approval.

E. The approval of a manufacturer applies to the manufacturer only and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications.

F. Contractor shall be responsible for all costs to other trades and all revisions required to accommodate any products which are different than those specified or shown.

G. In reviewing a manufacturer for acceptance, factors considered include the following: engineering data showing item's performance, proper local representation of manufacturer, likelihood of future manufacturer's local support of product, service availability, previous installation, previous use by Owner/Engineer and record, product quality, availability/quality of maintenance and operation data, capacity/performance compared to specified items, acoustics, items geometry/access utility needs, and similar concerns.

H. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.

I. If non-specified equipment is used and it will not fit job site conditions, this Division assumes responsibility for replacement with items named in Specification.

2.2 ACCESS DOORS

A. This contractor shall be responsible for furnishing and installing flush mounted access doors in walls, ceiling and floors and chases where the following equipment is concealed and is not accessible through same.

1. Valves (shut off)
2. Alarm devices

B. Doors shall be UL listed 16 ga. cold rolled steel with concealed hinge, screwdriver operated lock and prime coated. Furnish suitable for area mounted.

C. Approved Manufacturers:

1. Milcor
2. Karp
3. Greenheck

2.3 EQUIPMENT AND PIPING IDENTIFICATION

A. General: All piping, valves and fire suppression equipment shall be marked. All markings in concealed accessible spaces shall be reviewed and verified by Architect/Engineer prior to being concealed.

B. Piping: Piping shall be marked as follows:

1. Type: Self-sticking colored markers, lettered to identify the pipe contents, and banded at each end with arrow tape indicating the direction of flow. Markers shall be similar and equal to Brady "System 1" and Seton "Opti-Code" markers. Spray painted stencil labeling is not acceptable. Some markers may be special order.
2. Marker Colors and Wording:

Piping System & Wording	Background	Letters
Fire Sprinkler	White	Red

3. Marker Lettering: Lettering shall identify the material conveyed in each pipe. Systems which have supply and return piping shall have piping labeled as such (i.e. domestic hot water etc.). Size of letters and color field shall comply with ANSI A13.1., repeated here for convenience:

Outside Diameter of Pipe or Covering	Length of Color Field	Size of Letters
3/4 to 1-1/4 Inches	8 Inches	1/2 Inches
1-1/2 to 2 Inches	8 Inches	3/4 Inches
2-1/2 to 6 Inches	12 Inches	1-1/4 Inches

4. Locations: Markers shall be installed on all exposed piping adjacent to each shut-off valve, at branches to indicate changes of direction, where pipes pass through walls and floors, on 20 foot centers or at least one in each room on each pipe. Markers shall be installed on all concealed accessible piping (i.e., piping above suspended ceilings, behind access doors, in accessible chases, etc.) near the point of access, except that, for piping above suspended

ceilings, markers shall be installed the same as if the piping was exposed (i.e., same as if the suspended ceiling was not in place). Markers shall be installed so as to easily read by a person standing on the floor. Provide additional direction of flow arrows at each pipe connections at all control valves.

C. Valves shall be marked as follows:

1. Identification tags made of brass or aluminum, stamped with valve number and abbreviation of system served (HTG, PLBG, CW, HW, GAS, AC). Tags shall be installed on all valves except stops at plumbing fixtures. Tags shall be not less than 1-1/2 inch in diameter, markings shall be stamped and black filled, and lettering shall be minimum 1/4-inch high with numbers minimum 1/2-inch high. Tags shall be wired to each valve with No. 6 polished nickel-steel jack chain.

D. All equipment which was scheduled on the Contract Drawings shall be marked with the name of the item; i.e., Heating Ventilating Unit No. 1, Exhaust Fan No. 2, Boiler No. 1 etc. The identification shall be the same as shown on the Contract Drawings. The marking shall be located on two different sides of the equipment so as to be easily read, with at least one marking visible to a person standing at floor level near the unit (assuming any necessary access to a concealed unit has been made). Lettering shall be a minimum of 2" high. Marking shall be with engraved phenolic labels, white letters on black background. Equipment marking is not required for; air outlets and inlets, plumbing fixtures.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. This Contractor shall provide completed systems with a neat and finished appearance. If, in the judgment of the Engineer, any portion of the work has not been performed in a workmanlike manner or is left in a rough, unfinished state, this Contractor will be required to remove, reinstall or replace same and patch and paint surrounding surfaces in a manner acceptable to the Engineer, without increase in cost to the Owner.

3.2 CLOSEOUT SUBMITTALS

A. Requirements: Final approval of installation will be recommended upon completion of the following:

1. Completion of all punchlist items
2. Permit Submittal
3. Valve list posted
4. Reproducible As-Built drawings delivered to Engineer
5. Guarantees
6. Signed off Permit

3.3 FINAL INSPECTION

A. Final Inspection:

1. Prior to acceptance of the work, the Contractor shall put all fire suppression systems into operation for a period of not less than 5 working days so that they may be inspected by the Engineer and the Owner's representatives.
2. The time of the final inspection shall be mutually agreed to by the Owner, Engineer, and Contractor.
3. The Contractor shall furnish adequate staff to operate the fire suppression systems during inspection.

3.4 PREPARATION

A. Existing Buildings

1. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
2. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
3. This work shall be scheduled such that utility services and/or existing systems for the facility are not interrupted during normal operating hours, without prior written permission of the Owner's representative. Work that is performed during normal operational hours shall not interfere with the normal function of the facility's daily operation.

3.5 INSTALLATION

A. Install fire suppression equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance, (e.g., coils, heat exchanger bundles, sheaves, filters, meters, bearings, etc.) can be removed. Relocate items which interfere with access.

B. Provide access doors in equipment, ducts, and walls/ceilings as required to allow for inspection and proper maintenance.

C. If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Engineer before installing the item in a poor access location.

D. Belts, pulleys, couplings, projecting set screws, keys and other rotating parts which may pose a danger to personnel, shall be fully enclosed or guarded in accordance with OSHA regulations.

E. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil black plastic tape wrapped at point of contact or plastic centering inserts.

F. Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below panel to structure and clearance of 3 feet directly in front of panel, except

where indicated otherwise or required by NEC to be more. Such offsets are typically not shown on the drawings, but are required per this paragraph.

G. Safety Protection: All ductwork, piping and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and 2" wide reflective red/white striped self-sticking safety tape.

H. Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the laying out of pipe and duct routings, and in coordinating all work. Poor access to equipment will not be accepted. Contractor shall note that in essentially all areas, piping routed in ceiling space needs to run in joist space, necessitating elbows/fittings/transitions at crosses with other trades, at structural beams, and at all connections to mains and branches. Dashed areas at HVAC units indicate equipment access areas. These (and all other) access areas shall be clear of obstructions. The contractor is responsible to coordinate and ensure that all trades stay clear of access areas for any furnished equipment.

I. Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

3.6 ADJUSTMENT AND CLEANING

A. Properly lubricate equipment before Owner's acceptance.

B. Clean exposed piping, ductwork, equipment, and fixtures, remove debris from site. Repair damaged finishes and leave everything in working order.

C. All work areas shall be left broom clean and free of debris. Sweep mechanical rooms at completion of work, and dispose of waste. Dispose of all existing waste in mechanical rooms in addition to waste generated by this work.

3.7 COMMISSIONING

A. The Contractor has specific responsibilities relating to demonstrating the equipment and systems provided have been installed and function per the contract specifications. These responsibilities include, but are not limited to the following:

1. Complete all equipment and system start-up and checkout procedures, and to insure the complete readiness of equipment and systems, prior to the start of the functional performance testing phase of the commissioning process.
2. Functional test all fire suppression systems in accordance with Local Code. Demonstrate system performance to the Engineer.
3. Provide to the Owner written results of the functional performance testing.

B. Owner shall not accept equipment and systems, and Owner shall not make final payment, until all equipment and systems have been successfully commissioned and all specified requirements have been satisfied.

END OF SECTION

SECTION 211000 – FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Sprinkler System Design.

B. Calculation of Sprinkler System.

C. Piping.

D. Valves.

E. Sprinkler Heads.

F. Accessories.

G. Owner Instruction.

1.2 QUALITY ASSURANCE

A. All materials and equipment shall be listed as approved by the Underwriters' Laboratories "List of Inspected Fire Protection Equipment and Materials", or the Factory Mutual Laboratories, "List of Inspected Fire Protection Equipment and Materials", or the Factory Mutual Laboratories, "List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard"; and shall be of the Manufacturer's latest design.

B. Equipment and installation to meet requirements of NFPA 13, Standard for the installation of Sprinkler Systems and all other governing codes (see Section 210500), and to exceed these codes as indicated. Various items in these specifications exceed code requirements.

1.3 SUBMITTALS

A. All submittals shall comply with Section 210500.

B. Submit shop drawings of entire sprinkler system for approval by the local Fire Marshal. Submit Fire Marshal approved drawings to Architect/Engineer. Shop drawings shall show head locations on reflected ceiling plans; use shop drawings from ceiling installer for ceiling layout. Shop drawings shall also show ductwork along with sprinkler piping; use shop drawings from sheet metal contractor or contract drawings if no sheet metal shop drawings are provided.

C. Submit product information on all products to be used.

D. Shop drawings shall be submitted within 120 days after the notice to proceed.

1.4 GENERAL REQUIREMENTS

A. All fire sprinkler design shall be performed by a Contractor thoroughly familiar with and knowledgeable of NFPA 13, NFPA 24 and fire sprinkler system design and installation. By virtue of submitting a bid, the Contractor is acknowledging that he does in fact have such knowledge; and all work provided will fully comply with all the requirements of these specifications. The fire sprinkler Contractor shall be qualified, as required by local authorities to design and install all parts of the fire sprinkler system.

B. All fire sprinkler design drawings shall be stamped by a Washington State Licensed Fire Protection Engineer, or Fire Sprinkler Designer acceptable to the reviewing code authority. The fire sprinkler system shall be designed by persons or firms certified as level III competency holders by the State of Washington. The designing firm shall be direct responsible to the installing contractor (for all products).

C. System shall be Contractor-designed and approved by both the Fire Marshal and Architect/Engineer.

D. System Description: Provide a new dry pipe fire sprinkler system covering all areas of the building. All spaces shall be sprinklered, including all concealed combustible spaces and above and below all ceilings. Some fire sprinkler coverage is called for that exceeds code requirements, and shall be provided as noted.

E. This section alone does not specify all work for the fire sprinkler system. Other sections which include fire sprinkler work are: 220500 and 210500; the Contractor is responsible to review all sections. Other divisions may also describe related fire sprinkler work, the Contractor is responsible to review all divisions.

F. Special Design Areas: Portions of the building's fire sprinkler system where the fire sprinkler piping is to be run exposed or requires drilling through building structure require special design effort, and coordination among trades and with the Authority Having Jurisdiction (AHJ) and the design team. The Contractor shall include in his bid costs for such special coordination and design efforts. This work shall include multiple meeting with local and state code officials, various contractors, and members of the design team.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All products shall comply with Section 210500, Acceptable Manufacturers.

B. Sprinkler System Components: Reliable, Viking, Potter Roemer, Gem, Star, Victaulic, Sprink, Mech-Line, Central, Grinnell.

C. Valves: Crane, Grinnell, Potter Roemer, Viking, Gem, Victaulic, Kennedy, Central.

2.2 PIPE AND PIPE FITTINGS

A. Pipe and fitting standards shall be as specified in Section 220520, Pipe and Pipe Fittings.

B. Aboveground Piping and Fittings: Piping shall be schedule 40 black steel. Fittings shall be suitable for 175 psi working pressure, and shall be cast iron or malleable iron screwed, grooved or welded in accordance with NFPA 13. Piping and fittings ran outside and exposed to the outdoors shall be galvanized type. (i.e. if piping is concealed in soffit, galvanized is not required.)

C. Underground Piping and Fittings: Shall conform to local utility requirements, NFPA 24 and NFPA 13. Shall be ductile iron pipe conforming to AWWA C151, thickness class 52 minimum. Fittings shall conform to AWWA C111, with pressure rating no less than the piping connected to. Pipe and Fittings shall have cement-mortar lining conforming to AWWA C104. Pipe and fittings shall be restrained against movement in accordance with NFPA 24. Thrust restraining joints/fittings shall be UL listed for fire main use.

2.3 VALVES

A. 2 Inch and Smaller: Bronze gate valve, 175 psi water working pressure, threaded ends conforming to ANSI Standard B2.1, UL listed and FM approved. Stockham Figure B-133, or approved. Contractor Option: Bronze butterfly or ball valve, UL listed for fire protection service and FM approved. Milwaukee or equal.

B. 2-1/2 Inch and Larger:

1. OS & Y Type: Iron body OS & Y gate valve, 175 psi non-shock cold water, flanged ends conforming to ANSI Standard for Class 125 cast iron flanges B16.1, UL listed and FM approved. Stockham Figure G-634, or approved. (Provide with tapping for corporation stop matching detector check valve where valve is used upstream of detector check.)
2. NRS Type: Iron body NRS gate valve, 175 psi non-shock cold water, flanged or mechanical joint ends, bronze mounted, with indicator post flange, UL listed and FM approved. Stockham Figures G-632, G-635, or approved (for use with wall or post indicator only).

C. Check Valves: Iron body swing check valve, 175 psi non-shock cold water, UL listed and FM approved. Stockham Figures G-938, G-940, or approved.

D. Indicator Posts: Shall be UL listed and FM approved, of cast iron construction, with operating wrench, lock means, identification plates indicating valve open/shut, adjustable sleeve, sections to suit varying buried depths, tapped for supervisory, extension rod, base to match valve used with, and bright red factory enamel paint finish.

E. Automatic Ball Drip Valve: Straight or angle cast brass ball, drip, 1/2 Potter-Roemer Series 5980 or approved.

2.4 ALARM VALVES--DRY PIPE

A. Alarm valve shall be UL listed and FM approved for use as an alarm valve in a dry pipe fire sprinkler system, size as selected by Contractor.

B. Alarm valve shall be complete with accelerator, pressure gauges, main drain valve, pressure alarm switch, alarm test valving, priming connections, drain lines/drain cup, connections for water motor alarm, check and isolation valves for air line connection, air line relief valve and all other accessories to provide a complete alarm valve assembly as required to function in accordance with NFPA standards.

2.5 ALARM BELLS

A. Electric Type: 24 V Dc electric alarm shall sound continuous ringing alarm when water is flowing in the fire sprinkler system. Shall be compatible with flow switch furnished, be UL listed and FM approved.

B. Labeling: Alarm bells shall be labeled or provided with sign mounted adjacent to bell, reading "Sprinkler Fire Alarm" (in 1-inch high capital letters), followed by "when bell rings, call Fire Department or Police." Sign shall be aluminum lithographed, with red letters on white background.

2.6 SPRINKLER HEADS

A. Dry Type:

1. General: Provide where system may be exposed to freezing temperatures, finish, length and temperature rating to suit application. Heads in occupied areas shall be quick response type.
2. Finished Areas: Polished chrome finish type with flush type chrome plated escutcheon where installed through ceilings, soffits, and similar elements.
3. Unfinished Areas: Natural bronze finish with flush or deep type brass finish escutcheon where installed through a floor, ceiling, or similar element.
4. Sprinkler Guards: Hard-wire cage sprinkler guard, designed to protect sprinkler from mechanical damage, with chrome plated finish.
5. Sprinkler heads shall be upright, pendant or sidewall type as required to suit application.
6. See Section 220500 for definition of "Finished Areas", and "Occupied Areas".

2.7 ACCESSORIES

A. Waterflow Alarm - Flow Type Indicator: Shall be UL listed, with polyethylene paddle water flow detector, cast metal body, adjustable time delay retard mechanism to allow indicator to absorb fluctuations of water flow due to pressure surges to prevent false alarms.

B. Waterflow Alarm - Pressure Type: Furnished with Alarm valve, see paragraph entitled "Alarm Valves--Dry Pipe". Switch shall indicate activation of sprinkler system.

C. Low Pressure Air Alarm Switch: Single pole double throw switch, for indicating low air pressure supplied to a dry pipe system. Shall be rated for 250 psi service pressure, be enclosed in a NEMA 2 housing, have a neoprene diaphragm, and be field adjustable between 20 and 225 psi.

D. Valve Switches: Switch for indicating operation of valve; type and configuration to suit valve used on. Switch shall have single pole, double throw type contacts, with cast aluminum housing

and non-ferrous parts for corrosion resistance. Shall be weatherproof type where installed outdoors.

E. Sway Bracing/Restraints: Contractor fabricated of riser clamps, Schedule 40 pipe and pipe fittings, all welded construction, size and configuration to suit application.

F. Specialties: Access doors, gauges, and related piping specialties; see Section 210500.

G. Hangers/Supports: See Section 220529.

H. Sleeves/Seals: See Section 220530.

I. Air Compressor:

1. Sizing: Shall be by Contractor, in compliance with NFPA requirements.
2. Type: Air compressor shall be electric motor-driven, air cooled, single-stage, tank mounted type. Tank shall be ASME labeled. Unit shall be complete with connections for controlling unit On/Off, motor starter, disconnect, vibration isolators, relief valve, pressure gauge outlet isolation valve, outlet union, and related accessories for proper unit operation.
3. Power: Unit shall be no larger than 3/4 HP, and shall be for use with 120 volt/1 PH electricity, and shall have single point power connection.
4. Noise: Compressor noise shall not exceed NC 35 in any octave band. Provide acoustic enclosure or remote piped air intake with a muffler to reduce noise as required.

J. Air Maintenance Assembly: Shall be type for use with dedicated sprinkler system air compressor. Assembly shall include air line strainer, air pressure switch for compressor control, bypass globe valve, isolation valves, unions, and all related components to properly connect the air compressor to the dry pipe system, in compliance with NFPA and local code requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of all equipment shall be performed by a Contractor specializing in this work and subject to Owner and Fire Marshal approval.

B. All piping shall be run concealed in ceiling space, attic space, pipe shafts, soffits, etc. Provide all necessary drilling of beams, trusses, etc. Structural Engineer's approval is required. Piping may only be exposed with Engineers approval and then shall be painted as directed by the Architect/Engineer. Piping shall run parallel to building structure in a neat, workmanlike manner.

C. Provide chrome plated escutcheon plates at exposed pipe penetrations of all ceilings, floors and walls.

D. Where piping is below grade, it shall not be insulated, but it shall be painted with a heavy coat of bitumastic paint.

E. Electrical, mechanical, architectural and structural plans shall be carefully examined by the Sprinkler Contractor, and his work shall be arranged to avoid interferences and to comply with all related requirements on these drawings.

F. If piping routes are not properly coordinated with other trades and structures, rerouting and possible re-sizing will be required as directed by the Architect/Engineer. The fire piping system has lowest priority of all systems routed in ceiling space.

G. Offset, crossover and otherwise route piping to install system in available space. Not all offsets necessarily shown. Pitch all branch lines, cross mains, feed mains and risers to drainage points.

H. Special care shall be taken to insure that entire sprinkler system is drainable in accordance with NFPA 13. Any work without proper slope to drain will be rejected. Where space permits, increase slope to 1 inch per 10 feet.

I. Labeling: All drain valves, alarm bells, and risers shall be labeled to clearly indicate purpose/area served, per NFPA requirements and as specified herein. Risers shall be labeled to indicate hydraulic calculation basis.

J. Tamper Switches: Provide valve tamper switches at all isolation valves, and as required by the local Fire Marshal to indicate valves not fully open. Connection to central fire alarm system shall be by Division 26.

K. Heads shall be centered in ceiling panels. Where "scored" ceiling panels are used, heads shall be located to be centered in the flat portion of the tile between "scores".

L. Provide wire cage protectors where indicated on drawings and for heads susceptible to damage (this includes all heads in mechanical loft areas with sprinkler heads 7 feet or less above walking surface, outside soffit heads below 9', and similar areas).

M. Provide shields to divert sprinkler water from equipment (i.e. electrical panels) which may be damaged (typical all areas).

N. Hangers and Supports: Shall comply with NFPA 13 and Section 220529. See also structural drawings for added limitations/requirements of supports and attachments to structure.

O. Contractor shall use caution in routing of wet pipe lines to maintain distances from outside walls and other areas which could have freezing temperatures in extreme conditions.

P. Pipe Routing: Contractor shall in no way interfere with mechanical access, and shall maintain 7' clear headroom at all locations over platforms at mechanical equipment (unless structurally prohibited). Provide separate mains to serve corridors and areas below attic platform -piping that runs on platform or interferes with access will not be accepted.

Q. Air Compressor: Install and connect up air compressor piping and accessories to system and provide all wiring interconnections between controller and compressor. Install compressor on vibration isolators.

R. Provide building access doors as needed to allow maintenance access to all sprinkler heads and system components. Doors shall be no smaller than 24" x 24". Note: This is in excess of NFPA 13 requirements. Reference Section 220500 for access door requirements. Coordinate with other trades for proper framing/block-out provisions to accommodate doors, and to insure no other systems block door access.

3.2 SYSTEM DESIGN

A. System shall be Contractor designed in accordance with NFPA 13, and additional requirements as cited in the Contract Documents.

B. System design shall be based on hydraulic calculations using approved water flow test data on the water supply line to the fire protection system. Such test data must meet the approval of the local Fire Marshal and the Architect/Engineer. Water flow date is shown on the plans is preliminary only. Contractor is responsible to arrange for such water flow tests and pay all associated fees for such a test.

C. Submit all system calculations showing calculations and compliance with NFPA.

D. Design shall include complete system, including water main to building, and extending as far back into the local utilities systems (i.e. reservoirs) as deemed necessary by the AHJ.

3.3 TESTING

A. The systems shall be hydrostatically and operationally tested in accordance with the requirements of NFPA 13 and the local Fire Marshal. Any changes required to meet time or flow tests shall be made without additional cost to the Owner. Certificates of acceptance shall be submitted to the Architect/Engineer.

3.4 OPERATING AND OWNER INSTRUCTIONS

A. Typewritten, plastic covered, framed instructions shall be mounted in the buildings near each fire sprinkler riser. Instructions shall explain riser components, how to test, and how to drain.

B. The Owner or his representative shall be instructed by the Sprinkler Contractor in the operation of the system. The instruction shall be given by Contractor's personnel who are considered qualified in the opinion of the Architect/Engineer and shall be for a minimum of two (2) hours. Instruction shall include location of all valves, drains, and pipe routing, as well as proper maintenance and testing procedures.

END OF SECTION

SECTION 220000 – PLUMBING **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 WORK IN THIS SECTION

A. Piping and Accessories.

B. Plumbing Fixtures and Trim.

1.02 CODES AND STANDARDS

A. International Building Code (IBC).

B. International Mechanical Code (IMC).

C. Uniform Plumbing Code (UPC).

D. Washington State Non-Residential Energy Code (WSNREC)

1.03 SUBMITTALS

A. Complete specifications, descriptive drawings, catalog cuts, and descriptive literature, which shall include make, model, dimensions, and weight for products specified.

B. Hangers and supports layout showing type, spacing, maximum loads, and materials.

C. Certified copies of test reports.

PART 2 – PRODUCTS

2.01 GENERAL

A. Like Items: End products of one manufacturer to achieve standardization for appearance, maintenance, and replacement.

B. Provide installation, plumbing rough-in, and final connection of plumbing as shown on the Drawings.

C. See Division 40 for piping materials and requirements.

2.02 PIPE

A. See Specification Section 400500 – Process Piping.

2.03 CONNECTIONS

A. Solder-type with taper threaded adapters for valves and other appurtenances. Taper threads shall comply with ASME B1.20.1.

B. Solder: 95-5 tin-antimony, ASTM B32, Grade 95TA. Do not use cored solder.

C. Thread Lubricant and Seal:

1. Water: Teflon tape.

2.04 COUPLINGS AND FITTINGS

A. 1/2-Inch and Smaller Nominal Diameter: Compression type, brass or bronze, capable of holding the full bursting strength of the tubing complying with ANSI B16.26.

B. Larger than 1/2-Inch Nominal Diameter: Wrought copper or bronze, solder joint pressure fittings, complying with ANSI B16.22.

C. Piping reducers/enlargers shall be tapered. Bushing type adapters are not permitted.

D. Acceptable Manufacturers for 1/2-Inch and Smaller Nominal Diameter:

1. Swagelok.
2. Gyrolok.
3. Approved equivalent.

2.05 PRESSURE TANK

A. Provide 2-gallon pressure tank as shown on Drawings. Tank shall be an A.O. Smith Model LET2, or engineer-approved equal.

2.06 BACKFLOW PREVENTER

A. Backflow preventer valves 2-inch and larger shall be reduced-pressure type approved by the State of Washington Department of Health. Units shall be complete with inlet and outlet valves. Maximum pressure loss through the valve shall be 10 psi. Valve must be equipped with resilient seated shutoff valves and test cocks. Drain lines with air gaps shall be provided with piping to a floor sump. Backflow preventer valves shall be Clayton Model RP or equal.

B. Backflow preventer valves smaller than 2 inches shall be a reduced pressure-principle device meeting State of Washington Department of Health requirements. Backflow preventer valves shall have bronze bodies and bronze trim, 175 psi working pressure, 300 psi hydrostatic test pressure, and screwed ends. Backflow preventer valves shall be supplied with isolation gate valves of the same size as the RPBP valve, test cocks and threaded drain connection. Size shall be as shown on the Drawings.

2.07 DRAINS

A. Floor Drain:

1. Cast iron body and flashing collar, 5-inch-diameter chrome-plated or Nikaloy adjustable strainer, cast iron P-trap with trap primer connection.
2. Manufacturers and Products:

   a. Josam 31000 Series.
   b. Or equal.

2.08 CLEANOUTS

A. Cleanouts:

1. Cast iron body and frame.
2. Adjustable nickel bronze top.
3. Manufacturers and Products:

   a. Zurn; Z-1400T.
   b. J. R. Smith; Figure 4043.
   c. Or equal.

2.09 VENTS

A. Vent piping shall be same material as soil and waste piping.

B. Flash and counterflash vents under 3-inch with 4-pound sheet lead or use adjustable roof flashing of galvanized steel with lead caulking ring. Flash 3-inch vents and larger vents with “Stoneman” #1100-7 flashing assembly with vandal proof cast iron counterflashing sleeve.

2.10 PLUMBING FIXTURES

A. Service Sink:

1. Bowl: 19-inch by 20-inch stainless steel sink, drop-in counter type, as manufactured by Just Model SL-2019-A-GR, or approved equivalent.
2. Topmount Faucet: Faucet on 8-inch centers with solid cast brass body with vacuum breaker, chrome finish and high-rise swivel spout with 9-13/16-inch clearance as manufactured by Just Model JWF100 or approved equivalent.
3. P-Trap: 3-inch cast iron adjustable type standard with cleanout.

B. Lavatory:

1. Lavatory: 20-inch by 18-inch stainless steel, wall hung, as manufactured by Just Model A33338-T, or approved equivalent.

2. Faucet: PVD coated solid cast brass body, chrome, centerset lavatory faucet. Replaceable seats and aerator. Flow rate 2.2 GPM at 80 psi as manufactured by Just Model JV-1139-A or approved equivalent.
3. Drain: Chrome plated cast brass flat grid drain with 1-1/4-inch chrome plated 17 ga. tailpiece. Chrome plated overflow shall be included as manufactured by Just Model J-115-FS or approved equivalent.

C. Toilet:

1. Toilet: The elongated bowl toilet shall be made of vitreous china. Toilet shall be 30-1/8 inches in length, 21-1/4 inches in width, and 31-1/4 inches in height with a 12-inch x 10-inch water area. The toilet shall be 12-inch rough-in. The toilet shall be equipped with Sloan Flushmate – Sloan Valve Company. Toilet shall be 1.4 gpf (5.3 lpf). Toilet shall include polished chrome trip lever. Toilet shall be Kohler Model K-3493 or approved equivalent.
2. Seat: Lustra™ elongated open-front toilet seat as manufactured by Kohler Model K-4650 or approved equivalent.

2.11 ELECTRIC WATER HEATER

A. Instantaneous Electric Water Heater:

1. Instantaneous, electric, wall-mounted, water heater, 208 V three-phase, 18 kW, 50 A, 100 degrees F minimum temperature rise at 1.0 gpm, integral thermostatic control, 1/2-inch connections, UL listed, 150 psi working pressure.
2. EEmax Model ED180T3, or approved equivalent.

2.12 THERMOSTATIC MIXING VALVE

A. Emergency Water Mixing Valve:

1. Manually adjustable, bi-metal thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting with locking mechanism, and thermometer.
2. Leonard Valve TA-300-RF, or approved equal.

2.13 EYEWASH STATION

A. Piping and Valve: 1/2-inch BCP piping, 1/2-inch bronze, stay-open ball valve with CP ball, SS valve stem, SS push plate with actuation graphic, schedule 80 galvanized steel pedestal. Equal to Encon Yello-Bowl®/Eyewash.

B. Eyewash. Acetal heads with hinged covers, BCP wye.

C. Bowl: High visibility ABS plastic yellow bowl.

D. Bowl Cover: High visibility corrosion resistant ABS plastic; push-plate actuator opens cover; manually closing cover is independent of water flow actuator.

E. Supply: 1/2-inch NPT connection.

F. Waste 1-1/4-inch NPT connection.

2.14 HOSE BIBB

A. Freeze Proof Hose Bibb.

1. Rough bronze body with removable key or wheel handle, 3/4-inch threaded or solder-joint inlet, 125 psig, integral, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads on outlet.
2. Jay R. Smith #5609QT, or approved equal.

PART 3 – EXECUTION

3.01 CODES, ORDINANCES, STANDARDS, AND PERMITS

A. Comply with all local, state, and national code restrictions and requirements. In case of conflict between the Contract Documents and a governing code, the higher standard shall prevail. Extra payment will not be allowed for Work or changes required by local code enforcement authorities.

3.02 FABRICATION

A. Solder Joints:

1. Cut tubing square and remove burrs.
2. Immediately before soldering, clean both inside of fittings and outside of tubing with steel wool until bright.
3. After cleaning, a paste flux shall be evenly and sparingly applied to the surfaces to be joined prior to soldering.
4. Apply solder and pass flame toward the center of the fitting until the solder disappears.
5. Remove all excess solder while still plastic.
6. Do not use acid flux or acid wipe in making solder joints.
7. Take care to prevent overheating.

B. Takedown Couplings: Screw union type.

1. Where piping passes through walls or floors, takedown couplings shall be provided on both sides of the wall or floor and within two feet of the wall or floor.
2. A takedown coupling shall be provided within two feet of each threaded end valve or appurtenance.

C. Dielectric Protection:

1. Copper tubing or fittings shall not be permitted to come in contact with steel piping, reinforcing steel, or other steel at any location.

2. Electrical checks shall be made to ensure no contact is made between copper tubing and steel elements.
3. Wherever electrical contact is demonstrated by such tests, provide dielectric protection.

3.03 INSTALLATION

A. Connections: Indicated equipment connections are necessarily based on equipment of a given manufacturer. Contractor assumes responsibility for proper arrangement of pipes, valves, power connections, etc., to connect approved equipment in a proper and approved manner. Follow equipment manufacturer's detailed instructions and recommendations in the installation and connection of all equipment. No equipment installation or connections shall be made in a manner that voids the manufacturer's warranty.

B. Miscellaneous Hardware: Provide all required trim including sleeves, inserts, flashing, valves, fittings, connections, traps, floor and wall plates, accessories, etc., necessary for a complete installation.

C. Trenching and Backfilling: All trenching and backfilling required in connection with the piping installations shall be done in accordance with Division 31 – Earthwork. No piping shall be backfilled before inspection. Pressure piping shall not be backfilled until successfully tested and approved. Trenches shall be backfilled without delay after approval. All trenches shall be shored and braced according to OSHA requirements.

D. Drainage Piping System:

1. Trenches: Bottoms of trenches shall be shaped to give substantially uniform circumferential support to the lower fourth of each pipe. Trenches shall be kept free from water and pipe and shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so that no water, earth, or other substance will enter the pipe or fitting.
2. Slope: Horizontal lines shall have a grade of 1/4 inch per foot unless otherwise indicated on the Drawings. The grade may be reduced to not less than 1/8 inch per foot on overhead pipes that otherwise would reduce the headroom too much.
3. Joints: Soil pipe hubs shall extend a minimum of 6 inches above the floor where the pipe rises through the floor.
4. Check elevation of drains during placing of concrete so that adjacent surfaces will drain effectively; adjust height if necessary.
5. Bends: All changes in direction (except minor misalignments) shall be made by the appropriate use of 45-degree wyes (with screwed plug), long or short sweep bends, or equivalent fittings. The use of long sweep bends is preferred over the short type.
6. Slip Joints: Will be permitted only in trap seals or on the inlet side of the traps.
7. Cleanouts:

    a. General: Provide cleanouts in soil and waste pipes with floor or wall plates as required, flush with finished wall or floor. Provide cleanouts in accordance with Uniform Plumbing Code "Drainage System" chapter, in vertical waste pipe at each sink.
    b. Cleanouts consist of a long-sweep 1/4 or 1/8 bend extended to the place indicated on the Drawings or as required by code.
    c. Provide cleanouts the same size as pipe, except that cleanouts larger than 4-inch not required.

8. P Traps: Each fixture and piece of equipment requiring connections to the drainage system shall be equipped with a P-trap. Each P-trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Installation shall be in strict observance of all governing codes.
9. Vents:

    a. General: Provide vent for each trap, unless noted otherwise.
    b. Vent pipes shall project above roofline not less than 10 inches, nor more than 18 inches, unless other dimensions are noted on the Drawings.

10. Flashings:

    a. General: All pipes passing through the roof shall be flashed.
    b. Vent Pipes: Shall be flashed and sealed watertight.

E. Water Supply Piping Systems:

1. Potable Water Contamination: No plumbing fixture, device, equipment, or pipe connection shall be installed that will provide a cross connection or interconnection between a potable water supply and any source of nonpotable water.
2. Pipe Location: Run pipes parallel with the lines of the buildings wherever possible. No water pipe shall be buried in floors except floor drain trap prime piping, and any lines specifically indicated on the Plans or approved by the Engineer.
3. Bends: Pipe bending for other than minor misalignment corrections not permitted. Changes in direction shall be made with fittings.
4. Water Hammer Arresters: An air chamber shall be provided on hot and cold waterlines near each solenoid valve, control valve, or flush valve. Unless shown otherwise on the Plans, air chambers consist of a 12-inch length of pipe of the same diameter as the branch supply, capped. Commercial type snubbers, if installed, shall be accessible for maintenance.
5. Dielectric Unions: Connections between ferrous and nonferrous metallic pipe and connections to water heaters shall be made with insulating unions or flanges.
6. Unions: Shall be provided where required for disconnection and shall not be concealed in walls, ceilings, or partitions.
7. Wall and Floor Penetrations: Pipes passing through concrete or masonry walls or concrete floors shall be provided with pipe sleeves fitted into place at the time of construction or core drill.
8. Escutcheons: Shall be provided at all finished surfaces where exposed piping, bare or insulated, passes through floors, walls, or ceilings. Escutcheons to be fastened securely to pipe or pipe covering and are chromium-plated iron or chromium-plated brass, either one piece or split-pattern, held in place by internal spring tension or setscrew.
9. Access Panels: Furnish panels of approved adequate size for all valves and equipment requiring service and installed above ceilings, behind walls or in furring, complete with correct frame for type of building construction involved. Use no panel smaller than 12 inches by 12 inches for simple manual access or smaller than 16 inches by 20 inches where personnel must pass through.
10. Expansion: Swing joints, offsets, expansion joints, etc., shall be provided where necessary to accommodate expansion of piping, which will be approximately 2 inches in 100 feet of copper hot water piping.

3.04 CLEANING

A. General: Equipment, pipes, valves, fittings, fixtures, appliances, etc. shall be thoroughly cleaned of grease, dirt, metal cuttings, etc. and left in a satisfactory condition for use. Clean the interior of the pipe by swabbing.

B. Piping: Drain and flush to remove grease and foreign matter. Thoroughly clean out valves, traps, and strainers.

3.05 REPAIRS AND ADJUSTMENTS

A. General: Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the buildings shall be repaired to the satisfaction of the Engineer. Check, adjust, and lubricate all automatic plumbing equipment, valves, fixtures, accessories, appliances, etc. for smooth and proper operation.

B. Patching inserts, overlays, or pounding out of dents will not be permitted.

C. Remove damaged ends as a cylinder and the section end properly prepared.

3.06 TESTING

A. Plumbing: All plumbing shall be tested in accordance with applicable State and local codes and as specified.

1. Before final connections are made to main sewers, and prior to backfilling of trenches or connecting of fixtures, all drainage piping shall be hydrostatically tested. All openings shall be capped or plugged and the system filled with water to the top of a vertical section of pipe 10 feet high, temporarily connected to the highest point of the underground system. The water shall be allowed to stand in the system for at least 30 minutes prior to inspection. If the water level remains constant and no leaks are found during the period of inspection, the water shall be drained from the system. Final connections shall then be made to the main sewers and the trenches backfilled.
2. Before any fixtures are connected, all water piping shall be hydrostatically tested and proven tight at a pressure of not less than 150 psig at the lowest point in the system unless otherwise specified herein or on the Drawings. The pressure shall be maintained for at least 1 hour for inspection. If the pressure remains constant and no leaks are found during the period of inspection, the water shall be drained from the systems and final connections shall then be made to the fixtures.
3. Should any leaks, flaws, or defective materials or equipment be found during the testing operations, such leaks or flaws shall be corrected and effective materials and equipment replaced. After corrections have been made, tests shall be repeated until all systems are proven tight. All corrections and re-tests shall be made without additional cost to the Owner.

3.07 DISINFECTION

A. After testing, all potable water piping shall be thoroughly flushed and disinfected in accordance with Specification AWWA Standard C651.

END OF SECTION

SECTION 220500 – GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General Plumbing Requirements.

B. Plumbing Submittals.

C. Motors.

D. Equipment and Piping Identification.

E. Commissioning.

1.2 GENERAL

A. Includes, but not limited to, furnishing labor, materials, and equipment for completion of work unless indicated or noted otherwise.

B. All work included in Division 22 shall be the responsibility of a single Plumbing Subcontractor. This Contractor shall obtain and pay for all permits required by State and local authorities governing the installation of the plumbing work. It is the Contractor's responsibility to contact all utility organizations serving the building, prior to bid, and to include all charges for inspections, installation of materials, equipment and connection of all required utilities.

C. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

D. All plumbing equipment and devices furnished or installed under other Divisions of this specification which require connection to any plumbing systems (i.e., plumbing systems or duct systems, or controls) shall be connected under this division of the Specifications

E. The Contractor shall be responsible for checking field conditions and verifying all measurements and relationships indicated on the drawings before proceeding with the work.

1.3 ELECTRICAL

A. All equipment with an electrical connection shall be factory wired to a junction box for connection to electrical service.

B. Where a piece of equipment specified includes an electric motor, the motor shall be furnished and mounted by this Contractor. Motor starter, disconnect switches and wiring from the electrical panel to the motor control devices and to the motor shall be provided by the Division 26 Contractor unless stated otherwise in the mechanical specification and on the plumbing equipment schedule.

1.4 SYSTEMS DESCRIPTION

A. Site Inspection:

1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.
2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

B. Drawings:

1. Plumbing drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
2. Consider electrical drawings part of this work insofar as these drawings furnish information relating to design and construction of building.
3. Because of small scale of plumbing drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

1.5 SUBMITTALS

A. All material used on the project shall be new and free of defects. The Engineer reserves the right to reject any material, the appearance of which has been damaged on the site or in shipment. The material shall be of approved equal quality to that which is specified. Should the make and type of material differ from that specified, the Contractor may be required to submit catalog and engineering data (samples if requested) necessary to make a comparison and determine its suitability. The Contractor shall also bear the cost of any changes to the plumbing design made necessary by any approved substitutions.

B. The Contractor shall submit to the Engineer, for approval, complete information on all equipment and materials to be provided on the project including six copies of the manufacturer's catalog and engineering data, shop drawings of shop fabricated equipment and instruction data for each item included under this section of the specifications. Submittals shall be presented to the Engineer within 30 calendar days from the date of the contract signing in complete indexed and bound sets. The Contractor shall submit a typed, signed list including all items to be furnished on the project. The signature on the aforementioned list shall indicate that the contractor has examined the suitability of all material and equipment with respect to compliance with these specifications. The Contractor's approval shall also indicate that physical dimensions of the equipment have been verified with the installation requirements and were found to cause no interference therewith.

C. Review of submittal data by the Engineer or Engineers does not relieve the Contractor of responsibility for quantities, measurements, and compliance with the intent of all contract documents.

D. Furnish submittals on all items and equipment specified in Division 22 and all items indicated on plumbing drawings in a hard-back, three-ring binder:

E. The Contractor shall submit the plumbing cost breakdown including all sub-contractors costs.

1.6 OPERATION AND MAINTENANCE MANUAL FOR PLUMBING SYSTEMS

A. Bind Operation & Maintenance Manual for Plumbing Systems in three-ring, hard-backed binder with clear plastic pocket on spine. Spine of each binder shall have following typewritten lettering inserted:

OPERATION AND MAINTENANCE MANUAL

FOR PLUMBING SYSTEMS

B. Provide master index at beginning of Manual showing items included. Use plastic tab indexes for sections of Manual.

C. First section shall consist of name, address, and phone number of Engineer, General Contractor, and Mechanical, Plumbing, Sheet Metal, Refrigeration, Temperature control, and Electrical subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.

D. Provide section for each type of item of equipment.

E. Submit copies of Operation & Maintenance Manual to Engineer for approval.

F. Include descriptive literature (Manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.

G. Operating Instructions shall include:

1. General description of each plumbing system.
2. Step-by-step procedure to follow in putting each piece of plumbing equipment into operation.

H. Maintenance Instructions shall include:

1. Manufacturer's maintenance instructions for each piece of plumbing equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists operation instructions of equipment, and maintenance and lubrication instruction.
2. Summary list of plumbing equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
3. List of plumbing equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.

1.7 QUALITY ASSURANCE:

A. Requirements of Regulatory Agencies:

1. Perform work in accordance with applicable Codes.
2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern.

B. Product Approvals: See paragraphs elsewhere in this specification.

C. Manufacture: Use domestic made pipe, pipe fittings, and motors on project.

D. Identification: Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when project is turned over to Owner.

1.8 CODES AND STANDARDS

A. Codes and agencies having jurisdictional authority over plumbing installation.

B. Washington State Energy Code

C. International Building Code -- Latest Approved Edition

D. International Mechanical Code -- Latest Approved Edition

E. Uniform Plumbing Code -- Latest Approved Edition

F. Local Sewer and Water District Requirements

G. State and County Department of Health

H. Occupational Safety and Health Administration (OSHA)

1.9 PRODUCT HANDLING AND PROTECTION:

A. Contractor is responsible for protection of all material, equipment and apparatus provided under this section from damage, water, corrosion, freezing and dust, both in storage and when installed, until final project acceptance.

B. Provide temporary heated and sheltered storage facilities for material and equipment.

C. Completely cover motors and other moving machinery to protect from dirt and water during construction.

D. Handle and protect equipment and/or material in manner precluding unnecessary fire hazard.

E. Equipment requiring rotation and/or lubrication during storage shall have records maintained and witnessed on a monthly basis and forwarded to the Engineer prior to acceptance.

F. Material or equipment damaged because of improper storage or protection will be rejected.

G. Equipment finish that is damaged by handling, storage, etc. shall be corrected by the Contractor at no additional cost to the Owner.

1.10 WARRANTIES:

A. In addition to guarantee specified in General Conditions, guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

B. In order to be protected, secure proper guarantees from suppliers and subcontractors.

C. Provide certificates of warranty for each piece of equipment. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

1.11 ABBREVIATIONS:

1.	AFF	Above Finish Floor
2.	AMCA	Air Moving & Conditioning Association
3.	ANSI	American National Standards Institute
4.	APWA	American Public Works Association
5.	ARI	Air Conditioning and Refrigeration Institute
6.	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
7.	ASME	American Society of Mechanical Engineers
8.	ASTM	American Society of Testing & Materials
9.	AWWA	American Water Works Association
10.	BFF	Below Finish Floor
11.	BHP	Brake Horsepower
12.	BTU	British Thermal Unit
13.	CFC	Chloro - Fluorocarbon
14.	CFM	Cubic Feet per Minute
15.	DOT	US Department of Transportation
16.	EPA	Environmental Protection Agency
17.	fpm	feet per minute
18.	FS or Fed.	Spec. Federal Specifications
19.	HP	Horsepower
20.	IEEE	Institute of Electrical and Electronics Engineers
21.	KW	Kilowatt
22.	MBH	One Thousand British Thermal Units per Hour
23.	MS or Mil.Spec.	Military Specifications
24.	MSS	Manufacturers Standardization Society
25.	NEC	National Electrical Code
26.	NEMA	National Electrical Manufacturers Association
27.	per	in accordance with
28.	PVC	Polyvinyl Chloride
29.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
30.	SP	Static Pressure
31.	UL	Underwriter's Laboratories
32.	w.g.	Water Gauge (inches of water)
33.	WQA	Water Quality Association

34. Additional abbreviations are as listed on the drawings or elsewhere in these specifications.

1.12 DEFINITIONS:

A. Finished Spaces: Spaces used for habitation or occupancy where rough surfaces are plastered, paneled, or otherwise treated to provide a pleasing appearance.

B. Unfinished Spaces: Spaces used for storage or work areas where appearance is not a factor.

C. Concealed Spaces: Spaces out of sight. For example, above ceilings; below floors; between double walls; furred-in areas; pipe and duct shafts; and similar spaces.

D. Exposed: Open to view. For example, pipe running through a room and not covered by other construction.

E. Outside: Open to view up to 5 feet beyond the exterior side of walls, above the roof, and unexcavated or crawl spaces.

F. Conditioned Space: An area, room or space normally occupied and being heated or cooled for human habitation by any equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Any reference to the specifications or on the drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

B. The manufacturer listed as Acceptable Manufacturers are approved for the items indicated without obtaining prior approval. Other manufacturers require prior approval.

C. The listing of a manufacturer as an Acceptable Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which may be capable of manufacturing, or have in the past manufactured, items equal to those specified, and is intended to aid the Contractor in identifying manufacturers.

D. Products provided by Acceptable Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the plans and specifications. The Engineer shall be the final judge as to whether an item meets these requirements or not. If a manufacturer is not certain that his product meets these requirements or not, then the manufacturer shall submit data as required to obtain the Design Consultant's approval.

E. The approval of a manufacturer applies to the manufacturer only and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications.

F. Contractor shall be responsible for all costs to other trades and all revisions required to accommodate any products which are different than those specified or shown.

G. In reviewing a manufacturer for acceptance, factors considered include the following: engineering data showing item's performance, proper local representation of manufacturer, likelihood of

future manufacturer's local support of product, service availability, previous installation, previous use by Owner/Engineer and record, product quality, availability/quality of maintenance and operation data, capacity/performance compared to specified items, acoustics, items geometry/access utility needs, and similar concerns.

H. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.

I. If non-specified equipment is used and it will not fit job site conditions, this Division assumes responsibility for replacement with items named in Specification.

2.2 ACCESS DOORS

A. This contractor shall be responsible for furnishing and installing flush mounted access doors in walls, ceiling and floors and chases where the following equipment is concealed and is not accessible through same.

1. Valves (shut off)
2. Trap Primers

B. Doors shall be UL listed 16 ga. cold rolled steel with concealed hinge, screwdriver operated lock and prime coated. Furnish suitable for area mounted.

C. Approved Manufacturers:

1. Milcor
2. Karp
3. Greenheck

2.3 EQUIPMENT AND PIPING IDENTIFICATION

A. General: All piping, valves, and plumbing equipment shall be marked. All markings in concealed accessible spaces shall be reviewed and verified by Architect/Engineer prior to being concealed.

B. Piping: Piping shall be marked as follows:

1. Type: Self-sticking colored markers, lettered to identify the pipe contents, and banded at each end with arrow tape indicating the direction of flow. Markers shall be similar and equal to Brady "System 1" and Seton "Opti-Code" markers. Spray painted stencil labeling is not acceptable. Some markers may be special order.
2. Marker Colors and Wording:

Piping System & Wording	Background	Letters
Domestic Cold Water	White	Green

Domestic Hot Water	White	Red

3. Marker Lettering: Lettering shall identify the material conveyed in each pipe. Systems which have supply and return piping shall have piping labeled as such (i.e. domestic hot water etc.). Size of letters and color field shall comply with ANSI A13.1., repeated here for convenience:

Outside Diameter of Pipe or Covering	Length of Color Field	Size of Letters
3/4 to 1-1/4 Inches	8 Inches	1/2 Inches
1-1/2 to 2 Inches	8 Inches	3/4 Inches
2-1/2 to 6 Inches	12 Inches	1-1/4 Inches

4. Locations: Markers shall be installed on all exposed piping adjacent to each shut-off valve, at branches to indicate changes of direction, where pipes pass through walls and floors, on 20 foot centers or at least one in each room on each pipe. Markers shall be installed on all concealed accessible piping (i.e., piping above suspended ceilings, behind access doors, in accessible chases, etc.) near the point of access, except that, for piping above suspended ceilings, markers shall be installed the same as if the piping was exposed (i.e., same as if the suspended ceiling was not in place). Markers shall be installed so as to easily read by a person standing on the floor. Provide additional direction of flow arrows at each pipe connections at all control valves.

C. Valves shall be marked as follows:

1. Identification tags made of brass or aluminum, stamped with valve number and abbreviation of system served (HTG, PLBG, CW, HW, GAS, AC). Tags shall be installed on all valves except stops at plumbing fixtures. Tags shall be not less than 1-1/2 inch in diameter, markings shall be stamped and black filled, and lettering shall be minimum 1/4-inch high with numbers minimum 1/2-inch high. Tags shall be wired to each valve with No. 6 polished nickel-steel jack chain.

D. All plumbing equipment which was scheduled on the Contract Drawings shall be marked with the name of the item; i.e., Pump No. 1 etc. The identification shall be the same as shown on the Contract Drawings. The marking shall be located on two different sides of the equipment so as to be easily read, with at least one marking visible to a person standing at floor level near the unit (assuming any necessary access to a concealed unit has been made). Lettering shall be a minimum of 2" high. Marking shall be with engraved phenolic labels, white letters on black background. Equipment marking is not required for; air outlets and inlets, plumbing fixtures.

E. All mechanical control equipment shall be marked with phenolic labels. Equipment shall be marked to match the tags used in the programming of the control equipment.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. This Contractor shall provide completed systems with a neat and finished appearance. If, in the judgment of the Engineer, any portion of the work has not been performed in a workmanlike manner or is left in a rough, unfinished state, this Contractor will be required to remove, reinstall or replace same and patch and paint surrounding surfaces in a manner acceptable to the Engineer, without increase in cost to the Owner.

3.2 CLOSEOUT SUBMITTALS

A. Requirements: Final approval of plumbing installation will be recommended upon completion of the following:

1. Completion of all punchlist items
2. Operation instruction period to Owner's satisfaction
3. Permit Submittal
4. Valve list posted
5. Reproducible As-Built drawings delivered to Engineer
6. Asbestos Free Statement
7. Guarantees
8. Equipment Manufacturer of all plumbing units shall provide start-up logs.

3.3 FINAL INSPECTION

A. Final Inspection:

1. Prior to acceptance of the plumbing work, the Contractor shall put all plumbing systems into operation for a period of not less than 5 working days so that they may be inspected by the Engineer and the Owner's representatives.
2. The time of the final inspection shall be mutually agreed to by the Owner, Engineer, and Contractor.
3. The Contractor shall furnish adequate staff to operate the plumbing systems during inspection.

3.4 OPERATION AND MAINTENANCE TRAINING

A. Upon completion of the work, and after all tests and final inspection of the work by the Authority(s) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the various plumbing systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be Superintendents or Foremen knowledgeable in each system and Supplier's Representative when so specified.

B. Costs for time involved by Contractor shall be included in the bid.

3.5 PREPARATION

A. Existing Buildings:

1. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
2. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
3. This work shall be scheduled such that utility services and/or existing systems for the facility are not interrupted during normal operating hours, without prior written permission of the Owner's representative. Work that is performed during normal operational hours shall not interfere with the normal function of the facility's daily operation.
4. The Plumbing Contractor shall be responsible for the removal of all existing plumbing equipment and utilities indicated to be removed on the drawings. The Plumbing Contractor shall also be responsible for the removal and reinstallation of all existing plumbing equipment and utilities that will interfere with installation and operation of any new construction indicated or required and shall be responsible for the removal of all existing plumbing equipment and utilities indicated to be abandoned that will interfere with installation and operation of any new construction indicated or required. All plumbing equipment (other than piping) to be removed shall remain the property of the Owner, and shall be transported - stored - or disposed of, as directed by the Owner. This will be at no cost to the Owner.
5. The Plumbing Contractor shall provide proof of EPA certified training and EPA registered and tested recovery and recycling equipment with his initial submittals. The Contractor shall evacuate, store, transport, and reclaim all CFC’s evacuated from any of the units scheduled for removal to the ARI purity standard.

3.6 INSTALLATION

A. Install plumbing equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance, (e.g., coils, heat exchanger bundles, sheaves, filters, meters, bearings, etc.) can be removed. Relocate items which interfere with access.

B. Provide access doors in equipment, ducts, and walls/ceilings as required to allow for inspection and proper maintenance.

C. If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Engineer before installing the item in a poor access location.

D. Belts, pulleys, couplings, projecting set screws, keys and other rotating parts which may pose a danger to personnel, shall be fully enclosed or guarded in accordance with OSHA regulations.

E. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil black plastic tape wrapped at point of contact or plastic centering inserts.

F. Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below panel to structure and clearance of 3 feet directly in front of panel, except where indicated otherwise or required by NEC to be more. Such offsets are typically not shown on the drawings, but are required per this paragraph.

G. Safety Protection: All piping and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and 2" wide reflective red/white striped self-sticking safety tape.

H. Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the laying out of pipe routings, and in coordinating all work. Poor access to equipment will not be accepted. Contractor shall note that in essentially all areas, piping routed in ceiling space needs to run in joist space, necessitating elbows/fittings/transitions at crosses with other trades, at structural beams, and at all connections to mains and branches. Dashed areas at HVAC units indicate equipment access areas. These (and all other) access areas shall be clear of obstructions. The Division 22 contractor is responsible to coordinate and ensure that all trades stay clear of access areas for any Division 22 furnished equipment.

I. Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

3.7 ADJUSTMENT AND CLEANING

A. Properly lubricate equipment before Owner's acceptance.

B. Clean exposed piping, equipment, and fixtures, remove debris from site. Repair damaged finishes and leave everything in working order.

C. All work areas shall be left broom clean and free of debris. Sweep mechanical rooms at completion of work, and dispose of waste. Dispose of all existing waste in mechanical rooms in addition to waste generated by this work.

3.8 COMMISSIONING

A. The Contractor has specific responsibilities relating to demonstrating the equipment and systems provided have been installed and function per the contract specifications. These responsibilities include, but are not limited to the following:

1. Complete all equipment and system start-up and checkout procedures, and to insure the complete readiness of equipment and systems, prior to the start of the functional performance testing phase of the commissioning process.
2. Functional test all plumbing systems in accordance with the Washington State Energy Code. Demonstrate system performance to the Engineer.
3. Provide to the Owner a written commissioning process and the results of the functional performance testing.

B. Owner shall not accept equipment and systems, and shall not make final payment, until all equipment and systems have been successfully commissioned and all specified requirements have been satisfied.

END OF SECTION

SECTION 220510 – EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Excavation and Associated Grading.

B. Trenching and Trench Protection.

C. Backfilling and Compaction.

D. Verification of Existing Utilities.

E. Protection of Utilities.

1.2 QUALITY ASSURANCE

A. Inspection of Job Conditions: Prior to starting work and during work, the installer shall examine the work by others, site and job conditions under which excavation, trenching, and backfilling for underground utilities work will be performed, and not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Codes and Standards: Comply with requirements of the following codes and standards (Latest Edition) except as modified herein:

1. International Building Code.
2. Requirements of local County for all utility work, work in public right of way, and where specified.
3. OSHA and WISHA regulations.

1.3 RESPONSIBILITY

A. The Contractor is solely responsible for compliance with the requirements of the drawings and specifications local codes and standards, and the proper design, manufacture, delivery, construction coordination with work of other trades, protection and worker's safety. Contractor shall advise Design Consultant of any discrepancy in, or disagreement with the specifications and/or drawings prior to starting work and not proceed until issue is resolved. Only contractors who are fully experienced and entirely knowledgeable shall perform the work specified herein. Commencement of work shall indicate Contractor's acknowledgement of his expertise in this type of work. Any delay resulting from failure to comply with this procedure will not be basis for an extension of the completion date.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Society of Testing and Materials (ASTM) publications:

1. D 422-63 Particle Size Analysis of Soils.
2. D 423-66 Liquid Limit of Soils.
3. D 424-59 Plastic Limit and Plasticity Index of soils.
4. D 1557-78 Moisture Density Relations of Soils using a 10 lb (4.54kg) Rammer and 18 inch (457 mm) Drop.
5. D 2167-66 Density of Soil In Place by the Rubber Balloon Method.
6. D 2217-66 Wet preparation of Soil Samples for Particle Size Analysis and Determination of Soil Contents.
7. D 2487-69 Classification of Soils for Engineering Purposes.
8. D 2922-81 Test Methods for Density of Soil and Soil Aggregate In Place by Nuclear Methods (Shallow Depth).
9. E 548-79 Generic Criteria for Use in the Evaluation of Testing and Inspection Agencies.

PART 2 - PRODUCTS

2.1 SATISFACTORY MATERIALS

A. Materials classified as ASTM D2487, Unified Soil Classification System as SW, SP, GW, and GP are satisfactory for structural fill and for onsite use outside of structural fill areas. Materials classified as SP-SM, GP-GM, GM, GC and ML are also satisfactory for structural fill (excluding structural fill in building areas) provided that they contain moisture contents suitable for the intended use and are reasonably free of organic matter. Native material, not considered unsatisfactory as specified below, may comply. Except that no material shall have any dimension exceeding 2 inches.

2.2 UNSATISFACTORY MATERIALS

A. Materials classified in ASTM D2487, Unified Soil Classification System as PT, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse and all materials containing excessive organic matter or having moisture contents which are not suitable for the intended use.

2.3 COHESIONLESS AND COHESIVE MATERIALS

A. Cohesionless materials shall include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

Liquid limit and plasticity index shall be determined in accordance with ASTM D423 using ASTM D2217, PROCEDURE B.

2.4 UNSTABLE MATERIAL

A. Unstable material shall consist of material too wet to properly support the utility pipe, conduit, or appurtenance structure.

2.5 GRAVELLY SAND BORROW MATERIAL

A. Gravelly sand borrow material to construct structural fills, provide backfill, or replace unsuitable soil in all building and paving areas shall meet the requirements of SW, SP, GW, and GP materials, except that the maximum percentage passing the No. 200 sieve shall not exceed 5% based on the soil fraction passing the U.S. No. 4 sieve, and not contain discrete particles greater than 6 inches in diameter.

2.6 DEGREE OF COMPACTION

A. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, Method D. Minimum compaction requirements shall be as specified in PART 3.

2.7 DRAINAGE GRAVEL

A. Shall be 3/4 inch washed gravel with no more than 2% passing 1/2 inch sieve opening.

2.8 BEDDING

A. May be either (a) Minus 3/8 inch washed pea gravel, or (b) Gravelly Sand Borrow Material described above passing the 3/4 inch screen with a maximum of 5% passing the No. 200 sieve.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation of every description and of whatever substances encountered shall be performed to allow the installation of all utilities at the lines and grades indicated; or where not indicated as required. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected

from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material.

B. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on site or imported material from approved sources at no additional cost to the Owner.

C. Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of off site, at the Contractor's expense, at the Contractor's waste area. Any excess satisfactory excavated materials shall not be mixed with unsatisfactory materials. Unsatisfactory materials shall not cover available suitable materials, or be disposed of in such a manner as to interfere with subsequent borrow operations.

D. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Unauthorized over-excavation shall be backfilled at no additional cost to the Owner.

3.2 TRENCH EXCAVATION

A. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Where recommended trench widths are exceeded, redesign shall be performed by the Contractor using stronger pipe or special installation procedures. The cost of this redesign and the increased pipe or installation procedures shall be borne by the Contractor without additional cost to the Owner.

B. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe and for bedding. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

C. Removal of Unstable Material: Where unstable material is encountered in the bottom of the trench, such material shall be over-excavated 4" beyond the depth required for proper pipe bedding and replaced to the proper grade with select granular material as provided in paragraph. The Contractor is responsible for all costs associated with removing unstable material and replacing with suitable material. For bidding purposes the Contractor shall assume that 20 percent of all excavated material is unstable.

D. Bedding: The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. The pipe shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of pipe or arch. All the bedding shall be tamped into place. Bell holes and depressions for joints shall be only of such length, depth and width as required for properly making the particular type joint. Satisfactory materials may be used for bedding, except as noted in paragraph 3.06 of this section.

3.3 EXCAVATION FOR APPURTENANCES

A. Excavation for vaults or similar structures shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.4 JACKING, BORING AND TUNNELING

A. Unless otherwise indicated, excavation shall be by open cut, except that sections of a trench may be jacked, bored, or tunneled if the pipe, cable or duct can be safely and properly installed and backfill can be properly tamped in such sections.

3.5 BACKFILLING

A. Backfill material shall be compacted in 6" layers (except initial backfill which shall be 4") and as specified in Paragraph 3.07.

1. Trench Backfill: Trenches shall be backfilled to finish grade. The trench shall be backfilled to above the top of pipe as shown on the drawings prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.
2. Replacement of Unstable Material: Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material or gravel borrow placed in layers not exceeding 6 inches loose thickness.
3. Bedding and Initial Backfill: Bedding shall be of the type and thickness shown on the drawings. Where not indicated, bedding shall consist of satisfactory materials, with no dimension exceeding 2" on any bedding material used. Initial backfill shall be in 4" lift.
4. Backfill for Appurtenances: After the manhole, catch basin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for the days specified, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be placed in such a manner as to prevent eccentric loading and excessive stress on the structure. Compaction shall be as specified.

3.6 SPECIAL REQUIREMENTS

A. Special requirements for both excavation and backfill relating to the specific utilities are as follows:

1. Fire Lines: Trenches shall be of a depth to provide a minimum cover of 3.5 feet (or deeper if required by local authority) from the existing groundsurface, or from the indicated finished grade, whichever is lower, to the top of the pipe. Bedding shall use satisfactory materials as specified.

2. Domestic Water Lines: Trenches shall be of a depth to provide a minimum cover of 3.5 feet (or deeper if required by local authority) from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. Except that branch lines serving individual fixtures within building footprint shall have minimum of 1.0 foot cover. Bedding shall use satisfactory materials as specified.

3.7 COMPACTION

A. Each layer of fill, or the excavated subgrade, shall be compacted to at least 95 percent, per ASTM D1557, of laboratory maximum density. Compaction shall be accomplished by approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or other approved compaction equipment. Areas requiring structural fill to four feet below footings not accomplished under the previous contract, shall be compacted to 90 percent of maximum density, per ASTM D1557.

3.8 PROTECTION

A. Newly graded excavated or bedded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes.

B. Verify location of existing utilities prior to beginning work. Utilize Owner as-builts, field electronic detection equipment, visual site surveys, and careful exploratory digging at key locations. Protect all existing utilities from damage.

END OF SECTION

SECTION 220519 – PIPING SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Thermometers

B. Pressure Gauges

C. Strainers

D. Unions

E. Flexible Connectors

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Flexible Connectors: Flexonics, Metraflex, Resistoflex, Universal

2.2 THERMOMETERS

A. Adjustable angle type, with brass stem, separable brass sockets, 7-inch scale, aluminum case, red reading mercury, white face with black numerals, and markings in degrees F. Provide sockets with extension necks where installed on insulated piping.

B. Thermometer Temperature Ranges:

Measuring	Range Degrees F	Increments Degrees F
Domestic Cold Water	0 - 100	1
Domestic Hot Water	30 - 180	2

2.3 PRESSURE GAUGES

A. Pressure Gauges: 4-1/2-inch dial (except natural gas gauges which shall have 2-1/2 inch dial), stem mounting, aluminum or stainless steel case, white face with black numerals, phosphor bronze bourdon tube, 1/4-inch NPT bottom connection. Provide a shut-off cock for all gauges, coil siphon for all steam gauges, and snubber on all liquid line gauges.

B. Pressure Gauge Ranges:

Measuring	Range PSIG	Intervals PSIG	Inter-Graduations
Heating Hot Water	0 - 200	20	2
Chilled Water	0 - 120	20	2

2.4 STRAINERS

A. Water Strainers: "Y" type, same size as the pipe in which they are installed, with cast iron or semi-steel bodies rated for 125 psi working pressure, and with removable cover and sediment basket. Basket screen shall be stainless steel or monel, with a net free area of at least 3 times that of the entering pipe. Provide with blowdown valve where shown on the drawings.

2.5 UNIONS

A. Dielectric Unions: Rated at 250 psi at 180 deg. F., conforming to ANSI B16.39. Type and size to match piping.

B. Unions on Copper Pipe:

1. In 2-Inch Pipe and Smaller: Wrought copper solder joint copper to copper union.
2. In 2-1/2-Inch Pipe and Larger: Brass flange unions.

2.6 FLEXIBLE CONNECTORS

A. Double Bellows Type: Steel Flanges, Nylon reinforced neoprene body, Kinetics model KinFlex or approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Unions: Install unions in pipe connections to control valves, coils, regulators, reducers, all equipment, and where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated.

B. Dielectric Unions: Install dielectric unions at all connections between dissimilar piping materials.

END OF SECTION

SECTION 220520 – PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe.

B. Pipe Fittings.

C. Pipe Joining and Connections.

1.2 SUBMITTALS

A. Shall comply with Section 220500.

B. Product submittals are required for all pipe and pipe fittings to be used on this project.

1.3 GENERAL REQUIREMENTS

A. Application: See each individual system specification sections for call-out of piping materials to be used for that system.

1.4 REFERENCES

A. ANSI B16.4: Cast Iron Threaded Fittings

B. ANSI B16.3: Malleable Iron Threaded Fittings

C. ANSI B16.5: American 150, 300, 400, 600, 900, 1,500, and 2,500 Pound Steel Flange Standards.

D. ANSI/ASTM B88: Seamless Copper Water Tube.

E. ANSI/ASTM B32: Solder Metal.

F. ANSI B16.22: Wrought Copper and Bronze Solder Joint Pressure Fittings.

G. ANSI B16.18: Cast Bronze Solder Joint Pressure Fittings.

H. ANSI B16.24: Cast Copper and Bronze Flange Fittings.

I. CISPI 301: Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary System.

J. ASTM 564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

K. CISPI 310: Cast Iron Soil Pipe Couplings for Hubless Cast.

L. ANSI/ASTM D3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

M. ANSI/ASTM F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

N. ANSI/ASTM D1785: PVC Plastic Pipe

O. ANSI/ASTM D2466: PVC Plastic Pipe Fittings

P. ANSI/ASTM D2672: Joints for PVC Pipe Using Solvent Cement

Q. ANSI/ASTM D2661: ABS Plastic Pipe

R. ANSI/ASTM D2235: Joints for ABS Pipe Using Solvent Cement

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 220500, Acceptable Manufacturers.

B. Steel Pipe and Fittings: U.S. Steel, Bethlehem, Walworth, Flagg, Grinnell, Felker.

C. Copper Pipe and Fittings: Mueller, Nibco, Flagg, Elkhart.

D. Cast Iron Pipe: U.S. Steel, Tyler, U.S. Pipe & Foundry

E. Ductile Iron Pipe and Fittings: Pacific States, Union Foundry

F. Plastic Pipe and Fittings: Tyler, Chemtrol, Western Plastics, Spears, GPK.

G. Miscellaneous Fittings/Materials: As called out in individual specifications.

2.2 COPPER PIPE AND FITTINGS

A. Pipe: Seamless copper tubing, type K, L, or M as indicated, per ANSI/ASTM B88.

B. Fittings: Soldered joints with 95 5 tin antimony solder per ANSI/ASTM B32 or "Silvabrite 100" (95.5 tin/4 copper/0.5 silver) solder. Solder shall be lead-free. Wrought copper fittings per ANSI B16.22, cast bronze fittings per ANSI B16.18, cast flange fittings 150 lb per ANSI B16.24. Underground joints shall be brazed, with BCuP 4, BCuP 5, or BAg 1 filler metals (per American Welding Society Standards).

C. Refrigerant Pipe and Fittings: Piping shall be ACR Type L copper tubing, with silver brazed joints using filler metals per American Welding Society Standards, and wrought copper fittings.

2.3 NO HUB CAST IRON PIPE AND FITTINGS:

A. Pipe: Service weight no hub cast iron pipe per CISPI 301.

B. Fittings: Mechanical joints, stainless steel couplings with neoprene gaskets per ASTM C564 and CISPI 310. Below grade couplings shall be cast iron, conforming to CISP 301-78, and shall be MG Coupling Co. or approved.

2.4 CAST IRON SOIL PIPE AND FITTINGS:

A. Pipe: Service weight cast iron per ANSI/ASTM A74 coated with tar pitch.

B. Fittings: Bell and spigot joints, with neoprene gaskets per ASTM C564, and CISP-HSN.

2.5 DUCTILE IRON PIPE AND FITTINGS:

A. Pipe: Ductile iron pipe shall conform to AWWA C151 and shall be Thickness Class 50 minimum. Pipe shall have cement mortar lining conforming to AWWA C104/ANSI A21.4; standard thickness.

B. Fittings: Fittings shall conform to AWWA C110; fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Fittings shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness.

2.6 COPPER DWV PIPE AND FITTINGS

A. Pipe: Copper drainage tube (DWV), per ASTM B306.

B. Fittings: Wrought copper and wrought copper alloy solder-joint drainage fittings, per ANSI B16.29; or cast copper alloy solder joint drainage fittings, DWV, per ANSI B16.23.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION – GENERAL

A. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

B. Install piping at such heights and in such a manner so as not to obstruct any portion of windows, doorways, or passageways.

C. Coordinate installation of piping with all trades which are affected by installation to avoid conflicts.

D. Offset or reroute piping as required to clear any interferences which may occur.

E. Consult all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

F. Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.

G. Pitch all piping and provide drain valves so that all piping and equipment can be drained.

H. Provide escutcheons where pipe passes through walls, floors, or ceilings.

I. Install all exposed piping parallel to the closest wall and in a neat, workmanlike manner.

J. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary.

3.2 PIPE JOINING

A. General: Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, and the ends shall be reamed to remove any cutting burrs.

B. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use teflon tape or lead and graphite lubricant- on male threads only.

C. Caulked Connections: Cast iron pipe shall be made with picked oakum and at least 1 1/2 inches of molten lead or joined with neoprene gaskets in accordance with manufacturer's assembly instructions.

D. Hubless Connections: Made with hubless type coupling assemblies in accordance with manufacturer's recommendations

E. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.

F. Unions: Install unions in pipe connections to valves, coils, and any other equipment where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise.

G. Insulating Unions: Install dielectric insulating unions or insulating type flexible connectors between all connections of copper piping and steel piping or steel equipment. Where flanged connections occur use insulating type flanges.

END OF SECTION

SECTION 220529 – PIPING HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe Hangers

B. Equipment Hangers

1.2 QUALITY ASSURANCE

A. Pipe Hanger Standards: (MSS) Manufacturers Standardization Society Standards SP-58-1975, SP-89-1978, and SP-69-1976.

B. All methods, materials and workmanship shall conform to the International Building Code (IBC) and International Mechanical Code (IMC), as amended and adopted by the authority having jurisdiction.

1.3 SUBMITTALS

A. Submittals shall comply with Section 220500.

B. Submit product data. Indicate where such items are to be used.

C. Shop drawings are required for all equipment supports and fabricated supports or assemblies.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hangers and Supports: Elcen, Grinnell, B-Line Systems, Unistrut, Michigan, Tolco.

B. Anchors: Rawplug, Phillips, Hilti, Michigan.

2.2 GENERAL HANGERS AND SUPPORTS

A. Hanger Rods: Threaded hot rolled steel, electro-galvanized or cadmium plated. Hanger rods shall be sized so that the total load (including pipe or duct, insulation, hangers, and fluid) does not exceed the following:

Nominal Rod Diameter	Maximum Load

1/4 Inch	240 Pounds
5/16 Inch	440 Pounds
3/8 Inch	610 Pounds
1/2 Inch	1130 Pounds

B. Hanger Straps: Galvanized steel. Straps shall be sized so that the total load does not exceed the following:

Strap Size	Maximum Load
1" x 22 Gauge	230 Pounds
1" x 20 Gauge	290 Pounds
1" x 18 Gauge	380 Pounds
1' x 16 Gauge	630 Pounds

C. Beam Attachments: Shall be of the following type:

MSS Type	Elcen Figure No.	Grinnell Figure No.
21	33, 34	131
22	67	66
23	29A	87
28	95	292, 228
30	95	229

D. Steel: Structural steel per ASTM A36.

E. Wood: Shall be fire treated.

2.3 PIPE HANGERS AND SUPPORTS

A. All hangers used directly on copper pipe shall be copper plated or have a factory applied 1/16-inch thick (minimum) plastic coating on all contact surfaces.

B. All other hangers, supports, and hardware shall be cadmium plated or galvanized.

C. Pipe Hangers and Supports: Shall be of the following type (numbers are 'MSS'):

Maximum System Temperature	Insulated Pipe Type
120 to 450 Degrees	1, 3, 7, 9, 10, 41, 42, 43, 44, 45, 46, E
60 to 120 Degrees	1, 3, 7, 9, 10
33 to 59 Degrees	1, 3, 5, 7, 9, 10, 41, 42, 43, 44, 45, 46, E

D. Vertical Pipe Supports: MSS Type 8 riser clamp (elcen Fig. 39 and 339; Grinnel Fig. 261 and 261C).

E. Trapeze Hangers: Shall be constructed of carbon steel angles, channels or other structural shapes with flat surface for point of support. Trapeze hangers shall be supported with hanger rods suspended from concrete inserts or approved structural clips. Provide a steel washer plate (Elcen Fig. 84 or equal) where hanger rod nuts bear on trapeze hanger.

F. Insulated Pipe Supports:

1. Insulation material at pipe support shall consist of expanded perlite insert with flame resistant jacket of nylon reinforced kraft paper bonded to aluminum foil cover on insulation, with sheet metal shield. Expanded perlite shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.32 Btu/hr./sq. ft./degree F/1-inch thick.
2. Expanded perlite insert shall be same thickness as adjoining pipe insulation, sized to match pipe used on.
3. Minimum insulation, shield lengths, and shield gauge:

Normal Pipe Diameter In Inches	Insulation Length In Inches	Shield Length In Inches	Minimum Shield Gauge
1/2 to 2	6	3	20
2-1/2 to 3-1/2	6	4	18
4 to 5	9	6	18
6 to 10	9	6	16

4. Manufacturer: Michigan Hanger Company, Model Nos. 1031 and 4031.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

A. Provide all necessary bolts, nuts, washers, turnbuckles, rod connectors and any other miscellaneous accessories required for the support and anchoring of all pipes, ducts, and mechanical equipment.

B. Install steel or wood backing in walls (anchored to studs) as required to provide support for items hung from walls. Backing shall be of the same material as the studs or structure they are attached to.

C. All welded steel support assemblies shall have a power wire brush and primer paint finish.

D. Attach to building structure as shown on drawings.

E. Maximum spans between piping supports may be significantly less than the maximum spans allowed herein due to structural limitations of allowable loads on hangers. The most restrictive criteria governs. Reference structural drawings.

3.2 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. Pipe which is not run underground shall be adequately anchored to the structure to prevent sagging and to keep pipe in alignment.

B. All pipe supports shall be provided with a means of adjustment for the aligning and leveling of the pipe after installation.

C. Installation and sizing of pipe supports and accessories shall be in accordance with the manufacturer's recommendations and standard MSS SP-89 and MSS SP-69, UPC, and UMC.

D. Provide supports at each change in direction of piping.

E. Where mechanically coupled piping is used, a hanger shall be placed within 2 feet on each side of couplings, with hanger spacing in no case to exceed the following:

Normal Pipe Diameter	Maximum Span Mechanically Coupled Piping
3/4 to 1 Inch	7 Feet
1-1/4 to 1-1/2 Inch	7 Feet
2 Inches	10 Feet
2-1/2 Inches	10 Feet
3 Inches and Larger	12 Feet

NOTE: Manufacturer's support instructions shall be used where it is more restrictive than the above. Above is for rigid coupled piping systems. Follow manufacturer's requirements for flexible piping systems, except that in no case is spacing to be less than the above.

F. Copper Tubing: Maximum spacing between supports:

Nominal Tubing Diameter	Maximum Span Copper
1/2 to 1 Inch	5 Feet
1-1/4 to 1-1/2 Inch	6 Feet
2 to 2-1/2 Inch	8 Feet
3 Inches and Larger	10 Feet

G. Three or more pipes running parallel may be supported on trapeze hangers provided the slopes of such pipes allow use of common trapeze. Where trapeze width exceeds 24 inches, provide three (3) hanger rod supports.

H. Provide additional supports at concentrated loads (such as valves, in-line pumps, etc.) on each side of the load. Such supports are in addition to the ones otherwise required.

I. Vertical Piping Supports: Support piping at each floor line with pipe clamps and at intermediate points as required to prevent excessive pipe movement and so as to comply with the maximum spacings cited above. Support all pipe stacks at their bases with a concrete pier or suitable hanger. For vertical pipe drops which occur away from a wall or similar anchoring surface, provide angled bracing from nearest structure to provide rigid anchoring of pipe drop.

J. Pre-Insulated Pipe Supports: Protect all insulated pipe at point of support with pre-insulated pipe supports. Such supports shall be in place at time of installing pipe.

END OF SECTION

SECTION 220530 – PIPING SLEEVES AND SEALS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe Sleeves

B. Seals

1.2 REFERENCES

A. ASTM E814: Fire Tests of Through-Penetration Fire Stops

B. UL 1479: Through-Penetration Fire Stop Systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 220500, Acceptable Manufacturers.

B. Fire Seals: 3M, Down Corning, General Electric, Rectorseal.

2.2 PIPE SLEEVES

A. Size: Inside diameter of pipe sleeves shall be at least 1/2-inch larger than the outside diameter of the pipe or pipe covering, so as to allow free movement of piping.

B. Ends: Sleeve ends shall be cut flush with finished surfaces, except in rooms having floor drains where sleeves shall be extended 3/4-inch above finished floor.

C. Material - Structural: Sleeves through structural elements shall be fabricated from Schedule 40 steel pipe.

D. Material - Non-structural: Sleeves through non-structural elements shall be fabricated from 18 gauge galvanized sheet metal or 24 gauge spiral duct.

2.3 SEALS

A. Seals at exterior of building: Provide a sleeve through exterior walls sealed to the wall system per architectural plans. Core drilled penetrations is concrete do not require a sleeve. Provide modular mechanical seal between the sleeve and penetrating pipe. Eaton Link-Seal or approved.

B. Seals in other areas: Packed fiberglass or wool insulation, where no weatherproofing or adhesive properties are required; otherwise, sealants shall be silicone type, as specified in applicable Division 7 Specification Section.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE SLEEVES

A. Provide pipe sleeves for all piping passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements, except that sleeves are not required for penetrations through existing single solid elements, having no voids, at the location where the piping passes through the solid elements (e.g., solid wood stud, core drilled solid concrete, etc.). Where a sleeve is required, such sleeve shall continue all the way through any solid items within that element however.

B. Set sleeves plumb or level (or sloped as required for drainage pipe) in proper position, tightly fitted into the work.

C. Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating.

D. Seal around all pipes inside of pipe sleeve.

E. Insulation shall run continuous through sleeves in non-fire rated elements. Insulation shall not run continuous through sleeves in fire rated elements unless the fire sealant system used is UL accepted for use with insulated pipes.

3.2 INSTALLATION OF SEALS

A. Provide seals around all piping and ducts passing through walls, floors, roofs, foundations, footings, grade beams, partitions, and similar elements.

B. Pipe penetrations through the building envelope shall be sealed watertight.

END OF SECTION

SECTION 220548 – PIPING VIBRATION AND SEISMIC CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Vibration Isolators

B. Seismic Restraints

PART 2 - PRODUCTS

2.1 NEOPRENE ISOLATORS

A. Suspension Isolators: Shall be double deflection neoprene type, with isolator encased in open steel bracket and minimum 3/8-inch deflection. Hanger rod shall be isolated from steel bracket with neoprene grommets. Mason Series HD, Amber Booth "BRD" or approved.

2.2 SPRING ISOLATORS

A. General: The load carried by each isolator shall be carefully calculated and isolators selected so that the static deflection will be the same and the supported equipment will remain level. Isolators shall be so designed that the ends of the springs will remain parallel during and after deflection to operating height. At operating height, springs shall have additional travel to complete (solid) compression equal to at least 50 percent of the operating deflection. Suspension isolator springs shall have a static deflection (as shown on drawings) not less than 1-1/2", except that for units with components rotating at 1000 rpm and less, the static deflection shall be not less than 2 inches. Floor isolator springs shall have deflection of not less than 1 inch. All isolators shall provide at least 96% isolation efficiency. Note: Deflections other than these may be used where circumstances warrant and more optimum isolation results can be achieved.

B. Suspension Type Spring Isolators: Shall consist of a rigid steel frame, a stable steel spring in the bottom part of the frame, and double deflection neoprene isolating pad at the top of the frame. Where supporting rods pass through the frame, a clearance of not less than on half rod diameter shall be provided all around the rod. Mason Series DNHS, Amber Booth "BSSR" or approved.

2.3 SEISMIC RESTRAINTS

A. Materials: Steel shall be per STM A36; hangers and other devices shall be as shown in SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems latest edition. Sheet metal used for bracing shall be no less than 16 gauge. Cable bracing may be used provided that opposed acting cables are provided on the items being braced to provide bracing equal to that provided by rigid angle bracing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Vibration Isolation:

1. Motorized equipment shall be suspended from spring vibration isolators either integral or external to the equipment.
2. Unless otherwise indicated, resilient mounts for motorized equipment shall be of the type and size to provide maximum ten percent transmissibility. Use unhoused, free-standing stable steel springs which are preferred over housed spring assemblies. The horizontal stiffness of the spring shall be approximately equal to its vertical stiffness. The Spring deflection shall be selected based on the equipment power range (HP), speed range (RPM), and static deflection of the supporting structural floor. For large equipment such as fans the steel spring static deflection of the supporting structural floor. It is a specific recommendation that whenever a steel spring is used, two pads of ribbed waffle-pattern neoprene be used in series with the spring.
3. The design of vibration dampening shall consider lateral load as well as vertical load and be suitably snubbed against earthquake forces.
4. A list of isolators accompanied by certified transmissibility ratings for the required duty shall be submitted for each item of equipment.
5. Unless noted otherwise, all vibration isolating equipment shall be of the same make and shall be submitted as one group.
6. Special equipment, such as compressors shall be selected on an individual basis.

3.2 SEISMIC CONTROL

A. Provide earthquake snubbers for all equipment that is supported on spring isolators and weighing over 300 lbs. including base. Provide minimum of four snubbers for equipment weighing less than 2,000 lbs., and eight snubbers for heavier equipment.

B. Pipes of all sizes that are suspended on hangers that are longer than 12” shall be have a transverse brace every 40 ft and a longitudinal brace every 80 ft.

END OF SECTION

SECTION 220700 – PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe Insulation.

B. Equipment and Specialties Insulation.

1.2 DEFINITIONS

A. "Run-out" means "piping not more than 12 feet long that runs to an individual fixture or unit."

B. "Conditioned Areas" means "areas that are directly and intentionally supplied by heated or cooled air".

1.3 QUALITY ASSURANCE

A. All insulation shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E 84, NFPA 255, and UL 723.

1.4 SUBMITTALS

A. All submittals shall comply with Section 220500.

B. Provide product data on all insulation materials to be used. Indicate thicknesses to be used.

1.5 GENERAL REQUIREMENTS

A. Code Compliance: Contractor shall insulate all systems with the materials and thicknesses as specified herein, but in no case shall the insulation be less than that required by the Washington State Energy Code (latest edition and amendments) or Energy Code enforced by the authority having jurisdiction. Contractor shall, in addition to insulating those systems/items specified herein, provide insulation where required by Code.

B. Insulation at Hangers: Insulation shall be continuous through hangers on all insulated systems (except ductwork.) Inserts at hangers are specified and are considered as part of the hanger and support system. Inserts are required to be installed at the time of pipe installation and are intended to be installed by the Contractor installing the pine hangers/supports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 220500, Acceptable Manufacturers.

B. Insulation: Manville, Armstrong, Owens Corning, CSG, Knauf, Rubatex, Pittsburgh Corning, Imcoa, Halstead.

C. Accessories: Same as for insulation and Duro Dyne, Gustin Bacon, Childers, RPR, Tee Cee, J. P. Stevens, Buckaroos, Johnson.

2.2 PIPE INSULATION

A. Fiberglass Insulation: Rigid fiberglass insulation, thermal conductivity shall not exceed 0.24 Btu inch/hr sq. ft. degrees F. at 75 degrees F with jacket consisting of high density white kraft bonded to aluminum foil, with pressure sensitive closure system, integral vapor barrier with 0.02 perm rating.

B. Elastomeric Insulation: Density not less than 5 lbs per cubic foot and thermal conductivity not greater than 0.27 Btu inch/hr ft degrees F. Armstrong "Armaflex" or equal.

C. Foamglas Insulation: Glass cell insulation, Pittsburgh Corning "Foamglas," with thermal conductivity no less than 0.35 Btu-in/hr-sq. ft.-degrees F at 75 degrees F, compressive strength of 100 psi, and water-vapor permeability of 0.00 perm-inch as tested per ASTM and "pittwrap" water-proof membrane.

D. Pipe Fittings (except unions and expansion couplings): Shall be covered using any one of the following methods of the Contractor's choice:

1. Prefabricated segments of pipe insulation of same materials and thickness as the adjoining pipe insulation, formed to match pipe fitting.
2. Pre cut fiberglass insulation and pre-molded PVC covers suitable for the pipe size and insulation thickness encountered. PVC cover shall be equal to Manville "Zeston."
3. Insulating plastic cement brought up the full height of the adjacent covering.

E. Metal Jacket: Aluminum roll jacketing, with smooth surface, manufactured from 1100, 3003, 3105 or 5005 aluminum alloy conforming to ASTM B-209. Shall be minimum 0.016 inches thick, with an integrally bonded interior moisture barrier over the entire surface in contact with the insulation.

F. P-traps and HW/CW Lines on Handicap Lavatories: Prefabricated insulation specially designed for p-trap application, with white elastomeric insulation, white high gloss PVC cover, and snap together closure. Provide section for insulating HW stop, CW stop, and leads of same material. TRU BRO “LAV GUARD” or equal.

G. Insulation Thickness and Types:

1. Domestic Hot Water:

   a. Aboveground:

Pipe Size		Fiberglass Insulation Thickness
Run outs Up to 2 Inches		0.5 Inch
1 Inch and Less		1.0 Inch
1.5 Inches to 2 Inches		1.5 Inch
2.5 Inches to 4 Inches		2.0 Inch

2. Domestic Cold Water: 1/2 inch thick fiberglass insulation.
3. Refrigerant Suction Piping:

   a. 1 inch thick elastomeric insulation for pipe sizes 1 inch and less; 1.5 inch thick elastomeric for larger pipe sizes.

4. Condensate Drain Piping (within the building): 1/2 inch thick fiberglass or elastomeric insulation.
5. Outdoor Piping: Piping exposed to outside air shall have insulation thickness increased by 0.5 inch from that indicated above. Elastomeric insulation may be used in lieu of fiberglass, provided the insulation is manufacturer approved for applications proposed.
6. Alternative Insulation Thickness: Insulation thickness indicated is based on the thermal conductivities specified. Contractor at his option may use other insulation thicknesses for insulation with different thermal conductivities provided that the overall heat transfer coefficient is the same as if the specified insulation had been used. Submit calculations showing insulation equivalency for approval.

2.3 EQUIPMENT AND SPECIALTIES INSULATION

A. Equipment: Insulation shall be same material as that specified for the piping system the equipment is installed in. Insulation thickness shall be 1.5 inches.

B. Valves: All valves installed in insulated piping systems shall be insulated. Insulation material and thickness shall be same as that specified for the pipe system the valve is installed in. Insulation shall be removable type on all control valves.

C. Removable Insulation: Shall provide thermal insulating properties equivalent to that which is provided for piping system. Shall consist of 0.25-inch J. P. Stevens "Insulbatte" with glass cloth jacket, 4.0-inch Owens-Corning thermal insulating wool, Type II, fastened with No. 304 stainless steel hooks tied with 0.040-inch soft solid annealed copper wire. Where metal jacketing is required, provide with removable enclosures, of same material as metal jacketing, configured to suit items covered.

PART 3 - EXECUTION

3.1 GENERAL

A. Equipment and Floor Protection: Cover existing equipment and finished floors to protect such items from insulation fiber and dust. Keep all such existing areas in a "broom clean" condition at the end of each day. Take precautions in these areas to prevent glass fiber and insulation dust from entering existing ventilating systems.

B. Glass Fiber Insulation:

1. Finish all insulation ends, no raw edges allowed.
2. Joints: Tightly butt adjacent insulation sections together without any voids. Provide overlap of jacket material over all circumferential joints.

C. Insulation Thickness: See "Part 2 - Products" for insulation thicknesses.

D. Items To Be Insulated: Provide insulation on all piping, and all items installed in the piping systems, all energy conveying, all energy storage, and all energy consuming devices specified as part of Division 22, except where such insulation has been specifically excluded.

E. Items Excluded From Being Insulated:

1. Electric motors.
2. Factory insulated water heaters (except for base).
3. Fire sprinkler piping.
4. Stops and risers at plumbing fixtures (Except ADA Lavatories).

3.2 PIPE INSULATION INSTALLATION

A. All ends shall be firmly butted together and secured with butt strips of a minimum 3 inch wide. On hot piping, all jacket laps and butt strips shall be secured with outward clinch staples at 4 inch spacing, or by use of a suitable lap adhesive.

B. All piping shall be insulated except where specifically excluded.

C. Elastomeric Pipe Insulation: Shall be completely sealed to provide a vapor proof barrier.

D. Pipe Hangers: Provide insulation tight up to pre insulated pipe supports at pipe hangers.

E. Pipe Sleeves: For insulated pipe, do not run insulation through sleeve, except where fire sealant system used is UL approved for use with insulated pipes, then install insulation in full sized thickness completely through the pipe sleeve.

F. No pipe covering materials shall be applied until the pipe runs to be covered have been tested by the Contractor and reviewed by the Architect Engineer, and no covered sections of pipe shall be buried or concealed in the structure until said insulation and covering work has been reviewed.

G. Handicap Lavatories: Insulate P-trap and HW supplies below lavatory where exposed.

H. Items in piping that require access (i.e. flow measurement devices) shall have removable insulation provided.

I. Provide metal jacket over piping insulation for all outside exposed piping.

3.3 EQUIPMENT AND SPECIALTIES INSTALLATION

A. All equipment where access is required shall have insulation installed so that it can be easily removed and reinstalled without requiring new insulation. Items requiring such removable insulation include, but are not limited to, the following:

1. Control Valves.
2. Strainers.
3. Balancing Devices.
4. Pressure/Temperature/Flow Measuring Devices.

B. Specialties Requiring Insulation: All items connected in an insulated piping system shall be insulated, except the following:

1. Factory Insulated Items.
2. Water Meters.
3. Hose Bibbs.
4. Relief Valves.

END OF SECTION

SECTION 221100 – DOMESTIC WATER PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Domestic Water Piping.

B. Valves.

C. Water Hammer Arrestors and Air Chambers.

D. Trap Primers.

E. Backflow Preventers.

F. Water Service Connections.

G. Testing and Inspection.

H. Sterilization.

1.2 SUBMITTALS

A. Submittals shall comply with Section 220500.

B. Submit product information on all items to be used.

1.3 REFERENCES

A. AWWA B300, Hypochlorites.

B. AWWA B301, Liquid Chlorine.

C. AWWA M20, Water Chlorination Principles and Practices.

1.4 GENERAL REQUIREMENTS

A. Solder: Only lead-free solder shall be used on potable water systems.

B. All work and products shall comply with the governing codes (reference Section 220500).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 220500, Acceptable Manufacturers.

B. Valves: Crane, Grinnell, Nibco, Stockham, Walworth, Milwaukee, Kitz, Red-White, Watts.

C. Pressure Reducing Valves: Watts, Cla-Val, Bell & Gossett, Wilkins.

D. Trap Primers: JR. Smith, Precision Plumbing Products.

E. Backflow Preventers: Febco, Watts, Ames.

F. Additional manufacturers are as listed for each individual item.

2.2 PIPE AND FITTINGS

A. Pipe and fitting standards shall be as specified in Section 220520, Pipe and Pipe Fittings.

B. Domestic Water Piping Located Above Ground: Type L copper tubing with solder joints and wrought copper or cast brass fittings.

C. Domestic Water Piping Located Below Ground: Type K copper tubing with silver brazed joints and wrought copper or cast brass fittings.

D. Trap Primer Piping: Type L or K "soft" or "hard" (bending temper) copper, with compression fittings or soldered joints.

2.3 VALVES

A. Gate Valves:

1. 3 Inches and Larger: 125 psi swp iron body gate, bronze mounted, bolted bonnet, OS&Y, flanged. Stockham No. G-623.

B. Globe Valves:

1. 2 1/2 Inches and Smaller: 125 psi swp bronze globe, threaded bonnet, teflon or bronze disc, solder or threaded connection. Stockham No. B-13T, B-14T, B 16, B-17.
2. 3 Inches and Larger: 125 psi swp iron body globe, bronze mounted, bronze or teflon disc, flanged. Stockham No. G-512, G-514T.

C. Ball Valves:

1. 2-1/2 Inches and Smaller: 125 psi swp bronze ball, standard port, 2 piece construction, anti blowout stem, teflon seats, stainless steel or chrome plate ball, extended stem, memory stop, solder or threaded connections as required. Nibco S580, T580.

D. Check Valves: Class 125 bronze check valve, horizontal swing, regrinding type, Y-pattern, renewable discs, complying with MSS SP-80.

E. Pressure Reducing Valves:

1. Bronze body construction, renewable nickel alloy seat, with integral strainer and union inlet connections. Adjustable range 25 to 75 lbs. Watts U5 or approved.

F. Pressure Relief Valves: ASME rated pressure relief valve, set for pressure indicated or as required to protect system from over pressure. Valve shall have minimum 400,000 BTU/HR relief capability and no smaller than 3/4-inch connection sizes.

G. Buried Site Isolation Valves: 200 psi nonshock water working pressure, iron body, bronze mounted, non-rising stem type, open counterclockwise, with "o-ring" type packing, standard 2-inch operating nut, complying with ANSI/AWWA C500. Furnish with operating wrench, length to suit installation.

2.4 SPECIALTIES

A. Water Hammer Arrestors: All metal, factory precharged with inert gas, sealed internal bellows; 125 psi working pressure. All wetted parts shall be type 300 stainless steel, brass or copper. Zurn "Shoktrol", Wade "Shokstop", J. R. Smith "Hydrotrol", or Josam equivalent; in P.D.I. (Plumbing and Drainage Institute) sizes as indicated.

B. Trap Primer Valve:

1. For Single Drains: Cast bronze trap primer valve, 1/2-inch connections, for serving single floor drain. J.R. Smith No. 2699 or approved.
2. For Single and Multiple Drains: Manufactured of corrosion resistant copper and brass, with valve and line pressure adjustment with manifold for serving multiple drains. Primer valve activated by drop-in water pressure. Precision Plumbing Products "Prime Rite" or approved.
3. Valve Box: Cast iron box, rated for H2O loading, adjustable type with flanged top section and flared base. Style to suit valve used with and depth, and as acceptable to local code officials. Valve box cover shall be cast with words "WATER".

2.5 BACKFLOW PREVENTERS

A. Reduced Pressure Type: Washington State approved, with air gap drain and resilient seated full flow shutoff valves and test cocks. Size [and capacity] as shown on drawings. Febco Models 825Y, 825 or approved.

B. Double Check Type: Washington State approved, with resilient seated full flow shutoff valves and test cocks. Size [and capacity] as shown on the drawings. Febco Model 805, 805Y or approved.

2.6 DOMESTIC WATER DIAPHRAGM TANK

A. Diaphragm type thermal expansion absorber. Amtrol or approved.

B. Construction: Welded steel construction, with rigid polypropylene liner, butyl diaphragm, air charging valve, and ASME certified.

C. Capacity: 4.7 gallon tank volume (minimum).

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING AND FITTINGS

A. Installation and joining of all piping shall comply with Section 220520.

B. Provide all non potable water, domestic hot water, and cold water piping as indicated and as required to allow supply connections to each fixture and equipment item requiring water supply.

C. Run all piping concealed unless piping is specifically noted as to be run exposed.

D. Provide supply connections to equipment furnished by others in accordance with Section 220500

E. Install all piping sloped to low points to allow the system to be drained.

3.2 INSTALLATION OF VALVES

A. For Valves 2-Inch and Smaller: Provide ball valves unless drawings indicate globe valves.

B. Provide isolation valves as shown on the drawings. In addition to those shown, provide added valves to allow for the isolation of each group of fixtures and all individual equipment items.

C. Install valves so as to be easily accessible and oriented to permit ease of operation. Valve stem shall be directed toward operator in either the vertical or horizontal direction. Provide access doors or panels to valves built into construction.

D. Provide pressure reducing valves as shown on drawings, complete with by pass line, isolation valves, unions, and pressure gauges. Set initial pressure as shown, and adjust as required so that all fixtures/devices served have sufficient water pressure.

E. Provide drain valves at the base of all risers.

F. Provide drain valves at piping low points where the piping cannot be drained through fixtures or hose bibbs.

G. Provide balancing valves in hot water circulation piping where indicated and where required to allow for equal distribution of hot water circulation flows.

H. Butterfly valves installed at equipment or other system components which may be disconnected from the system shall be lug type suitable for dead end service. This includes butterfly valves at water heaters, pressure reducing valves, and similar equipment.

3.3 INSTALLATION OF SPECIALTIES

A. Water Hammer Arrestors: Install per manufacturer's instructions. Provide ball isolation valve in piping to arrestor. Where access cannot be provided at water line location, extend water hammer arrestor piping and locate above ceiling outside of plumbing chase. Provide ceiling access doors as required. Provide water hammer arrestors at each flush valve or at the end of a bank of flush valves. Size water hammer arrestors per P.D.I.

B. Trap Primers: Provide trap primers to all vented floor drains and where required by the governing code. Install as shown on drawings and provide with a isolation valve in the branch line to the trap primer valve.

C. Access Covers and Doors: Provide access to all valves, water hammer arrestors, trap primers, backflow preventers, and any other piping accessories which would otherwise be inaccessible.

D. Provide backflow preventers of type, and in locations, as shown on the drawings.

E. Backflow devices shall be installed, inspected, and tested in accordance with the applicable portions of the Washington Administrative Code and other applicable regulations as set forth by the Washington State Department of Social and Health Services.

F. Install heat tracing as shown on drawings and in accordance with manufacturer's instructions and NEC requirements.

3.4 WATER SERVICE CONNECTIONS

A. Provide connection to water main outside the building as shown on the drawings.

B. Provide sleeve in floor for entrance of service main into building, seal watertight; anchor service main firmly to building floor and walls. Seals shall comply with Section 220530, Supports, Sleeves, and Seals.

3.5 TESTING AND INSPECTION

A. All piping shall be tested, inspected, and approved (by the local authority having jurisdiction) prior to being concealed or covered.

B. Testing shall be witnessed by the plumbing inspector and the Architect/Engineer. Notify Architect/Engineer 48 hours prior to date of testing.

C. Piping shall be hydrostatically tested for a period of 2 hours, during which time no drop in pressure or leakage shall occur.

D. Test pressure shall be not less than 150 percent of the maximum to which the pipe will ordinarily be subjected; but in no case less than 150 psig.

E. Any leaks or defective piping disclosed by testing and inspection shall be repaired with new materials and the system re tested.

3.6 FLUSHING AND DISINFECTION

A. System Flushing: After tests are completed, all water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. System valves and fixture faucets shall be opened and re-closed to completely flush system. After flushing and cleaning, systems shall be prepared for disinfection service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building, due to the Contractor's failure to properly clean the piping system, shall be repaired by the Contractor.

B. Upon completion of the job and prior to final acceptance, the plumbing system shall be disinfected with Chlorine solution. Review procedures and disinfection with the authority having jurisdiction to ensure that all work complies with code requirements. Verify any deviations from specified procedures with the Engineer prior to proceeding. The chlorinating material shall be either liquid chlorine conforming to AWWA B301 or hypochlorite conforming to AWWA B300 (or as otherwise required by the authority having jurisdiction). Water chlorination procedure shall be in accordance with AWWA M20 (or procedure acceptable to authority having jurisdiction). The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the system in an approved manner. The treated water shall be retained in the pipe long enough to destroy all non spore forming bacteria.

C. The retention time shall be at least 24 hours and shall produce not less than 10 ppm of chlorine at the extreme end of the system at the end of the retention period. All valves in the system being sterilized shall be opened and closed several times during the contact period. The system shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period all valves and faucets shall be opened and closed several times.

D. The Contractor shall employ an approved agency to take test samples at several points of the system in properly sterilized containers and arrange with the Health Department having jurisdiction to test the samples. Should the samples not test satisfactory, the system shall be re sterilized and re flushed until satisfactory samples are obtained.

E. The Contractor shall furnish a letter to the Engineer stating that Chlorination has been completed. The letter shall also include a copy of a certificate from the Health Department having jurisdiction stating that samples taken have been found acceptable.

END OF SECTION

SECTION 221123 – PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Domestic Circulators.

1.2 SUBMITTALS

A. All submittals shall comply with Section 220500.

B. Provide product information and performance data for all pumps.

C. Performance data shall include pump curves, showing pump performance as head vs. GPM, BHP and NPSH vs. GPM, with system operating point clearly marked. (NPSH vs. GPM not required for pumps 1 HP and less.)

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 220500.

B. Domestic Circulators: Bell & Gossett, Grundfos, Armstrong.

2.2 GENERAL

A. All rotating parts shall have been statically and dynamically balanced at the factory.

B. Pumps shall operate at 1750 rpm unless indicated otherwise.

C. Pump Capacity: Shall be no less than the values listed on the Mechanical Equipment Schedule on the drawings.

D. Pump Types: The type of each pump is indicated on the Mechanical Equipment Schedule under the "Type" column, and corresponds to the types specified herein.

E. Motors: Shall comply with Section 220500. Motors shall be of sufficient size so as to be non-overloading at any point on the operating curve and shall be no smaller than the size shown on the drawings. Motors shall be of drip-proof construction, unless indicated otherwise shall be 1750 rpm, resilient mounted with oil lubricated journal or ball bearings, and have built-in thermal

overload protectors. Motors shall be for use with the voltage and phase as scheduled on the drawings.

F. Controls: Furnish each pump with motor starter and overload protectors unless indicated otherwise.

G. Bronze: Pumps used on domestic water systems shall be of all-bronze construction.

H. Testing: All pumps shall be factory tested and thoroughly cleaned.

I. Finish: Pumps shall have minimum one coat high grade machinery enamel finish, factory applied, manufacturer's standard color.

2.3 DOMESTIC CIRCULATORS

A. Type: Centrifugal, single stage, wet rotor type.

B. Construction: Bronze or stainless steel body; polypropylene, nylon, brass, or stainless steel impeller; ceramic or alloy steel shaft. Pump shall require no coupling or shaft seal for proper operation.

C. Operating Range: Pump shall be suitable for 200 degree F operating temperature and 125 psig maximum working pressure.

D. Motor: Motor shall be non-overloading at any point on the pump curve. Motor shall be integral to the pump; shall be cooled/lubricated by the pumped fluid; of quiet-operating construction; and shall be equipped with thermal overload protection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps at locations shown on the drawings.

B. Decrease from line size to pump inlet size with long radius reducing elbows and minimum 5-pipe diameter straight pipe into pump (except where suction diffusers are used). Where reducers (in the horizontal) are used on pumps, they shall be the eccentric type installed with taper on the bottom.

C. Check motor alignment after pump installation, realign as necessary.

D. Check pump operation to ensure that specified flows are provided, without motor unloading or pump cavitation. Notify the Architect/Engineer of any unusual conditions or performance other than as specified.

END OF SECTION

SECTION 221300 – SOIL WASTE AND VENT PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Soil, Waste and Vent Piping.

B. Condensate, Overflow, Miscellaneous Drains.

C. Cleanouts.

D. Vent Flashing.

E. Testing and Inspection.

1.2 SUBMITTALS

A. Submittals shall comply with Section 220500.

B. Submit product information on all items to be used.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 220500, Acceptable Manufacturers.

B. Cleanouts: Josam, Zurn, J. R. Smith, Wade.

2.2 PIPE AND FITTINGS

A. Pipe and fitting standards shall be as specified in Section 220520, Pipe and Pipe Fittings.

B. Piping 2 1/2 Inches and Smaller Located Above Ground:

1. No hub cast iron pipe with mechanical joints; or copper DWV.

C. Piping 3 Inches and Larger Located Above Ground and All Piping Located Below Ground:

1. Cast iron soil pipe with bell and spigot joints; or

2. No hub cast iron pipe with mechanical joints. Below ground mechanical joints shall have below ground couplings, shall be super duty stainless steel type. Type 304 stainless shield & bands. 24 gauge shield, neoprene rubber gasket. Bands shall tighten to 80 inch pounds. Husky SP 4000 or approved.

D. Acid Waste and Vent Piping: As specified in Section 220520.

E. Piping Exposed in Finished Areas: Chrome or nickel plated brass; piping 2 inches and larger may be provided with chrome or nickel plated brass sleeves to conceal pipe and fittings.

F. Condensate Drains:

1. Copper DWV or type M copper with soldered joints; or Solid Core, Schedule 40 PVC.

2.3 CLEANOUTS

A. General:

1. All cleanouts shall have cast iron bodies with bronze countersunk rectangular slotted plugs, lubricated with a non-hardening teflon base thread lubricant and having a gasket seal.
2. Cleanouts located in waterproof membrane floors shall be provided with an integral cast flange and flashing device.
3. All cleanouts shall be the same size as the pipe which they are intended to serve (but not larger than 4-inch).
4. Pipe fittings for cleanouts which turn through walls or up through floors shall use long sweep ells or a "Y" and 1/8 bend.
5. All cleanouts and access covers shall be provided with vandal proof screws.
6. Cleanouts in carpeted areas shall have cleanout marker.

B. Floor Cleanouts:

1. Areas with Floor Tile (or Linoleum): J. R. Smith No. 4140 Series adjustable floor level cleanout with round heavy duty nickel bronze top with tile recess.
2. Areas with Bare Concrete Floors: J. R. Smith No. 4100 Series stable floor level cleanout with round heavy duty nickel bronze top.
3. Areas with Terrazzo (and Similar Poured Floors): J. R. Smith No. 4180 Series adjustable floor level cleanout with round heavy duty nickel bronze top with terrazzo recess.
4. Areas with Carpet: J. R. Smith 4020-X Series adjustable floor level cleanout with round heavy duty nickel bronze top and carpet clamp.

C. Wall Cleanouts: Cast iron ferrule with cast bronze taper threaded plug, with plug tapped 1/4-inch, 20 thread, to accept access cover screw; with access cover. Access cover shall be stainless steel or chrome plated in “wet” areas (kitchen, lockers, restrooms) and prime painted steel elsewhere.

D. Outside Cleanouts: Heavy duty, round, cast iron, double-flanged housing, having scoriated cast iron cover with lifting device, ferrule and bronze closure plug. Housing and lid shall be galvanized and have vandal resistant screws. J. R. Smith No. 4251 or 4256 Series.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE AND FITTINGS

A. Installation and joining of all piping shall comply with Section 220520, Pipe and Pipe Fittings.

B. Provide all soil, waste and vent piping as indicated and as required to allow waste and vent connections to each fixture and equipment item requiring connection.

C. The work of this section shall include all sanitary sewer lines inside of the building and 5-feet outside of the building (unless indicated otherwise), to the point of and including connections to outside sanitary sewer lines or sanitary sewer manholes.

D. The installation of all piping shall be in compliance with the Governing Codes.

E. Install all horizontal soil or waste lines with a slope of 1/4-inch per foot. Exceptions require written approval of the Administrative Authority.

F. Make all changes of direction and junctions with Y fittings and 1/8 bends; use sanitary tee fittings in vertical pipe only.

G. Consult manufacturer's data and architectural drawings for information on plumbing fixtures before beginning rough in.

H. Verify points of connection, invert elevations, and grade requirements before beginning installation.

I. Coordinate installation of piping with all trades affected by installation.

J. Stub all piping for all items requiring connection through wall or floor; cap and protect until connection to items is complete.

K. Vents extending through roof shall terminate at least 10 inches above roofing; and not less than 10 feet from and 3 feet above any building opening.

L. Vent Flashing: Provide vent flashing at each vent through roof; 4 lb. sheet lead, extending 10-inches all around pipe with sleeve to top of vent; counterflashing to overlap 2-inch and turn down inside the pipe (or similar water-proof methods as required to best suit roofing material/manufacturer).

M. Connect equipment furnished by others in accord with Section 220500.

N. Trap all fixtures and equipment items as required by governing code; provide proper venting for each trap.

O. All excavation, trenching and backfilling shall comply with Section 220510.

P. Provide drain piping for all drip pans, unit condensate drains, unit P-traps, etc. Run piping to nearest point of drainage, or as shown on drawings. Where routing is not shown, route to nearest point of proper drainage.

3.2 INSTALLATION OF CLEANOUTS

A. Install cleanouts in all soil and waste piping:

1. At no more than 100 foot intervals on horizontal runs;
2. At the end of all piping runs;
3. At the base of all vertical risers.
4. At all changes of direction for a run of 10 feet or over;
5. At all locations shown on the drawings and where needed to correct possible stoppage and as required by governing code.

B. Where cleanouts occur in concealed spaces provided extensions to floors above or to walls to allow access.

C. Provide wall access covers for all wall cleanouts. See Section 220700 - Piping Insulation for specification of wall access covers.

D. Floor cleanouts shall be installed so as to be flush with the finished floor; where recessed cleanout covers are used the recess shall be filled flush with material to match the surrounding finished floor.

E. Install cleanouts so as to assure proper clearances as required by governing code.

F. All cleanouts located outside shall be provided with an access housing located in a 24" x 24" x 6" thick concrete pad, flush with the adjacent finished grade. The pipe and cleanout shall be independent of this access housing and pad.

3.3 TESTING AND INSPECTION

A. All piping shall be tested, inspected and approved prior to being concealed or covered.

B. Testing shall be by water or air, and shall comply with governing code.

C. Testing shall be witnessed by the plumbing inspector and the Engineer's representative.

D. Water Testing:

1. Fill system with water so that there is no less than 10 feet of head above the highest system section being tested.
2. System shall hold pressure for a period of at least 15 minutes with no leakage before the inspection starts.
3. The system shall be inspected and shall hold tight with no leakage at all points.

E. Air Testing:

1. Pressurize system with air so that there is no less than 5 psig of air pressure in the system.
2. System shall hold pressure for a period of at least 15 minutes without the introduction of additional air before the inspection starts.
3. The system shall be inspected and shall hold tight with no leakage at all points.

F. All leaks shall be eliminated and the system re-tested before proceeding with work or concealing pipe.

G. All repairs to piping shall be with new material and no caulking of screwed joints or holes is allowed.

END OF SECTION

SECTION 224000 – PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Plumbing Fixtures and Trim.

B. Water Heaters.

C. Adjustment and Cleaning.

1.2 DEFINITIONS

A. "Plumbing Brass" means "P traps, stops, strainers, tailpieces, flanges, and other brass fittings and accessories NOT including faucets or stops."

B. "Trim" includes all plumbing brass items, faucets, and any fixture accessories.

1.3 REFERENCES

A. Uniform Plumbing Code.

1.4 SUBMITTALS

A. All submittals shall comply with Section 220500.

B. Submit product data for all plumbing fixtures, plumbing trim, and water heaters.

1.5 GENERAL REQUIREMENTS

A. Provide new fixtures and fittings, approved, free from flaws and blemishes with finished surfaces clear, smooth and bright. Visible parts of fixture brass and accessories, and all items located in accessible cabinet spaces, shall be heavily chrome plated. All stops risers, P-traps shall be chrome plated.

B. All products and connections shall be in compliance with the Governing Code, the local Health Department, and Public Utilities Department.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 220500, Acceptable Manufacturers.

B. Vitreous china and enameled cast iron fixtures: American Standard; Eljer; Kohler; Crane.

C. Water Closet Seats: Church; Beneke; Olsonite; Kohler; Bemis.

D. Carriers: Josam; J. R. Smith; Wade; Zurn; Watts Drainage.

E. Stainless Steel Sinks: Elkay, Just.

F. Hydrants and Hose Bibbs: Zurn; Woodford; Wade; J.R. Smith.

G. Floor Drains: J. R. Smith; Wade; Zurn; Watts Drainage.

H. Water Heaters: Chronomite, Rheem, A.O. Smith.

I. Plumbing Brass: American Standard; Brasscraft; Chicago Faucet; Crane; Eljer; Frost; Kohler; Speakman; Symmons; T & S Brass; McGuire; Elkay; Eastman.

J. Faucets: Chicago Faucet; T & S Brass.

K. Flush Valves: Sloan Royal (NO SUBSTITUTIONS).

2.2 PLUMBING FIXTURES

A. General:

1. Plumbing Fixtures are listed below by reference numbers, corresponding to the reference number adjoining these items on the drawings.
2. All vitreous china and enameled cast iron fixtures shall be finished white unless specifically noted otherwise.
3. All stainless steel sinks shall be sound deadened, and shall have faucet ledge (except where noted specifically without ledge).
4. In interests of Owner's Standardization, fixtures of similar type shall be product of one manufacturer; trim of similar type shall be product of one manufacturer.

B. Water Closets:

1. P-1A Water Closet – Wall Hung - Handicap:

2. Water Closet: Kohler "Kingston-Lite", No. K-4330, vitreous china, elongated bowl, wall mounted, siphon jet action bowl with 1 1/2" top spud, and 1.6 gallon flush. Wall mounted for handicap access. Verify with Architectural drawings for mounting heights and off-center stall dimensions.

3. Flush Valve: Sloan "Royal 111-1.5" chrome plated flush valve with vacuum breaker, quiet action, and screw driver stop. Provide with flush valve so that handle is on wide side of stall.

4. Seat: Kohler "Lustra", No. K-4670-SC, white plastic seat, open front and stainless steel self sustaining check hinge.

5. Carrier: Cast iron or steel construction, adjustable to support fixture. J. R. Smith "Linebacker" Figure 115 to 280, type to suit application. Provide with rear anchoring lug on single units.

6. Plumbing Brass: Chicago stop and chrome plated brass supply.

7. P-1B Water Closet - Wall Hung:

8. Water Closet: Kohler "Kingston-Lite", No. K-4330, vitreous china, elongated bowl, wall mounted, siphon jet action bowl with 1 1/2" top spud, and 1.6 gallon flush. Wall mounted for handicap access. Verify with Architectural drawings for mounting heights and off-center stall dimensions.

9. Flush Valve: Sloan "Royal 111-1.5" chrome plated flush valve with vacuum breaker, quiet action, and screw driver stop. Provide with flush valve so that handle is on wide side of stall.

10. Seat: Kohler "Lustra", No. K-4670-SC, white plastic seat, open front and stainless steel self sustaining check hinge.

11. Carrier: Cast iron or steel construction, adjustable to support fixture. J. R. Smith "Linebacker" Figure 115 to 280, type to suit application. Provide with rear anchoring lug on single units.

12. Plumbing Brass: Chicago stop and chrome plated brass supply.

13. P-1C Water Closet – Floor Mount - Handicap:

14. Water Closet: Kohler "Wellworth", No. K-3481, vitreous china, elongated bowl, floor mounted, flush tank, siphon jet action bowl with 1.6 gallon flush. Mounted for handicap access. Verify with Architectural drawings for mounting heights and off-center stall dimensions.

15. Seat: Kohler "Lustra", No. K-4670-SC, white plastic seat, open front and stainless steel self sustaining check hinge.

16. Plumbing Brass: Chicago loose key angle stop and brass supply

17. P-1D Water Closet – Floor Mount:

18. Water Closet: Kohler "Wellworth", No. K-3481, vitreous china, elongated bowl, floor mounted, flush tank, siphon jet action bowl with 1.6 gallon flush. Mounted for handicap access. Verify with Architectural drawings for mounting heights and off-center stall dimensions.

19. Seat: Kohler "Lustra", No. K-4670-SC, white plastic seat, open front and stainless steel self sustaining check hinge.

20. Plumbing Brass: Chicago loose key angle stop and brass supply

21. P-1E Water Closet – Wall Hung – Handicap:

22. Water Closet: Provide and install Acorn Dura-Ware Blowout Jet Toilet, Off-Floor Outlet. Toilet bowl shall be fabricated from 14 gage, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Toilet shall be concealed blowout jet type with an elongated bowl, a self-draining flushing rim, and an integral contoured seat. Toilet shall meet ASME A112.19.3 and CSA B45.4 requirements and will flush with a minimum of 25 PSI flow pressure when used in conjunction with a minimum of 1.6 GPF. Toilet trap shall have a minimum 3-1/2" seal that shall pass a 2-1/8" diameter ball and be fully enclosed. Toilet waste outlet shall be a gasketed waste. Connecting hardware provided by installer. Fixture shall withstand loadings of 5,000 pounds without permanent damage. Fixture shall be furnished with necessary fasteners for proper installation.

23. Flush Valve: Sloan "Royal 142-1.6" chrome plated flush valve with vacuum breaker, quiet action, and screw driver stop. Provide with flush valve so that handle is on wide side of stall.

24. Carrier: Cast iron or steel construction, adjustable to support fixture. J. R. Smith "Linebacker" Figure 115 to 280, type to suit application. Provide with rear anchoring lug on single units.

25. Plumbing Brass: Chicago stop and chrome plated brass supply.

C. Lavatories:

1. P-3A Lavatory - Wall Hung - Handicap:

2. Lavatory: Kohler "Greenwich", No. K-2030, 20" x 18", vitreous china lavatory with 8" faucet centers, for use with concealed arm carrier.

3. Plumbing Brass: Kohler No. K-7715 lavatory drain with perforated grate and 1 1/4" off-set tailpiece; Kohler No. K-8998, 1 1/4" Cast brass "P" trap with cleanout; loose key stops and flexible risers.

4. Faucet: Chicago Faucet No. 404 faucet, with no. 390 handles, 8" centers, vandal resistant, 1/2 GPM outlet/aerator, 5" spout.

5. Carrier: Steel construction, adjustable, anchored to floor, with concealed arms for high back lavatory support. J. R. Smith Figure 700 with accessories to suit application.

6. P-3B Lavatory – Counter Mounted:

7. Lavatory: Kohler Pennington, K2196. Vitreous china, self-rimming, 4” centers, white.

8. Plumbing Brass: Kohler No. K-7715 lavatory drain with perforated grate and 1 1/4" off-set tailpiece; Kohler No. K-8998, 1 1/4" Cast brass "P" trap with cleanout; and Chicago Faucet loose key stops and flexible risers.

9. Faucet: Chicago faucet No. 797 faucet with No. 390 handles, 4” centers, 4” spout.

10. P-3C Lavatory – Counter Mounted – Handicap:

11. Lavatory: Kohler "Pennington", No. K-2196, 20" x 17", oval, vitreous china, self rimming, 4” centers, with overflow.

12. Plumbing Brass: Kohler No. K-7715 lavatory drain with perforated grate and 1 1/4" off-set tailpiece; Kohler No. K-8998, 1 1/4" Cast brass "P" trap with cleanout; and loose key stops and flexible risers.

13. Faucet: Chicago Faucet No. 802 faucet, with no. 1000 handles, 4" centers, quarter turn cartridges, vandal resistant, 1/2 GPM outlet/aerator, 5" spout.

14. Insulation: Insulate trap, HW and CW supplies with Tru Bro Lav Guard or approved.

15. P-3D Hand Sink:

16. Lavatory: Elkay no. PSRADQ191955L Three hole drilled stainless steel sink 19" front-to-back x 19 1/2” left-to-right x 5-1/2" deep, self rimming sink with rear faucet ledge.

17. Plumbing Brass: Elkay No. LK-335, stainless steel cup strainer with 1-1/2" stainless steel tailpieces, cast brass “P” traps each with a cleanout, angle stops and flexible risers.

18. Faucet: Chicago Faucet No. 1100 faucet, with no. 317 wrist blade handles, 8" centers, vandal resistant, 5 1/4” gooseneck, 2 GPM outlet/aerator, quaturn cartridges.

19. P-3E Lavatory - Wall Hung - Handicap:

20. Lavatory: Acorn “Meridian” Stainless Steel Straight Front Uni Basin. Heavy gauge, 304 stainless steel. Countertop, backsplash, and housing fully welded with integral round basin. With grid strainer, waste piping and 1-1/2” P-trap. Lavatory to include backsplash mounted pushbutton and stainless steel tubular spout with 0.5 GPM flow control and adjustable metering up to 60 seconds. Lavatory faucet to include integral mixing valve field set to 105 F and to include integral strainers and check valves. Trap enclosure assembly to be fabricated of 304 stainless steel.

21. Carrier: Steel construction, adjustable, anchored to floor, with concealed arms for high back lavatory support. J. R. Smith Figure 700 with accessories to suit application.

D. Sinks:

1. P-5A Sink – Two Compartment:

2. Sink: Elkay No. DLR 331910 multi-hole drill, 18 gauge, Type 304 stainless steel, 19 1/2" front-to-back x 33" left-to-right x 10" deep self rimming sink with back faucet ledge.

3. Plumbing Brass: Elkay No. LK-358, stainless steel cup strainer with 1-1/2" stainless steel tailpieces, cast brass "P" traps each with a cleanout, angle stops and flexible risers.

4. Faucet: Chicago Faucet No. 2300-8CP single handle deck mount sink faucet with E12 aerator, 8" center mounting.

5. P-5B Sink – Wall-Mounted Exterior:

6. Sink: Elkay No. EWMA48204 multi-hole, 14 gauge, Type 304 stainless steel, 20" front-to-back x 48" left-to-right x 8" deep wall-mounted sink with 10" backsplash.

7. Plumbing Brass: Elkay No. LK-358, stainless steel cup strainer with 1-1/2" stainless steel tailpieces, cast brass "P" traps each with a cleanout, angle stops and flexible risers.

8. Faucet: Chicago faucet No. W8W wall mounted, with no. 317 wrist blade handles, 8" centers, vandal resistant, 5 1/4" gooseneck, 2 GPM outlet/aerator, quaturn cartridges.

9. P-6A Service Sink:

10. Sink: Swanstone MS 2424 mop sink. Molded composite, 24"x24" basin. Provide vinyl rim guard and stainless steel wall guard.

11. Plumbing Brass: 3" cast brass drain, dome strainer and lint basket.

12. Faucet: Chicago faucet No. 897 wall mounted. Vacuum breaker spout with pail hook and wall brace. 3/4" hose thread outlet, Quaturn ceramic cartridges, adjustable supply arms, rough chrome finish.

13. P-6B Service Sink:

14. Sink: Elkay No. ESS23192 multi-hole, 14 gauge, Type 304 stainless steel, 18-1/2" front-to-back x 23" left-to-right x 12" deep wall-mounted sink with 12" backsplash.

15. Plumbing Brass: 3" cast brass drain, dome strainer and lint basket.

16. Faucet: Chicago faucet No. 897 wall mounted. Vacuum breaker spout with pail hook and wall brace. 3/4" hose thread outlet, Quaturn ceramic cartridges, adjustable supply arms, rough chrome finish.

E. Drinking Fountains

1. P-8A Interior Drinking Fountain – Dual Height – Handicap:

2. Fixture: Halsey Taylor hydroboost bi-level with back panel. Push button on front ADA, stainless steel, chrome plated brass bubbler with guard. Integral water cooler and sensor-activated bottle filler.

3. P-8B Exterior Drinking Fountain – Dual Height – Handicap:

4. Fixture: MDF Model 10485WM bi-level with button-activated bottle filler. Push button on front ADA, stainless steel, stainless steel or chrome plated brass bubbler with guard. Custom color by Architect.

F. Showers

1. P-9A Shower – Handicap:

2. Shower Unit: Symmons Model No. C-96-300-B30-V. Unit shall be No. T-300-V wall/hand shower with 5 foot flexible metal hose, in-line vacuum breaker and wall connection, 30 inch slide bar for mounting hand shower, No. 46-1X Temptrol pressure-balancing mixing valve with piston, integral thermometer, adjustable stop to limit handle turn.

3. P-9B Tub/Shower:

4. Shower Unit: Symmons Model No. C-96-400-B30-V. Unit shall be No. T-300-V tub/hand shower with 5 foot flexible metal hose, in-line vacuum breaker and wall connection, 30 inch slide bar for mounting hand shower, diverter tub spout, No. 46-1X Temptrol pressure-balancing mixing valve with piston, integral thermometer, adjustable stop to limit handle turn.

5. P-9C Shower – Handicap:

6. Shower Unit: Acorn “Penal-Ware,” ADA Compliant Wall Shower. Shower Panel shall be fabricated from 14 gauge, type 304 stainless steel. Exposed trim shall be chrome-plated brass. Fixture shall be furnished with a fixed Showerhead, a handheld Shower with Vacuum Breaker, Quick-Disconnect and Mounting Bracket. Shower shall include ASSE 1016 compliant pressure-balancing mixing valve with adjustable stop to limit handle turn.

G. Hydrants and Hose Bibbs:

1. P-10A Wall Hydrant - Non-Freeze:

2. Zurn No. Z-1300 recessed box wall hydrant, non-freeze type, with polished bronze box and bronze hinged cover, integral vacuum breaker, "T" handle key and 3/4" inlet, 3/4" hose outlet, and "A" dimension of at least 8".

3. P-10B Wall Hydrant:
4. Zurn No. Z-1300 recessed box wall hydrant, non-freeze type, with polished bronze box and bronze hinged cover, integral vacuum breaker, "T" handle key and 3/4" inlet, 3/4" hose outlet, and "A" dimension of at least 8".

H. Floor Drains

1. P-11A Floor Drain:

2. JR Smith Fig. 2005. Cast iron drain body with round nickel-bronze strainer. Vandal-proof screws

3. P-11B Trough Drain:

4. JR Smith Fig. 9667 Stainless steel shower drain system. 18 Gage type 304 stainless steel construction, Slotted Grate, flashing skirt.

I. Wall Boxes:

1. P-12A Refrigerator Icemaker Connection:

2. Provide cold water supply and shutoff in outlet box

3. Guy Gray Model No. FBB-200TS, top supply, 1/2" brass supply sweat connection and valves.

4. P-12B Clothes Washer Connection:

5. Provide shutoffs, water and waste for owner’s appliance in outlet box.

6. Guy Gray Model No. B200 galvanized steel box with brass hose bibs and 2” stand pipe connection.

7. Fittings: Precision Plumbing Products No. WHA-500L Shock Arrestors. Steel braided hoses to connect washer.

8. P-12C Dishwasher Connection:

9. Provide shut-offs, water and waste for owner’s appliance in outlet box.

10. Stainless Steel braided supply hoses to connect washer. PVC Airgap Fitting mounted at adjacent sink. 5/8” drain hose.

J. Eyewash:

1. P-13A Eyewash Station:

2. Acorn Model S0420 Wall-Mount eyewash station with ABS plastic 11-3/4" diameter bowl, ANSI-compliant identification sign, and ABS plastic Eye/Face wash heads supplied by a combined integral Flow Control, with integral flip Dust Covers, internal Flow Controls and Filters to remove debris from the water. Flow control to include integral mixing valve field set to 85 F and to include integral strainers and check valves.

K. Instantaneous Water Heaters:

1. Type: Electric, point-of-use instantaneous booster type heaters.
2. Construction: Stainless steel heating elements, Celcon or copper or stainless steel waterways, with plastic (or steel) enclosure. Unit shall be for use with electricity as scheduled on the plans. Unit shall be UL listed and meet all applicable codes.
3. Capacity: Shall be as indicated on the plans. Unit shall be for use with 120F outlet temperatures, flow rates from 1.0 to 3.0 gpm, and 25 psig inlet water pressure.

L. Water Heaters

1. Type: Hybrid electric tank, air-to-water heat pump

   a. Construction: Integrated air-to-water heat pump unit, stainless steel backup heating elements, Celcon or copper or stainless steel water ways, with plastic or steel enclosure. Self-diagnostic electronic control featuring digital readout of water temperature set point. Front access cover to equipment shall be installed to be easily accessible.
   b. Capacity: Shall be as indicated on the plans. Unit shall be for use with 95 – 150 F outlet temperatures.
   c. Unit shall be for use with electricity as scheduled on the plans. Unit shall be UL listed and meet all applicable codes. Unit shall have a minimum 6-year warranty.

2.3 SPECIALTIES

A. Unless indicated otherwise, the following fittings and materials shall be used:

1. Fixture Traps: 17 gauge seamless chrome plated tubing, with 2 inch minimum seal, size as required by Uniform Plumbing Code and to suit construction.
2. Exposed piping and fittings in finished areas and in accessible cabinets: Chrome plated or sleeved with chromed sleeves; all chrome to have a bright polished finish. No exposed copper allowed (includes accessible cabinet areas).
3. Stops: 1/4 turn ball valve type. Stops shall be with loose key.
4. Escutcheons: Chrome plated, one piece.

B. Rims: Lavatories and sinks mounted in the counterwork shall be self rimming or equipped with deck stainless steel rims similar and equal to the Hudee Rim.

C. Vacuum Breakers: Anti siphon vacuum breaker, by same manufacturer as flush valve or faucet with which used.

D. Carriers: Provided for wall mounted fixtures, type to suit construction. J.R. Smith or equal.

E. Sealant: Silicone type, General Electric type SCS1202 series or Dow Chemical equal, color to match fixture.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIXTURES

A. All fixtures shall be completely connected to piping as needed to make a complete and operable installation.

B. All wall mounted water closets, urinals, lavatories, drinking fountains and sinks shall be installed with supporting carriers that transmit the load to the floor.

C. All wall mounted fixtures that standard carriers are not manufactured for, shall be supported with bolts through the wall which attach to a 3/16" thick steel back plate for block walls and wood stud walls; or a 2" x 2" x 1/4" angle welded to at least four studs for metal stud walls.

D. Where plumbing fixtures abut to walls and floors, seal all joints with a uniform fillet bead of silicone sealant.

E. Mounting heights and locations of fixtures shall be as shown on the Architectural drawings; these locations shall be verified and coordinated with the various trades affected by the installation of these fixtures. When not indicated or shown, obtain mounting location and heights from the Architect/Engineer prior to installation.

F. Protect fixtures against use and damage during construction; provide guards and/or boxing as required.

G. Pipe all pressure relief valves to nearest floor drain.

H. In toilet rooms where only one (1) urinal is shown, that urinal shall be ADA accessible.

3.2 INSTALLATION OF SPECIALTIES

A. Escutcheons: Provide escutcheons at each point where an exposed pipe or other fitting passes through walls, floors, backs of cabinets or ceilings.

B. Stops: Provide stops in all water connections to all lavatories and sinks.

C. Vacuum Breakers: Provide vacuum breakers with all flush valves and service sink faucets and where indicated on the drawings.

3.3 ADJUSTMENT AND CLEANING

A. After completion of installation remove all labels and thoroughly clean all fixtures, trim and fittings.

B. Adjust all flush valves, fixture stops, valves, and associated plumbing items as necessary for the proper operation of all equipment.

END OF SECTION

SECTION 230500 – GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General HVAC Requirements.

B. HVAC Submittals.

C. Motors.

D. Equipment and Piping Identification.

E. Commissioning

1.2 GENERAL

A. Includes, but not limited to, furnishing labor, materials, and equipment for completion of work unless indicated or noted otherwise.

B. All work included in Division 23 shall be the responsibility of a single HVAC Subcontractor. This Contractor shall obtain and pay for all permits required by State and local authorities governing the installation of the HVAC work. It is the Contractor's responsibility to contact all utility organizations serving the building, prior to bid, and to include all charges for inspections, installation of materials, equipment and connection of all required utilities.

C. Furnish exact location of electrical connections and complete information on motor controls to Division 26.

D. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

E. The ductwork and accessibility to HVAC equipment shall take precedence over all other equipment in the ceiling interstitial spaces or other mechanical areas including, but not limited to, domestic water piping and electrical conduit.

F. All HVAC equipment and devices furnished or installed under other Divisions of this specification which require connection to any mechanical systems (i.e., plumbing systems or duct systems, or controls) shall be connected under this division of the Specifications.

G. The Contractor shall be responsible for checking field conditions and verifying all measurements and relationships indicated on the drawings before proceeding with the work.

1.3 ELECTRICAL

A. All electrical work, conduit, boxes and devices in connection with control wiring as required to install the control equipment as specified herein or shown on the drawings shall be furnished and installed complete by the Division 23 Contractor.

B. All electrical work performed under this section of the Specifications shall conform to all applicable portions of the Division 26 specifications and shall conform to all governing codes.

C. All equipment shall be factory wired to a junction box for connection to electrical service.

D. Where a piece of equipment specified includes an electric motor, the motor shall be furnished and mounted by this Contractor. Motor starter, disconnect switches and wiring from the electrical panel to the motor control devices and to the motor shall be provided by the Division 26 Contractor unless stated otherwise in the HVAC specification and on the HVAC equipment schedule.

1.4 SYSTEMS DESCRIPTION

A. Site Inspection:

1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.
2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

B. Drawings:

1. HVAC drawings show general arrangement of ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
2. Consider electrical drawings part of this work insofar as these drawings furnish information relating to design and construction of building.
3. Because of small scale of HVAC drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

1.5 SUBMITTALS

A. All material used on the project shall be new and free of defects. The Engineer reserves the right to reject any material, the appearance of which has been damaged on the site or in shipment. The material shall be of approved equal quality to that which is specified. Should the make and type of material differ from that specified, the Contractor may be required to submit catalog and engineering data (samples if requested) necessary to make a comparison and determine its suitability. The Contractor shall also bear the cost of any changes to the electrical design made necessary by any approved substitutions.

B. The Contractor shall submit to the Engineer, for approval, complete information on all equipment and materials to be provided on the project including six copies of the manufacturer's catalog and engineering data, shop drawings of shop fabricated equipment and instruction data for each item included under this section of the specifications. Submittals shall be presented to the Engineer within 30 calendar days from the date of the contract signing in complete indexed and bound sets. The Contractor shall submit a typed, signed list including all items to be furnished on the project. The signature on the aforementioned list shall indicate that the contractor has examined the suitability of all material and equipment with respect to compliance with these specifications. The Contractor's approval shall also indicate that physical dimensions of the equipment have been verified with the installation requirements and were found to cause no interference therewith.

C. Review of submittal data by the Engineer or Engineer does not relieve the Contractor of responsibility for quantities, measurements, and compliance with the intent of all contract documents.

D. Furnish submittals on all items and equipment specified in Division 23 and all items indicated on HVAC drawings in a hard-back, three-ring binder.

E. The Contractor shall submit the HVAC cost breakdown including all sub-contractors costs.

1.6 OPERATION AND MAINTENANCE MANUAL FOR HVAC SYSTEMS

A. Bind Operation & Maintenance Manual for HVAC Systems in three-ring, hard-backed binder with clear plastic pocket on spine. Spine of each binder shall have following typewritten lettering inserted:

OPERATION AND MAINTENANCE MANUAL
FOR HVAC SYSTEMS

A. Provide master index at beginning of Manual showing items included. Use plastic tab indexes for sections of Manual.

B. First section shall consist of name, address, and phone number of Engineer, General Contractor, and Mechanical, Plumbing, Sheet Metal, Refrigeration, Temperature control, and Electrical subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.

C. Provide section for each type of item of equipment.

D. Submit copies of Operation & Maintenance Manual to Engineer for approval.

E. Include descriptive literature (Manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.

F. Operating Instructions shall include:

1. General description of each HVAC system.

2. Step-by-step procedure to follow in putting each piece of HVAC equipment into operation.

G. Maintenance Instructions shall include:

1. Manufacturer's maintenance instructions for each piece of HVAC equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists operation instructions of equipment, and maintenance and lubrication instruction.
2. Summary list of HVAC equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
3. List of HVAC equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.

1.7 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform work in accordance with applicable Codes.
2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern.

B. Product Approvals: See paragraphs elsewhere in this specification.

C. Manufacture: Use domestic made duct, duct fittings, and motors on Project.

D. Identification: Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

1.8 CODES AND STANDARDS

A. Codes and agencies having jurisdictional authority over HVAC installation.

1. Washington State Energy Code
2. International Building Code -- Latest Approved Edition
3. International Mechanical Code -- Latest Approved Edition
4. International Fuel Gas Code – Latest Approved Edition
5. State and County Department of Health
6. Occupational Safety and Health Administration (OSHA)
7. Washington Industrial Safety and Health Act (WISHA)

1.9 PRODUCT HANDLING AND PROTECTION

A. Contractor is responsible for protection of all material, equipment and apparatus provided under this section from damage, water, corrosion, freezing and dust, both in storage and when installed, until final project acceptance.

B. Provide temporary heated and sheltered storage facilities for material and equipment.

C. Completely cover motors and other moving machinery to protect from dirt and water during construction.

D. Handle and protect equipment and/or material in manner precluding unnecessary fire hazard.

E. Equipment requiring rotation and/or lubrication during storage shall have records maintained and witnessed on a monthly basis and forwarded to the Engineer prior to acceptance.

F. Material or equipment damaged because of improper storage or protection will be rejected.

G. Equipment finish that is damaged by handling, storage, etc. shall be corrected by the Contractor at no additional cost to the Owner.

1.10 WARRANTIES

A. In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

B. In order to be protected, secure proper guarantees from suppliers and subcontractors.

C. Provide certificates of warranty for each piece of equipment. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

1.11 ABBREVIATIONS

1.	AFF	Above Finish Floor
2.	AMCA	Air Moving & Conditioning Association
3.	ANSI	American National Standards Institute
4.	APWA	American Public Works Association
5.	ARI	Air Conditioning and Refrigeration Institute
6.	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
7.	ASME	American Society of Mechanical Engineers
8.	ASTM	American Society of Testing & Materials
9.	AWWA	American Water Works Association
10.	BFF	Below Finish Floor
11.	BHP	Brake Horsepower
12.	BTU	British Thermal Unit
13.	CFC	Chloro – Flurocarbon
14.	CFM	Cubic Feet per Minute
15.	DOT	US Department of Transportation
16.	EPA	Environmental Protection Agency
17.	fpm	feet per minute
18.	FS or Fed.	Spec. Federal Specifications

19.	HP	Horsepower
20.	IEEE	Institute of Electrical and Electronics Engineers
21.	KW	Kilowatt
22.	MBH	One Thousand British Thermal Units per Hour
23.	MS or Mil.Spec.	Military Specifications
24.	MSS	Manufacturers Standardization Society
25.	NEC	National Electrical Code
26.	NEMA	National Electrical Manufacturers Association
27.	per	in accordance with
28.	PVC	Polyvinyl Chloride
29.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
30.	SP	Static Pressure
31.	UL	Underwriter's Laboratories
32.	w.g.	Water Gauge (inches of water)
33.	WQA	Water Quality Association

34. Additional abbreviations are as listed on the drawings or elsewhere in these specifications.

1.12 DEFINITIONS

A. Finished Spaces: Spaces used for habitation or occupancy where rough surfaces are plastered, paneled, or otherwise treated to provide a pleasing appearance.

B. Unfinished Spaces: Spaces used for storage or work areas where appearance is not a factor.

C. Concealed Spaces: Spaces out of sight. For example, above ceilings; below floors; between double walls; furred-in areas; pipe and duct shafts; and similar spaces.

D. Exposed: Open to view. For example, duct running through a room and not covered by other construction.

E. Outside: Open to view up to 5 feet beyond the exterior side of walls, above the roof, and unexcavated or crawl spaces.

F. Conditioned Space: An area, room or space normally occupied and being heated or cooled for human habitation by any equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Any reference to the specifications or on the drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

B. The manufacturer listed as Acceptable Manufacturers are approved for the items indicated without obtaining prior approval. Other manufacturers require prior approval.

C. The listing of a manufacturer as an Acceptable Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which may be capable of manufacturing, or have in the past manufactured, items equal to those specified, and is intended to aid the Contractor in identifying manufacturers.

D. Products provided by Acceptable Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the plans and specifications. The Engineer shall be the final judge as to whether an item meets these requirements or not. If a manufacturer is not certain that his product meets these requirements or not, then the manufacturer shall submit data as required to obtain the Design Consultant's approval.

E. The approval of a manufacturer applies to the manufacturer only and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications.

F. Contractor shall be responsible for all costs to other trades and all revisions required to accommodate any products which are different than those specified or shown.

G. In reviewing a manufacturer for acceptance, factors considered include the following: engineering data showing item's performance, proper local representation of manufacturer, likelihood of future manufacturer's local support of product, service availability, previous installation, previous use by Owner/Engineer and record, product quality, availability/quality of maintenance and operation data, capacity/performance compared to specified items, acoustics, items geometry/access utility needs, and similar concerns.

H. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.

I. If non-specified equipment is used and it will not fit job site conditions, this Division assumes responsibility for replacement with items named in Specification.

2.2 ACCESS DOORS

A. This contractor shall be responsible for furnishing and installing flush mounted access doors in walls, ceiling and floors and chases where the following equipment is concealed and is not accessible through same.

1. Valves (shut off)
2. Dampers (balancing)
3. Electric Heater Control Panels
4. Fire Smoke Dampers
5. HVAC Controls and Actuators

B. Doors shall be UL listed 16 ga. cold rolled steel with concealed hinge, screwdriver operated lock and prime coated. Furnish suitable for area mounted.

C. Approved Manufacturers:

1. Milcor
2. Karp
3. Greenheck

2.3 EQUIPMENT AND PIPING IDENTIFICATION

A. General: All ducting, valves, and HVAC equipment shall be marked. All markings in concealed accessible spaces shall be reviewed and verified by Architect/Engineer prior to being concealed.

B. Valves shall be marked as follows:

1. Identification tags made of brass or aluminum, stamped with valve number and abbreviation of system served (HTG, PLBG, CW, HW, GAS, AC). Tags shall be installed on all valves except stops at plumbing fixtures. Tags shall be not less than 1-1/2 inch in diameter, markings shall be stamped and black filled, and lettering shall be minimum 1/4-inch high with numbers minimum 1/2-inch high. Tags shall be wired to each valve with No. 6 polished nickel-steel jack chain.

C. All HVAC equipment which was scheduled on the Contract Drawings shall be marked with the name of the item; i.e., Heating Ventilating Unit No. 1, Exhaust Fan No. 2, Boiler No. 1 etc. The identification shall be the same as shown on the Contract Drawings. The marking shall be located on two different sides of the equipment so as to be easily read, with at least one marking visible to a person standing at floor level near the unit (assuming any necessary access to a concealed unit has been made). Lettering shall be a minimum of 2" high. Marking shall be with engraved phenolic labels, white letters on black background. Equipment marking is not required for; air outlets and inlets, plumbing fixtures.

D. All HVAC control equipment shall be marked with phenolic labels. Equipment shall be marked to match the tags used in the programming of the control equipment.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. This Contractor shall provide completed systems with a neat and finished appearance. If, in the judgment of the Engineer, any portion of the work has not been performed in a workmanlike manner or is left in a rough, unfinished state, this Contractor will be required to remove, reinstall or replace same and patch and paint surrounding surfaces in a manner acceptable to the Engineer, without increase in cost to the Owner.

3.2 CLOSEOUT SUBMITTALS

A. Requirements: Final approval of mechanical installation will be recommended upon completion of the following:

1. Completion of all punchlist items
2. Operation instruction period to Owner's satisfaction
3. Permit Submittal
4. Valve list posted
5. Reproducible As-Built drawings delivered to Engineer
6. Asbestos Free Statement
7. Guarantees
8. Equipment Manufacturer of all HVAC compressor units shall provide start-up logs.

3.3 FINAL INSPECTION

A. Final Inspection:

1. Prior to acceptance of the HVAC work, the Contractor shall put all HVAC systems into operation for a period of not less than 5 working days so that they may be inspected by the Engineer and the Owner's representatives.
2. The time of the final inspection shall be mutually agreed to by the Owner, Engineer, and Contractor.
3. The Contractor shall furnish adequate staff to operate the HVAC systems during inspection.

3.4 OPERATION AND MAINTENANCE TRAINING

A. Upon completion of the work, and after all tests and final inspection of the work by the Authority(s) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the various HVAC systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be Superintendents or Foremen knowledgeable in each system and Supplier's Representative when so specified.

B. Scheduled instruction periods shall be:

HVAC System Controls:	4 Hours
HVAC Equipment Maintenance:	4 Hours
Control / Maintenance Refresh:	4 hours, 6 months after Substantial Completion

C. Costs for time involved by Contractor shall be included in the bid.

3.5 PREPARATION

A. Existing Buildings

1. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
2. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
3. This work shall be scheduled such that utility services and/or existing systems for the facility are not interrupted during normal operating hours, without prior written permission of the Owner's representative. Work that is performed during normal operational hours shall not interfere with the normal function of the facility's daily operation.
4. The HVAC Contractor shall be responsible for the removal of all existing HVAC equipment and utilities indicated to be removed on the drawings. The HVAC Contractor shall also be responsible for the removal and reinstallation of all existing HVAC equipment and utilities that will interfere with installation and operation of any new construction indicated or required and shall be responsible for the removal of all existing HVAC equipment and utilities indicated to be abandoned that will interfere with installation and operation of any new construction indicated or required. All HVAC equipment (other than piping) to be removed shall remain the property of the Owner, and shall be transported - stored - or disposed of, as directed by the Owner. This will be at no cost to the Owner.

3.6 INSTALLATION

A. Install HVAC equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance, (e.g., coils, heat exchanger bundles, sheaves, filters, meters, bearings, etc.) can be removed. Relocate items which interfere with access.

B. Provide access doors in equipment, ducts, and walls/ceilings as required to allow for inspection and proper maintenance.

C. If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Engineer before installing the item in a poor access location.

D. Belts, pulleys, couplings, projecting set screws, keys and other rotating parts which may pose a danger to personnel, shall be fully enclosed or guarded in accordance with OSHA regulations.

E. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil black plastic tape wrapped at point of contact or plastic centering inserts.

F. Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below panel to structure and clearance of 3 feet directly in front of panel, except where indicated otherwise or required by NEC to be more. Such offsets are typically not shown on the drawings, but are required per this paragraph.

G. Safety Protection: All ductwork, piping and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and 2" wide reflective red/white striped self-sticking safety tape.

H. Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the laying out of duct routings, and in coordinating all work. Poor access to equipment will not be accepted. Dashed areas at HVAC units indicate equipment access areas. These (and all other) access areas shall be clear of obstructions. The Division 23 contractor is responsible to coordinate and insure that all trades stay clear of access areas for any Division 23 furnished equipment.

I. Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

3.7 ADJUSTMENT AND CLEANING

A. Properly lubricate equipment before Owner's acceptance.

B. Clean exposed ductwork, equipment, and fixtures, remove debris from site. Repair damaged finishes and leave everything in working order.

C. All work areas shall be left broom clean and free of debris. Sweep HVAC rooms at completion of work, and dispose of waste. Dispose of all existing waste in HVAC rooms in addition to waste generated by this work.

3.8 COMMISSIONING

A. The Contractor has specific responsibilities relating to demonstrating the equipment and systems provided have been installed and function per the contract specifications. These responsibilities include, but are not limited to the following:

1. Complete all equipment and system start-up and checkout procedures, and to insure the complete readiness of equipment and systems, prior to the start of the functional performance testing phase of the commissioning process.
2. Functional test all HVAC systems in accordance with the Washington State Energy Code. Demonstrate system performance to the Engineer.
3. Provide to the Owner a written commissioning process and the results of the functional performance testing.

B. Owner shall not accept equipment and systems, and shall not make final payment, until all equipment and systems have been successfully commissioned and all specified requirements have been satisfied.

END OF SECTION

SECTION 230529 – HVAC HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Duct Hangers

B. Equipment Hangers

1.2 QUALITY ASSURANCE

A. Duct Hanger Standards: (MSS) Manufacturers Standardization Society Standards SP-58-1975, SP-89-1978, and SP-69-1976.

B. All methods, materials and workmanship shall conform to the International Building Code (IBC) and International Mechanical Code (IMC), as amended and adopted by the authority having jurisdiction.

1.3 SUBMITTALS

A. Submittals shall comply with Section 230500.

B. Submit product data. Indicate where such items are to be used.

C. Shop drawings are required for all equipment supports and fabricated supports or assemblies.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hangers and Supports: Elcen, Grinnell, B-Line Systems, Unistrut, Michigan, Tolco.

B. Anchors: Rawplug, Phillips, Hilti, Michigan.

2.2 GENERAL HANGERS AND SUPPORTS

A. Hanger Rods: Threaded hot rolled steel, electro-galvanized or cadmium plated. Hanger rods shall be sized so that the total load (including pipe or duct, insulation, hangers, and fluid) does not exceed the following:

Nominal Rod Diameter	Maximum Load

1/4 Inch	240 Pounds
5/16 Inch	440 Pounds
3/8 Inch	610 Pounds
1/2 Inch	1130 Pounds

B. Hanger Straps: Galvanized steel. Straps shall be sized so that the total load does not exceed the following:

Strap Size	Maximum Load
1" x 22 Gauge	230 Pounds
1" x 20 Gauge	290 Pounds
1" x 18 Gauge	380 Pounds
1' x 16 Gauge	630 Pounds

C. Beam Attachments: Shall be of the following type:

MSS Type	Elcen Figure No.	Grinnell Figure No.
21	33, 34	131
22	67	66
23	29A	87
28	95	292, 228
30	95	229

D. Steel: Structural steel per ASTM A36.

E. Wood: Shall be fire treated.

2.3 DUCT HANGERS AND SUPPORTS

A. Hangers: As shown in SMACNA HVAC Duct Construction Standards.

B. Vertical Duct Supports at Wall: 1-1/2" x 1/8" (minimum) strap or 1-1/2" x 1-1/2" x 1/8" (minimum) angle bracket and as shown in SMACNA HVAC Duct Construction Standards Figure 4-7.

C. Hanger Attachments to Structure: As shown in SMACNA HVAC Duct Construction Standard Figures 4-1, 4-2, 4-3 to suit building construction and as allowed on structural drawings. Where C-clamps are provided, retainer clips shall be used. Friction beam clamps shall not be used.

D. Hanger Attachments to Ducts: As shown in SMACNA HVAC Duct Construction Standards Figure 4-4.

E. Rooftop Supports: Polyethylene platform with galvanized steel strut. Foam bottom for contact with roof membrane. Load rated for a minimum of 1000 Lbs. Provide galvanized steel straps sized as hanger straps, Erico Caddy Pyramid ST or approved.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

A. Provide all necessary bolts, nuts, washers, turnbuckles, rod connectors and any other miscellaneous accessories required for the support and anchoring of all ducts, and HVAC equipment.

B. Install steel or wood backing in walls (anchored to studs) as required to provide support for items hung from walls. Backing shall be of the same material as the studs or structure they are attached to.

C. All welded steel support assemblies shall have a power wire brush and primer paint finish.

D. Attach to building structure as shown on drawings.

E. Maximum spans between piping supports may be significantly less than the maximum spans allowed herein due to structural limitations of allowable loads on hangers. The most restrictive criteria governs. Reference structural drawings.

3.2 INSTALLATION OF DUCT HANGERS AND SUPPORTS

A. Provide anchors and supports for all ductwork.

B. Rectangular Duct: Supports and hangers shall be of size and spacing as shown in SMACNA HVAC Duct Construction Standards for the appropriate class of duct. (Hangers maximum allowable loads shall not be as shown in SMACNA Tables but shall be as specified in these specifications.)

C. Round Duct: Supports and hangers shall be of size and spacing as shown in SMACNA HVAC Duct Construction Standards for the appropriate class of duct.

D. Maximum Hanger Spacing (provided duct gauge and reinforcement comply with SMACNA Standards for such spacing):

Duct Area	Maximum Spacing
Up to 4 sq. ft. (27 " dia)	8 Feet
4.1 to 10 sq. ft. (28" to 42" dia)	6 Feet
10.1 sq. ft. and up (43" dia and up)	4 Feet

E. Provide supports at each change in direction of duct. Locate hangers at inside and outside corners of elbows, or at each end of fitting, on each side.

F. Provide additional supports at each side concentrated loads (such as modulating dampers, duct heaters, sound attenuators, etc.)

G. Provide supports for exterior ductwork per SMACNA HVAC Duct Construction Standards or as detailed on the drawings.

3.3 INSTALLATION OF HVAC EQUIPMENT ANCHORS AND SUPPORTS

A. Provide anchoring and supports for all HVAC equipment.

B. Heating, Ventilating and Air Conditioning equipment where suspended from structure shall be supported per SMACNA HVAC Duct Construction Standards or as shown on the drawings.

C. Equipment shall be supported and anchored in such a way so that no equipment vibration is transmitted to the building structure.

D. Added supports and bracing shall be provided per Section 230548.

END OF SECTION

SECTION 230548 – HVAC VIBRATION AND SEISMIC CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Vibration Isolators

B. Seismic Restraints

PART 2 - PRODUCTS

2.1 NEOPRENE ISOLATORS

A. Suspension Isolators: Shall be double deflection neoprene type, with isolator encased in open steel bracket and minimum 3/8-inch deflection. Hanger rod shall be isolated from steel bracket with neoprene grommets. Mason Series HD, Amber Booth "BRD" or approved.

2.2 SPRING ISOLATORS

A. General: The load carried by each isolator shall be carefully calculated and isolators selected so that the static deflection will be the same and the supported equipment will remain level. Isolators shall be so designed that the ends of the springs will remain parallel during and after deflection to operating height. At operating height, springs shall have additional travel to complete (solid) compression equal to at least 50 percent of the operating deflection. Suspension isolator springs shall have a static deflection (as shown on drawings) not less than 1-1/2", except that for units with components rotating at 1000 rpm and less, the static deflection shall be not less than 2 inches. Floor isolator springs shall have deflection of not less than 1 inch. All isolators shall provide at least 96 percent isolation efficiency. Note: Deflections other than these may be used where circumstances warrant and more optimum isolation results can be achieved.

B. Suspension Type Spring Isolators: Shall consist of a rigid steel frame, a stable steel spring in the bottom part of the frame, and double deflection neoprene isolating pad at the top of the frame. Where supporting rods pass through the frame, a clearance of not less than on half rod diameter shall be provided all around the rod. Mason Series DNHS, Amber Booth "BSSR" or approved.

2.3 SEISMIC RESTRAINTS

A. Materials: Steel shall be per STM A36; hangers and other devices shall be as shown in SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems latest edition. Sheet metal used for bracing shall be no less than 16 gauge. Cable bracing may be used provided that opposed acting

cables are provided on the items being braced to provide bracing equal to that provided by rigid angle bracing

PART 3 - EXECUTION

3.1 INSTALLATION

A. Vibration Isolation:

1. Motorized equipment shall be suspended from spring vibration isolators either integral or external to the equipment.
2. Unless otherwise indicated, resilient mounts for motorized equipment shall be of the type and size to provide maximum ten percent transmissibility. Use unhoused, free-standing stable steel springs which are preferred over housed spring assemblies. The horizontal stiffness of the spring shall be approximately equal to its vertical stiffness. The Spring deflection shall be selected based on the equipment power range (HP), speed range (RPM), and static deflection of the supporting structural floor. For large equipment such as fans the steel spring static deflection of the supporting structural floor. It is a specific recommendation that whenever a steel spring is used, two pads of ribbed waffle-pattern neoprene be used in series with the spring.
3. The design of vibration dampening shall consider lateral load as well as vertical load and be suitably snubbed against earthquake forces.
4. A list of isolators accompanied by certified transmissibility ratings for the required duty shall be submitted for each item of equipment.
5. Unless noted otherwise, all vibration isolating equipment shall be of the same make and shall be submitted as one group.
6. Special equipment, such as compressors shall be selected on an individual basis.

3.2 SEISMIC CONTROL

A. Provide earthquake snubbers for all equipment that is supported on spring isolators and weighing over 300 lbs. including base. Provide minimum of four snubbers for equipment weighing less than 2,000 lbs., and eight snubbers for heavier equipment.

B. Ductwork: Longitudinal and transverse bracing shall be required for all round ducts 28 inches in diameter and larger, for rectangular ducts 6 square feet and larger, and on all duct systems used for life safety and smoke control installed in either the horizontal or vertical position. Bracing shall be applied as follows:

1. Transverse bracing shall occur at maximum intervals of 30 feet, at each duct turn and at the end of a duct run.
2. Longitudinal bracing shall occur at maximum intervals of 60 feet. Transverse bracing for one duct section may also act as longitudinal bracing for a duct section connected perpendicular to it, if bracing is installed within 4 feet of the intersection and sized and installed on the larger duct.

3. Groups of ducts may be combined in a larger size frame using overall dimensions and maximum weight of ducts. At least two sides of each duct must be connected to the angles of the brace.
4. Walls, including non-bearing fixed partitions which have ducts running through them, may replace a transverse brace.
5. Bracing may be omitted when the top of the duct is suspended 12 inches or less from the supporting structural members and on roof top ductwork.

END OF SECTION

SECTION 230593 – AIR AND HYDRONIC BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Air Balancing.

B. Hydronic System Balancing

C. Report.

1.2 REFERENCES

A. Associated Air Balance Council: National Standards for Field Measurements and Instrumentation.

B. ASHRAE: 2001 Handbook of Fundamentals.

C. American Conference of Governmental Hygienists: Industrial Ventilation, A Manual of Recommended Practice, 20th Edition.

1.3 GENERAL REQUIREMENTS

A. General: The air and hydronic balancing shall be done by a company which specializes in this type of work and is totally independent and separate from the company or contractor which has installed the systems to be balanced.

B. Prior to beginning balancing, submit the name of the company the Contractor proposes to have do the balancing to the Architect/Engineer for approval.

C. Engineer: The final report of this work shall be stamped by a licensed Mechanical Engineer and accompanied by a statement from this engineer that the work complies with the Associated Air Balance Council Standards and these project specifications.

D. Notify the Architect in writing of all problems or discrepancies between actual conditions and what design documents show as work proceeds.

E. The Balancer shall be directly responsible to the Engineer and shall perform this work as directed by the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL INSTRUMENTATION

A. Balancing equipment shall comply with Associated Air Balance Council recommendations for field measurement instrumentation.

B. All measuring instruments shall be accurately calibrated and maintained in good working order. Calibration dates and certifications shall be available at Engineer's request.

C. Instruments shall be capable of:

1. Air velocity instruments, direct reading in feet per minute with 2% accuracy.
2. Static pressure instruments, direct reading in inches water gauge with 2% accuracy.
3. Tachometers, direct reading in revolutions per minute with 1/2% accuracy; or revolution counter accurate with 2 counts per 1,000.
4. Thermometers, direct reading in degrees Fahrenheit with 1/10 of a degree accuracy.
5. Pressure gauges, direct reading in feet of water or psig with 1/2% accuracy.
6. Water flow instruments, direct reading in feet of water or psig with 1/2% accuracy suitable for readout of balancing valve provided.

PART 3 - EXECUTION

3.1 GENERAL

A. All air systems shall be completely balanced and adjusted to provide the air and flow rates indicated, and to produce an even heating and cooling effect and control response.

B. Consult and coordinate with the Section 230900 (Controls) Contractor for the adjustment of all control devices to allow for proper system operation.

C. Make final adjustments for flow rates in order to optimize each space's comfort, including such considerations as temperature, drafts, noise, pressurization, and air changes. Where variances are made from design values, state reasons in report (e.g., "too much noise", etc.). All such variances are subject to approval by the Architect/Engineer.

D. All measurements and adjustments shall be in accordance with the Associated Air Balance Council National Standards.

3.2 AIR BALANCING

A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:

1. Verify that clean filters have been installed, that system is free from debris, and that all inlets/outlets are not obstructed.
2. Check all fans and equipment to verify that proper start-up and system preparation has been done by the installing contractor.

3. Check all door/window and similar building opening status to insure building is ready and proper pressurization can be obtained.
4. Open all dampers to full flow position, check positions and operation of all motorized dampers to allow full system flows.
5. Review controls and sequences of operation.

B. Tolerances: All air flow rates (supply, return, and exhaust) shall be adjusted to within plus 5 percent and minus 5 percent of the values shown in the contract documents, except that relative space-to-space pressure relationships shall always be maintained (e.g., restrooms shall be negative relative to other areas, general offices shall be positive, etc.).

C. All diffusers, grilles, and registers shall be adjusted to minimize drafts and to eliminate objectionable noise.

D. Air balancing shall be done with new, clean air filters installed. Adjust air deliveries so that design quantities will be obtained when filters are half dirty. This condition shall be simulated by covering a portion of the filter area.

E. Adjust fan speeds and fan drives as required to produce design air quantities.

F. Measurements and adjustments of the air handling and distribution equipment shall be executed in a manner consistent with the manufacturer's recommendations.

G. At completion of balancing, mark the final position of all balancing dampers and record all data.

H. Air flow measurements in main ducts shall be made with a duct traverse using a pitot tube and micromanometer. Summation of air terminal outlets and inlets is not sufficient. Quantity of duct leakage shall be indicated.

I. Duct traverses in rectangular duct shall measure the center of equal areas in the air flow stream, with centers not more than 6 inches apart. Round duct traverses shall measure at least 20 locations, with locations being the centers of equal annular area. Reference the ACGIH Industrial Ventilation Manual, Chapter 9, Testing of Ventilation Systems.

J. Balance each branch run so that there is at least one wide open run; balance branches relative to one another so that at least one branch damper is wide open.

K. Requirements for All Air Handling Systems: Data to be measured/recorded and provided in report:

1. Floor plans clearly showing and identifying all diffusers, grilles, O.A. louvers, ducts and all other items where air flow rates were measured.
2. Identify manufacturer, model number, size, and type of all air inlets/outlets.
3. Initial, trial, and final air flow measurements for all diffusers, grilles, O.A. louvers, ducts, and all other items where air flow rates were measured.
4. Design air flow rates and percentage final air flow rates are of design values
5. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all fan motors.

6. Initial and final RPMs of all fans.
7. Static pressures on inlet and outlet of all units.
8. Fan initial and final CFMs.
9. Outdoor air CFMs (record minimum and maximum values).
10. Data required for all equipment which are part of balanced systems:

    a. Equipment name and number (as used on drawings).
    b. Service.
    c. Equipment manufacturer and model numbers.
    d. Sheave and belt sizes (where applicable).
    e. Filters sizes and quantities (where applicable).
    f. Motor manufacturer and complete nameplate data.
    g. Design operating conditions.
    h. Actual operating conditions (flows, pressure drops, rpm, etc.).

3.3 HYDRONIC SYSTEM BALANCING

A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:

1. Verify that all strainers have been cleaned.
2. Examine fluid in system to verify treatment and cleaning.
3. Check for proper rotation and operation of all pumps.
4. Verify that expansion tanks are not air bound and properly charged and that system is full of fluid.
5. Verify that all air vents at high points in the fluid system are properly installed and are operating freely. Remove all air from the circulating system.
6. Open all valves to full flow position, including coil and heater stop valves, close any bypass valves, and open fully balancing valves. Set temperature controls so that automatic valves are open to full flow.
7. Check operation of automatic bypass valves and similar flow/pressure controls.
8. Check and set operating temperature of equipment to design requirements when balancing by temperature drop.
9. Check all equipment for proper start-up and system preparation by installing contractor.
10. Review controls and sequences of operation.

B. Tolerances: All water flow rates shall be adjusted to within plus 5 percent and minus 5 percent of the values shown in the contract documents.

C. Adjust control valve bypass valves so that pressure drop is the same for full flow-through bypass valve as for full flow-through control valve and controlled equipment.

D. Set all controls and valves as required to maintain design water and/or air temperatures as shown on the drawings.

E. All adjustments and measurements shall be made in strict accordance with the manufacturer's instructions.

F. Upon completion of flow readings and adjustments, mark all settings and record all data. Permanently mark balanced position of all balancing valves. Stamp indicator plate of balancing valves without memory stop.

G. Requirements for All Hydronic Systems: Data to be measured/recorded and provided in report:

1. Floor plans or schematics showing and identifying all valves, coils, pumps and other items where temperatures, pressure drops, or water flow rates were measured.
2. Identify manufacturer, model number, size and type for all balancing devices.
3. Initial, trial, and final water flow measurements (pressure drops, temperatures, and GPMs) for all items where measurements were made.
4. Design water flow rates, and percentage final water flows are of design values.
5. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all pump motors.
6. Pump operating suction and discharge pressures and final total developed head.
7. Pump initial and final GPMs.
8. Entering and leaving fluid temperatures at coils and major equipment.
9. GPM flow of each coil and major equipment.
10. Pressure drop across each coil and major equipment.
11. Pressure drop across bypass valve.
12. Final position of all valves (percent open or setting position on valve).
13. Data required for all equipment which are part of balanced systems:

    a. Equipment name and number (as used on drawings).
    b. Service.
    c. Equipment manufacturers and model number.
    d. Equipment capacities.
    e. Motor manufacturer and complete nameplate data.
    f. Design operating conditions.
    g. Actual operating conditions (flows, pressure drops, etc.).

3.4 BALANCING REPORT

A. General: A balancing report shall be submitted as specified herein, documenting all balancing procedures and measurements.

B. Preliminary Report: Two preliminary review copies of the balancing report shall be submitted to the Architect/Engineer when the balancing work is 90% complete (or as near 90% complete as possible due to uncompleted work of other trades). In addition to containing all the information required of the final report, the preliminary report shall contain a list of all the work required of other trades in order to allow the balancing work to be completed. The Architect/Engineer will review the preliminary report and inform the Contractor of any additional items or revisions required for the final report. Preliminary reports may be omitted where the Architect/Engineer grants approval.

C. Final Report: Shall be included in the Operation and Maintenance Manual. Submit reports to Contractor for inclusion in Manuals (or, when manuals have been already sent to Engineer, send

report to Engineer who will insert report into Manual). Provide number of reports as required to match quantity of O&M Manuals, but in no case less than five (5).

D. Report Organization: The report shall be divided into logical sections consistent with the building or system layout (i.e. by floors, building wings, air handling units, or other convenient way). Tabulate data separately for each system. Describe balancing method used for each system.

E. Format: 8 1/2" x 11" size, neat, clean copies, drawings accordion folded. Report shall be typed, shall have a title page, table of contents, and divider sheets with identification tabs between sections. Information shall be placed in a three-ring notebook, with the front cover labeled with the name of the Job, Owner, Architect/Engineer, Balancing Contractor, and Report Date.

F. General Balancing Information Required:

1. At the beginning of the report, include a summary of problems encountered, deviations from design, remaining problems, recommendations, and comments.
2. List of instruments used in making the measurements and instrument calibration data.
3. Names of personnel performing measurements.
4. Explanation of procedures used in making measurements and balancing each system.
5. List of all correction factors used for all diffusers, grilles, valves, venturi meters, and any other correction factors used.
6. Areas where difficulties were encountered in obtaining design flow rates, or where unstable operating conditions may exist.
7. Note any parts of the system where objectionable drafts or noises may be present and efforts made to eliminate same and why they may still be present.
8. Note where variances from design values occur; explain why.

G. Air Balancing Information: All previously cited required measurement/recorded data, any additional recorded data, and observations.

H. Hydronic Balancing Information: All previously cited required measurement/recorded data, any additional recorded data, and observations.

END OF SECTION

SECTION 230700 – HVAC INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Duct Insulation.

B. Equipment and Specialties Insulation.

1.2 DEFINITIONS

A. "Run-out" means "piping not more than 12 feet long that runs to an individual fixture or unit."

B. "Conditioned Areas" means "areas that are directly and intentionally supplied by heated or cooled air".

1.3 QUALITY ASSURANCE

A. All insulation shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E 84, NFPA 255, and UL 723.

1.4 SUBMITTALS

A. All submittals shall comply with Section 230500.

B. Provide product data on all insulation materials to be used. Indicate thicknesses to be used.

1.5 GENERAL REQUIREMENTS

A. Code Compliance: Contractor shall insulate all systems with the materials and thicknesses as specified herein, but in no case shall the insulation be less than that required by the Washington State Energy Code (latest edition and amendments) or Energy Code enforced by the authority having jurisdiction. Contractor shall, in addition to insulating those systems/items specified herein, provide insulation where required by Code.

B. Insulation at Hangers: Insulation shall be continuous through hangers on all insulated systems (except ductwork.) Inserts at hangers are specified and are considered as part of the hanger and support system. Inserts are required to be installed at the time of pipe installation and are intended to be installed by the Contractor installing the pipe hangers/supports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 230500, Acceptable Manufacturers.

B. Insulation: Manville, Armstrong, Owens Corning, CSG, Knauf, Rubatex, Pittsburgh Corning, Imcoa, Halstead.

C. Accessories: Same as for insulation and Duro Dyne, Gustin Bacon, Childers, RPR, Tee Cee, J. P. Stevens, Buckaroos, Johnson.

2.2 DUCT INSULATION

A. Fiberglass Insulation: 1.0 lb. per cubic foot minimum density; thermal conductivity no greater than 0.25 Btu-in/hr-sq. ft.-deg. F. at 75 degrees F with factory applied jacket as specified below.

B. Fiberglass Insulation Jacket: Vapor proof jacket, consisting of aluminum foil cover with open mesh fiberglass, reinforcement, laminated to UL rated Kraft, vapor transmission rate shall not exceed 0.05 perms.

C. Adhesive: Fire retardant, Duro Dyne type FPG or equal.

D. Clips: Cement on or welded on pins impaled through glass fiber, with surface washers.

E. Insulation Thickness:

1. Supply Air Ductwork Within Building Space with Conditioned Air on Each Side of Space (e.g., mid-floor ceiling spaces, exposed duct): 1.0 inch thick.
2. Supply Air Ductwork Within Building Space Without Conditioned Air on Each Side of Space (e.g., attic, crawl space, area between ceiling and roof): 2.0 inch thick.
3. Supply Air Ductwork on Roof or Exterior of Building: Interior duct lining used--specified in Section 233100.
4. Return Air Ductwork Within Building Space With Conditioned Air on Each Side of Space (e.g., mid-floor ceiling plenums): No insulation required.
5. Return Air Ductwork Within Building Space Without Conditioned Air on Each Side of Space (e.g., attic, crawl space): 1.0 inch thick.
6. Outdoor Air Intake Ductwork Within Building Space With Conditioned Air on Each Side of Space (e.g., ceiling plenums, exposed duct): 2.0 inch thick.
7. Outdoor Air Intake Ductwork Within Building Space Without Conditioned Air on Each Side of Space (e.g., attic, crawl space): 1.0 inch thick.
8. Exhaust Air Ductwork: 2.0 inch thick from point of exhaust airstream backdraft damper to outdoor termination.
9. Alternative Insulation Thickness: Insulation thicknesses indicated are based on the thermal conductivities specified. Contractor at his option may use other insulation thicknesses for insulation with different thermal conductivities provided that the overall heat transfer

coefficient is the same as if the specified insulation had been used. Submit calculations showing insulation equivalency for approval.

2.3 EQUIPMENT AND SPECIALTIES INSULATION

A. Equipment: Insulation shall be same material as that specified for the HVAC system the equipment is installed in. Insulation thickness shall be 1.5 inches.

B. Valves: All valves installed in insulated HVAC systems shall be insulated. Insulation material and thickness shall be same as that specified for the HVAC system the valve is installed in. Insulation shall be removable type on all control valves.

C. Removable Insulation: Shall provide thermal insulating properties equivalent to that which is provided for HVAC system. Shall consist of 0.25-inch J. P. Stevens "Insulbatte" with glass cloth jacket, 4.0-inch Owens-Corning thermal insulating wool, Type II, fastened with No. 304 stainless steel hooks tied with 0.040-inch soft solid annealed copper wire. Where metal jacketing is required, provide with removable enclosures, of same material as metal jacketing, configured to suit items covered.

PART 3 - EXECUTION

3.1 GENERAL

A. Equipment and Floor Protection: Cover existing equipment and finished floors to protect such items from insulation fiber and dust. Keep all such existing areas in a "broom clean" condition at the end of each day. Take precautions in these areas to prevent glass fiber and insulation dust from entering existing ventilating systems.

B. Glass Fiber Insulation:

1. Finish all insulation ends, no raw edges allowed.
2. Joints: Tightly butt adjacent insulation sections together without any voids. Provide overlap of jacket material over all circumferential joints.

C. Insulation Thickness: See "Part 2 - Products" for insulation thicknesses.

D. Items To Be Insulated: Provide insulation on all ductwork, and all items installed in these duct systems, all energy conveying, all energy storage, and all energy consuming devices specified as part of Division 23, except where such insulation has been specifically excluded.

E. Items Excluded From Being Insulated:

1. Electric motors.
2. Factory insulated or factory lined HVAC units.
3. Fans.
4. Internally lined ductwork.

3.2 DUCT INSULATION INSTALLATION

A. Insulate all ducts with specified thickness.

B. Insulation shall be firmly butted at all joints with a maximum allowable compression of 25%. All seams shall overlap a minimum of 2 inches and be finished with appropriate pressure sensitive tape or glass fabric and vapor retardant mastic. Pressure sensitive tapes and glass cloth shall be a minimum 3 inches wide.

C. For rectangular ducts over 18 inches wide, duct wrap shall be additionally secured to the bottom of the ductwork with mechanical fasteners on 18 inch centers to reduce sagging. Washers shall be applied without compressing the insulation. All seams, joints, penetrations, and damage to the facing shall be sealed with vapor retardant mastic.

D. Inside duct lining shall be as specified in Section 230700 - Ductwork.

E. All HVAC supply and outdoor air ducts shall be covered with glass fiber insulation. Where duct lining is used, the insulating properties of the lining may be credited toward meeting the R value specified for insulation.

3.3 EQUIPMENT AND SPECIALTIES INSTALLATION

A. All equipment where access is required shall have insulation installed so that it can be easily removed and reinstalled without requiring new insulation. Items requiring such removable insulation include, but are not limited to, the following:

1. Control Valves.
2. Strainers.
3. Balancing Devices.
4. Pressure/Temperature/Flow Measuring Devices.

B. Specialties Requiring Insulation: All items connected in an insulated HVAC system shall be insulated, except the following:

1. Factory Insulated Items.
2. Diffusers & Grilles.

END OF SECTION

SECTION 230900 – HVAC CONTROLS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Control System Design.

B. Complete system of automatic heating, ventilating, and air conditioning controls.

C. Control devices, components, and wiring.

D. Testing and adjustment.

E. Operator Training.

1.2 DEFINITIONS

A. "Conventional control components" means "control valves, dampers, actuators, wiring, air compressors, and other control devices that are not microprocessor based."

1.3 SUBMITTALS

A. Shall comply with Section 230500.

B. Submit a complete list of equipment to be furnished, including product information for each item on the material list. Submit samples of wall sensor and bypass switch.

C. Submit a complete set of shop drawings prior to installation containing the following information: interconnect drawings showing all wiring and control connections, control panel locations, all control device locations, arrangement of devices in panels, sequence of operation for all equipment, ladder diagrams showing switching functions of system and programs, logical outline of intended programs, building floor plans with all proposed thermostatic and other control device locations shown.

D. Submit list of proposed component labeling.

E. Record Drawings: See Section 230500.

F. Operation and Maintenance Manuals: See Section 230500. In addition to the information required by that Section, provide (for inclusion in mechanical O&M Manual) the following:

1. A list of spare parts and prices recommended for purchase by the Owner.
2. System description and complete sequence of operation.
3. Reduced size (11" x 17") copies of record drawings.

4. Input/Output (I/O) summary forms for the system listing all connected analog and binary input and output functions and the number types of all points.
5. Description of unique devices/controls/programs specific to this system.

G. Programmers Manuals: Provide manufacturer's programming manuals to Owner.

1.4 GENERAL REQUIREMENTS

A. The entire control system shall be installed by skilled electricians and mechanics, all of whom are properly trained and qualified for the work they perform.

B. One single Contractor shall be responsible to design, furnish and install the complete building controls. Any subcontracted installation work shall be done by Contractors experienced and qualified in the work they perform subject to approval by the Engineer. Submit names(s) of proposed subcontractor(s) who will perform control work and extent of the work they will perform.

1.5 SPARE PARTS AND SPECIAL TOOLS

A. Special Tools: Provide any special tools needed per Section 230500.

B. Spare Parts: Provide one spare room temperature sensor of the type installed.

1.6 WARRANTY AND SERVICE

A. Warranty: After completion of the installation of the control system and acceptance by the Owner, the system shall be warranted as free against defects in manufacturing, programming, workmanship and materials for a period of one year from date of acceptance. In addition, the system shall be warranted to provide the sequence of operation and basic features specified, with the accuracy and flexibility also specified. The system shall be repaired or replaced, including materials and labor, if in owner's reasonable opinion, system is other than as warranted. Preventive and emergency maintenance shall be included.

B. End of Warranty Service: At the end of the warranty period, the Contractor shall provide a re-check of the entire system operation, including calibration testing of a sample number of components and providing any necessary control adjustments for proper system operation. Such work shall be for a minimum of 4 man-hours.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 230500, Acceptable Manufacturers.

B. Programmable Thermostats: Factory Supplied Thermostats.

C. Conventional Control Components and Accessories:

1. Products shall comply with Section 230500, Acceptable Manufacturers.
2. Control Components: Seibe, Honeywell, Johnson Controls.
3. Control Accessories: Idec, Hoffman, McDonnell, Tridelta, Edwards, Mamac, APC, Barksdale, Mark-Time, and manufacturers listed for Control Components.
4. Control Components factory supplied with equipment specified are acceptable if capable of meeting performance and operation requirements.

2.2 BASIC SYSTEM

A. The system shall be programmable thermostats with added features for door switches, timeclock functions, occupancy sensors, and similar functions.

2.3 PROGRAMMABLE THERMOSTATS

A. Thermostats shall be wall-mounted thermostats supplied by the equipment manufacturer. Thermostats have a programmable occupancy schedule, temperature display, and adjustable temperature setting.

2.4 ACTUATORS

A. Actuators shall be heavy duty reversible type, with driving motor and gear train and sealed in die cast case. Proportional actuators shall have a built-in electro-mechanical system to provide for positive repeatability of position, regardless of changes in output load. Belimo only.

B. Actuator shall be proportional or two position type, as required for application. Actuator power and torque shall be sufficient to match dampers or valves being controlled and allow proper damper and valve operation against system pressures liable to be encountered. Actuator shall be capable of driving dampers from full closed to full open in less than 15 seconds.

C. Units shall be complete with all linkages, brackets, and hardware required for mounting and to allow for the proper control of the regulated damper or valve.

D. Actuator shall spring return upon power interruption to allow controlled devices to "fail safe" in open or closed position as dictated by freeze, fire or temperature protection requirements.

2.5 ACCESSORIES

A. Wiring and Conduit: Shall comply with Division 26 specifications. Wiring that performs code required life safety shutdown of equipment or fire alarm interface shall comply with NFPA and local codes for fire alarm system wiring.

B. Control Cabinet: Wall mounted, NEMA Type 1 construction, UL listed minimum 14 gauge sheet metal, hinged front door with latch. Size as required to house controls. Controls/devices shall be logically assembled in cabinet, with all devices and cabinet labeled.

C. Relays: See paragraph "Contactors".

D. Contactors: Shall be the single coil electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contacts shall be doubled break silver to silver type protected by arching contact where necessary. Number of contacts and rating shall be selected for the application intended. Operating and release times shall be 100 milliseconds or less. Contractors shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage.

E. Miscellaneous Sensors/Transmitters/Switches/Transformers: Shall be manufacturer's standard, designed for application in commercial building HVAC control systems, compatible with other components so as to provide sequence of operation specified.

2.6 SWITCHES

A. Air Flow Switches: General Purpose utilizing differential air pressure, SPDT snap-acting contacts, adjustable 0.1in. W.C. to 2.0 in. (minimum), neoprene diaphragm, all aluminum construction.

B. Damper End Switches: Shall be momentary type limit switches for monitoring the motion of the damper at a prescribed arc of rotation. The switch shall be hermetically sealed mercury contacts that operate by way of a trip lever. The switch shall be mounted on the exterior of the duct so that the trip lever is aligned with the damper vane. Mechanical adjustments in the switch case shall permit the proper lever action for tripping the mercury switch contacts. The switch shall have a SPDT contact arrangement that exceeds the load requirements for both voltage and current.

C. Pressure to Electric Switches (PE): Shall sense a gradual control air pressure change and provide a snap action SPDT contact output. The setpoint shall be adjustable from 3 to 25 PSIG with a fixed differential of 2 PSI. The PE switch shall be suitable for both line and low voltage control applications and be listed by UL for electrical safety.

D. Bypass Switch: Shall be momentary contact type push button. Install in standard wall box with stainless steel cover.

E. Wall On/Off Switch: Standard wall box type switch, single pole, with illuminated switch for when controlled item is on. Provide with stainless steel wall plate, labeled as to function. Leviton or approved.

F. 3-Position Wall Switch: Standard wall box type switch, with center off position, pole and throw to suit application. Provide with >036 stainless steel wall plate engraved as to function and each switch position. Arrow-Hart No. 4356, 4357, 4361, 4371, or equal.

G. Electronic Count Down Timer Switch: 120V SPST switch rated for ½ HP motor. Switch has choice of 5, 15, 30, 45, 60, or 120 minutes. Install in standard wall box with stainless steel cover. Marktime 42802 or approved.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide complete system with sequences of operation and Energy Code requirements as indicated on drawings.

B. Time Control: Central time clock shall provide occupied/unoccupied mode switching for all items indicated as having time clock control.

C. Warm-up Control: Central optimum-start controls shall provide warm-up switching for all items indicated as having a warm-up cycle.

D. Provide all actuators and other devices for all equipment where such actuators or related devices are not specified as being furnished by the equipment manufacturer.

E. Various thermostats are not shown on the drawings but are required per the sequence of operation specified. Coordinate with Engineer for location of all such thermostats prior to installing.

F. Provide all motor rated relays and/or motor starters required to allow for automatic control as specified herein, where such devices have not been provided by others.

3.2 INSTALLATION

A. Provide all computer software and hardware, operator input/output devices, sensors, relays, switches, dampers, actuators, conduit, tubing, wiring, motor starters and all other devices required to provide a complete integrated system with the sequence of operation and basic system features as specified.

B. Room thermostats shall be mounted 48" above finished floor unless indicated otherwise. Thermostats shall connect to the HVAC or fan unit serving the space the thermostat is located in, unless indicated otherwise. Not all thermostats are shown on the drawings and those shown are preliminary only. Contractor shall indicate all final thermostat locations on submittal drawings. Contractor is responsible to coordinate locations to avoid chalkboards, tackboards, and other interferences.

C. It shall be the responsibility of this Contractor to provide power for all damper motors, time clocks, and other control devices requiring power. Coordinate with the Division 26 Contractor to arrange for necessary power circuits. Circuits have been made available in various electrical panels for this purpose (see electrical drawings/panel schedules).

D. Provide all electrical wiring and devices in accordance with applicable National, State and local codes and Division 26 requirements. All wiring shall be installed in conduit and in accordance with electrical section of these specifications, except that low voltage wiring within the ceiling plenum spaces and in mechanical platform area may be ran without conduit provided that plenum rated cable is used. Install all conduit and wiring parallel to building lines.

E. Component Labeling: All control components, except regular room thermostats, shall be equipped with name plates to identify each control component. Components in finished rooms shall be labeled as to generic item controlled for better user understanding; other devices shall be labeled with the same designation which appears on the Control Diagrams. Contractor shall submit list of proposed labeling prior to installing.

F. Thermostat setpoints (all adjustable) shall be as follows unless indicated otherwise:

1. Occupied Heating 72 degrees F
2. Unoccupied Heating 70 degrees F

G. Motor Starters: Control contractor shall provide all necessary motor starters and motor starting relays to allow proper control of the items listed herein where such starters/relays have not been specifically shown on the electrical drawings. Such starters/relays provided shall comply with the applicable Division 26 specifications, NEC, and governing code requirements. It is the general intent of the project documents that motor starting devices for motors 3/4 HP and smaller be provided by the Control Contractor, except where specifically shown.

END OF SECTION

SECTION 233100 – DUCTWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Environmental Ductwork Systems.

B. Acoustical Duct Lining.

C. Duct Cleaning and Testing.

D. Duct Shop Drawings.

1.2 DEFINITIONS

A. Duct Sizes: All duct dimensions shown are inside clear dimensions. Where inside duct lining is specified or indicated, duct dimensions are to the inside face of lining.

B. Low Pressure System: Velocities less than 2,000 fpm and static pressure in duct 2 inches w.g. or less.

C. Gauges: Steel sheet and wire are U.S. Standard Gauge; aluminum sheet is Brown and Sharpe Gauge.

1.3 QUALITY ASSURANCE

A. Fabricate and install ductwork in accordance with SMACNA duct construction publications and ASHRAE handbooks.

B. Materials and installations shall comply with NFPA 90A, NFPA 90B, and the IMC.

1.4 SUBMITTALS

A. Submittals shall comply with Section 230500.

B. Submit shop drawings for all HVAC ductwork which is to be installed differently than as shown on the drawings.

1.5 DUCT PRESSURE CLASS

A. All ductwork shall be constructed to the static pressure indicated by the fan which serves the ductwork, or to 1-inch (plus or minus as appropriate), whichever is higher.

1.6 REFERENCES

A. SMACNA HVAC Duct Construction Standards, Current Edition.

B. SMACNA Duct Liner Application Standard, Current Edition.

C. NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems.

D. NFPA 90B: Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

E. IMC: International Mechanical Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 230500, Acceptable Manufacturers.

B. Sheet Metal: All domestic manufacturers.

C. Spin in Fittings: General Environment Corp., Clevepak Corp.

D. Duct Sealant and Tape: Durkee Atwood, Hardcast, Duro Dyne, Benjamin Foster, Products Research, Chemical Corp, and Ductwork.

2.2 GENERAL MATERIALS

A. Ducts: Construct of galvanized sheet steel, suitable for lock forming without flaking or cracking, conforming to ASTM A527, having a zinc coating of 1.25 ounces total per square foot for both sides of a sheet, corresponding to coating designation G90 per ASTM A525.

B. Fasteners: Use rivets and bolts throughout; sheet metal screws are acceptable on low pressure ductwork only.

C. Spin-in Fittings: Factory fabricated of galvanized steel, bell-shaped, with die-formed mounting groove and damper. Provide 45 degree extractor when the spin-in fitting is installed in a duct which has a width of 12 inches or more. General Environmental Model SM-1D or SM-1 DEL.

D. Duct Sealant: Shall be fire resistant with a flame spread rating of 25 or less, and a smoke developed rating of 50 or less. Sealant shall also be water resistant and compatible with mating materials and types of joints or connections being sealed, specifically made for sealing ducts. Exterior duct sealant shall be specifically intended for outdoor use as a duct sealant.

E. Duct Tape: Shall be fire resistant with a flame spread rating of 25 or less, and a smoke developed rating of 50 or less. Tape used shall be specifically compounded for maximum adhesion to galvanized steel, and shall be compatible with the duct sealant used.

2.3 LOW PRESSURE DUCT FABRICATION

A. Duct Gauge and Reinforcement: Shall be as shown in SMACNA HVAC Duct Construction Standards according to the pressure classification of the system and the duct dimensions.

B. Joints and Seams: Construct in accordance with SMACNA HVAC Duct Construction Standards. Leakage shall be less than 5% of total system airflow. Button punch or bolt connections in standing seams shall be spaced on centers not greater than 6" apart. Coordinate joint spacing with duct reinforcement requirements so that transverse joints having the required stiffness may be incorporated in the reinforcement spacing schedule.

C. Elbows and Tees: Shall be long radius type with a center line radius not less than 1 1/2 times the width or diameter of the duct. Where space does not permit the use of long radius elbows, short radius or square elbows with turning vanes shall be used.

D. Transitions: Increase duct sizes gradually. Transitions for diverging air flow shall be made with each side pitched out not more than 20 degrees. Transitions for converging air flow shall be made with each side pitched in not more than 30 degrees.

E. Branch Connections: Duct take offs from rectangular ductwork to round ductwork shall be made using spin in fittings (unless a different fitting type is specifically shown). Duct take-offs from rectangular duct to rectangular duct shall be as shown on the drawings and in compliance with SMACNA Standards.

F. Ductmate Systems: Transverse duct joints may be made with Ductmate System, or approved equal. System shall consist of companion flanges of 20 gauge galvanized steel with an integral polymer mastic seal; corner pieces of 12 gauge G90 galvanized steel; 20 gauge G90 galvanized cleats; closed cell, high density gasket type; and galvanized carriage bolts with hex nuts. The flanges shall be securely fastened to the duct walls using self-drilling screws, rivets or spot welding. Fastener spacing shall be as recommended by the manufacturer for the size of duct and the pressure class. The raw duct ends shall be properly seated in the integral mastic seal. A continuous strip of gasket tape, size 1/4" x 3/4", shall be installed between the mating flanges of the companion angles at each transverse joint; and the joint shall be made up using 3/8-inch diameter x 1-inch long plated bolts and nuts. Galvanized drive-on or snap-on cleats shall be used at spacings as recommended by the manufacturer.

2.4 DUCT LINING

A. Material: Flexible, inorganic glass fiber material, maximum thermal conductivity of 0.26 Btu-inch/hr-sq. ft.-degree F at 75 degrees F, coated to prevent erosion, and conforming to SMACNA Duct Liner Application Standard. Lining shall be 1-inch thick on ductwork within the building and 2-inch thick on ductwork exterior of the building.

B. Adhesives: Fire resistant, Type 1, conforming to the Standard for Adhesives for Duct Liner, ASC-A-7001C-1972, of the Adhesive and Sealant Council, as contained in the SMACNA Duct Liner Application Standard.

C. Mechanical Fasteners: Shall conform to the Mechanical Fasteners Standard, MF-1-1975, as contained in the SMACNA Duct Liner Application Standard.

PART 3 - EXECUTION

3.1 SHOP DRAWINGS

A. Shop drawings of all ductwork are required. Contractor shall field locate existing building features that may interfere with new ductwork. See Section 230500 for drawing requirements.

B. Contractor shall include in his bid a minimum of 2 hours per room for the creation of shop drawings.

3.2 DUCTWORK INSTALLATION

A. Install all ductwork and plenums in sizes and locations as shown on the drawings, complete with all accessories and connections to provide complete and operable heating, ventilating, air conditioning, and exhaust systems.

B. Ducts shall be installed level and in neat lines with the building construction.

C. All ducts are to be installed concealed unless indicated otherwise.

D. Apply a bead of duct sealant to all spin in fittings where fitting seals against sheet metal duct.

E. Seal all joints in accordance with Seal Classification as shown in Table 1 2 of the SMACNA HVAC Duct Construction Standards. All "Ductmate" and similar systems shall be installed in strict accordance with manufacturer's instructions.

F. In addition to applying sealant to joints in accordance with the SMACNA requirements, all joint corners and seams shall be sealed and all joints and seams shall be taped over with minimum 3-inch wide duct tape. Such tape is not required on exposed ducts, but all joint corners shall have adhesive applied. Exposed ducts shall be carefully sealed to maintain good appearance.

G. Alternative Duct Sizes: The Contractor, at his option, may use duct sizes other than those shown on the drawings, provided that the Architect/Engineer gives prior approval, and the pressure drop per lineal foot of the proposed duct does not exceed that for the duct shown.

3.3 DUCT CLEANING AND TESTING

A. All ducts shall be wiped or blown clean of all dust and debris prior to the installation of grilles or diffusers.

B. All plenums shall be vacuum cleaned of all dust and debris prior to system operation.

END OF SECTION

SECTION 233113 – METAL DUCTWORK AND ACCESSORIES **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section specifies duct silencers, minor ductwork, air filters, equipment connections, reinforcing, hangers and supports, hardware, and accessories for fan equipment. The Contractor shall be responsible to provide all appurtenances and devices required to make the air distribution systems complete and operational.

B. Duct silencer in the Mechanical Room shall have an intake air filter bank attached to it.

1.02 SUBMITTALS

A. Comply with procedures per Section 013300 – Submittal Procedures.

A. Provide the following submittals:

1. An 8-1/2-inch by 11-inch manual with detail sheets or catalog data of construction standards, flexible duct connectors, duct sleeves, duct access doors, turning vanes, volume dampers, supports, hangers, etc.
2. Layout drawings showing location of all hangers and supports.
3. Calculations for design of all hangers, supports, seismic anchorage and bracing, in accordance with Paragraph 2.03.

1.03 DESIGN CRITERIA AND CONSIDERATIONS

A. General: Unless otherwise indicated, sheet metal gauge, reinforcing, hanger and support systems, ductwork joint types, and other basic design construction details shall be in accordance with the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards. Ductwork shall be fabricated to meet the configurations and dimensions specified on the Drawings. Dimensions specified indicate net free area; dimensions shall be increased by the thickness of the lining where internal lining is required.

B. Low Pressure Ductwork: Low pressure ductwork shall convey air with a velocity less than 2,000 feet per minute (fpm) and maximum static pressure of 2 inches of water column. Low-pressure ductwork shall conform to 2-inch water column (w.c.) pressure class.

C. Medium Pressure Ductwork: Medium pressure ductwork, where specified, shall convey air with a velocity greater than 2,000 fpm and a maximum static pressure of 6 inches of water column. Medium pressure ductwork shall conform to 6-inch w.c. pressure class.

B. System Leakage: All joints shall be sealed as required to limit total system leakage to a maximum of 1 percent of the specified equipment air flows.

D. Duct Sleeves: Whenever ducts extend through concrete or masonry walls, floors, or ceilings, the ducts shall be provided with a sleeve as specified in Paragraph 2.06.

E. Vibration Isolation Flexible Connections: Flexible connections shall be provided at duct connections to motor-driven air handling equipment and other locations specified. Flexible connections shall be UL approved and provided with the necessary angle, straps, bolts, clips, or other fasteners to secure the flexible material to the equipment and ducts. Flexible connections exposed to the weather shall be provided with approved sheet metal weather covers. Provide at duct connections to fan inlets and outlets, minimum clear length of 6 inches. Duro-Dyne "Durolon," Ventfabrics "Ventglas," or approved equal.

F. Grilles:

1. Aluminum Grille: TITUS Model 301F (single deflection) of the sizes and mounting types shown on the Plans. Grills shall have roll-formed borders with a minimum thickness of 0.032 inch. Blades shall be spaced on 3/4-inch centers. Blades shall have friction pivots on both sides to allow individual blade adjustment without loosening or rattling or be inserted through the frame and held tight with steel friction wire interlocked to the frame on both ends of each side.
2. Finish shall be No. 26 White. Finish shall be an anodic acrylic paint baked at 315 degrees F for 30 minutes. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test.
3. Manufacturer shall provide published performance data of the registers. The registers shall be tested in accordance with ANSI/ASHRAE Standard 70-2006.

G. Insulation:

1. Duct insulation shall be provided in accordance with the Washington Energy Code.
2. Duct liner shall be provided for compressor discharge ducts.

H. Filters:

1. All filter performance ratings based on tests in accordance with ASHRAE Test Standard No. 52-76, unless noted otherwise.
2. All filter media Underwriters Laboratories (UL) listed as Class 1 and Class 2.
3. Quantity, size, type, and resistance as scheduled on the Drawings.
4. Manufacturer must guarantee performance and performance must be stated in the manufacturer's printed literature.

I. Miscellaneous:

1. Relief – Backdraft Dampers: Metal blade type; Arrow United Industries No. 335 with Counterbalance, Oilite bearings and 1/2-inch mesh bird screen, or approved equal.
2. Wall Openings: Seal space around ducts where ducts pass through walls or ceilings. Densely pack void space with loose fill fiberglass Insulation. Install galvanized iron frame at each side of opening to cover edges of duct openings.

PART 2 – PRODUCTS

2.01 DUCT SILENCERS – MECHANICAL ROOM INTAKE AND EXHAUST

1. Outer casing shall be made of 22-gauge type #G-90 lock-former-quality galvanized steel.
2. Interior partitions shall be not less than 26-gauge type #G-90 galvanized lock-former-quality perforated steel.
3. Filler material shall be inorganic glass fiber of a proper density to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert, vermin and moisture-proof.
4. Combustion ratings for the silencer acoustic fill shall be not greater than the following when tested to ASTM E 84, NFPA Standard 255, or UL No. 723:

    a. Flamespread Classification: 20
    b. Smoke Development Rating: 20

5. Units shall be constructed in accordance with the ASHRAE Guide recommendations for high pressure duct work.
6. Units shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge from inside to outside the casing.
7. Silencer testing facilities shall be NVLAP accredited for the ASTM 477-99 (or later) test standard.
8. Silencers shall not exceed a pressure drop of 0.09 inches w.c. at 1,500 CFM.
9. Sound dynamic insertion loss (DIL) shall not be less than the following:

	Octave Band Center Frequency, Hz							
Length in Inches	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
36	5	11	16	32	38	35	25	14

10. Sound trap design criteria as follows:

Mechanical Room, Equipment	**Air Volume, SCFM**	**Dimensions, inches**			
		Maximum Pressure Drop, In., WC	**Depth**	**Height**	**Width**
Intake	1,500	0.09	36	18	24

*Match to 30” x 24” louver.

11. Acceptable Manufacturers:

    a. I.A.C. Series S.
    b. Kinetics.
    c. Dynasonics.

12. The entire length of filter/silencer system including louver to silencer transition, silencer, air filter unit, shall not be longer than 5 feet.

2.02 DUCT AND PLENUM MATERIAL

A. Aluminum sheet of lock forming grade ASTM B209 alloy 3003 H14, 0.027-inch aluminum sheets minimum thickness unless indicated on the Drawings or specified otherwise.

B. Round and flat oval ducts exposed in finished spaces, and round and flat oval ducts upstream of air terminal units provide spiral lock seam duct and solid-weld fittings United-McGill "Uni-Seal" ducts and fittings, AccuDuct, Semco, Norlock, or approved equal. At Contractor's option, Contractor may provide ducts with SMACNA Type RL-4 longitudinal seams for unexposed round duct upstream of air terminal units. exhaust duct systems use 1/2-inch W.C. negative basis of compliance

C. Provide spiral seam duct for all round and flat oval ducts, manufactured by United-McGill, Mitco, Sheet Metal Products Co., or local manufacturer with more than 5 years in producing round or flat duct of similar size.

D. Joint tape shall be Hardcast manufactured; Type DT mineral impregnated woven fiber tape with Type FTA-20 adhesive; 3-inches minimum width; UL approved.

2.03 HANGERS AND SUPPORTS

A. Duct support spacing shall be in accordance with the SMACNA standards for the pressure class and conditions specified and prevailing in the system.

B. Select upper attachments using a minimum safety factor of 5.

C. Install ducts so that the ducts and hangers do not touch moving equipment or equipment supports, conduit, or piping subject to vibration.

D. Supports shall be spaced to prevent visible duct deflection and loss of system integrity.

E. Aluminum ductwork shall be constructed with strength and dimensional stability comparable to conventional steel duct. In the absence of other criteria, aluminum sheet and reinforcing shall have a moment of inertia three times greater than that recommended for steel ductwork.

F. Supports shall be designed in accordance with the International Building Code.

G. Provide seismic restraints on ductwork in accordance with Seismic Hazard Level SHL-A of the "Seismic Restraint Manual: Guidelines for Mechanical Systems," current edition as published by SMACNA, and in accordance with Uniform Building Code, Uniform Mechanical Code, including amendments adopted by the local jurisdiction. Superstrut seismic restraint systems or approved equal.

2.04 DUCT SEALING

A. Supply ducts upstream of air terminal units and aluminum duct seal per Class A requirements and all other ducts seal joints per class requirements per the latest edition of SMACNA "HVAC Duct Construction C Standards Metal and Flexible."

B. Return and exhaust ducts shall be constructed for 1-inch pressure class and meet class C seal requirements.

C. Sealant Ductmate No. 795, Ductmate No. 511-1M, or approved equal.

2.05 FITTINGS

A. Air Terminal Units Upstream Duct Connection:

1. Provide two box inlet diameter lengths of straight duct of the same diameter as the inlet diameter of the air terminal unit. Where duct sizes on the Drawing indicate larger or smaller size, provide increaser or reducer fitting ahead of straight length.
2. Provide rigid connection to the air terminal unit.

B. Provide airtight stuffing boxes in supply ducts upstream of air terminal units at penetrations such as thermostats, thermometers, and pipes. Use rubber grommets or U-channel rubber extrusions of Rubbercraft Mfr. to create airtight seal.

2.06 DUCT SLEEVES

A. Duct penetrations shall be sleeved and insulated per International Mechanical Code 607.5.3, 3.6 (Steel Sleeve and Rock Wool Batting).

2.07 FILTERS

A. Replaceable (300-500 FPM Face Velocity):

3. Dry Media (30 percent):

a. One-inch-thick nonwoven cotton media pleated, 30 percent efficiency ASHRAE Dust Spot, 65 grams per square foot dust holding capacity, 93 percent ASHRAE Weight Arrestance, with heavy duty, beverage board enclosing frame.
a. Media in a 0.09-inch-thick aluminum holding frame with wire fasteners retaining clips and polyurethane foam gasket. Fasteners removable without use of tools.
b. Farr 30/30, American Air Filter, or approved equal.

2.08 INSULATION

A. Materials:

1. UL Labeled, 1.0 inch, 1.5 to 3.0 lb/ft^3 duct liner, mineral or glass fiber blanket or equivalent to provide an installed total thermal resistance of at least R-3.3. Insulation shall have a vapor retarder, with a perm rating not greater than 0.5.
2. Acceptable Manufacturers:

a. Johns Manville.
b. Owens-Corning.
c. Approved Equal.

2.09 ELBOWS

1. Square throat elbows in rectangular ducts must have double-wall turn vanes.
2. Turn vanes must be double-wall type.
3. Do not use straight tap for branch connections in rectangular duct.
4. Do not use dovetail joint for round branch connection to rectangular ducts. Provide notch spin-in type.
5. Do not use adjustable type elbows in duct systems upstream of air terminal units.
4. Provide conical fittings in supply duct systems upstream of air terminal units. Ninety-degree tee with oval to round tap may be used.

2.10 MISCELLANEOUS

A. Wall Openings:

1. Seal space around ducts where ducts pass through walls, ceilings, or floors.
2. Densely pack void space with loose fill fiberglass insulation. Install galvanized iron frame at each side of opening to cover edges of duct openings.

B. Pressure Testing:

1. Test supply systems upstream of air terminal units.
5. Leakage not to exceed 5 percent of the total design air flow when tested under a pressure of two times the working pressure. When partial sections of the duct system are tested, the summation of the leakage for all sections not to exceed the total allowable leakage.
2. Test method in accordance with SMACNA manual for the “Balancing and Adjustment of Air Distribution Systems.”
3. Notify Owner at least 24 hours in advance of test.

C. Seal duct systems not specified for pressure testing so leakage during system operation does not exceed 5 percent of required system cfm.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install ductwork in accordance with SMACNA and NFPA. All ductwork indicated on the Drawings is schematic. Therefore, changes in duct size, duct configuration, and location may be necessary to conform to field conditions. Duct sizes shown on the Drawings are nominal inside dimensions. Where liner is provided, dimensions of metal duct shall be increased to accommodate insulation thickness to provide inside dimensions as shown.

B. Make all ductwork airtight. Seal flanged joints with closed-cell neoprene gaskets compressed between mating flanges. Seal all other joints and seams with liquid or mastic type sealants. Taped joints are not permitted. All joints, both transverse and longitudinal, shall comply with the requirements of SMACNA Seal Class A.

C. Install filters in filter banks, flat configuration. Secure filter sections in racks with airtight seals between filter sections and at perimeter of filters to prevent bypass of unfiltered air. Install filters for service access as shown on the Drawings.

3.02 TESTING

A. Perform tests as specified in Section 238110.

B. Provide duct test holes with patches in ducts where directed or necessary for testing and balancing purposes.

3.03 METAL DUCTWORK SCHEDULE

A. Unless otherwise indicated, all HVAC systems exterior supply and exhaust air ductwork material for supply air shall be 304 SST. Interior ducts shall be aluminum.

B. All ductwork shall be fabricated in accordance with SMACNA Standards requirements for medium pressure ductwork and shall conform to 6-inch w.c. positive and negative pressure regardless of actual working pressure of the HVAC systems.

END OF SECTION

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Flexible Connections

B. Roof Hood

C. Manual Dampers

D. Motorized Dampers

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 230500, Acceptable Manufacturers.

2.2 FLEXIBLE CONNECTIONS

A. Provide flexible connections at all duct connections to fans, where ducts of dissimilar metals are connected, and where shown on the drawings.

B. For round ducts, the flexible material shall be secured by zinc-coated, iron clinch type draw bands.

C. For rectangular ducts, the flexible material shall be locked to metal collars which shall be connected to the duct using normal duct seam construction methods.

D. Install flexible connections with sufficient slack to permit 2 inches of horizontal or vertical movement of ducts or equipment at flexible connection point without stretching the flexible material.

E. Where installed exposed to outside weather, provide a galvanized "hat" channel protecting top and vertical stretches of flexible connector from sunlight and weather.

2.3 ROOF HOOD

A. Type: Rectangular aluminum, for rooftop curb mounting. Greenheck, Fabra Hood or approved.

B. Housing: Hood shall be constructed of minimum 16 gauge aluminum with galvanized steel support members. Provide ½" mesh birdscreen in fan discharge.

C. Roof Curbs: Provide factory roof top curb for mounting of hood. Shall be constructed of minimum 18 gauge galvanized steel or 0.064-inch thick aluminum of all -welded construction, with top wooden nailer held in place by metal wrap-around, and internally insulated with minimum ½-inch thick rigid fiberglass. Size of curb shall match hood. Provide with built-in cant and step height (to allow for roof insulation), as required to match roof.

2.4 MANUAL DAMPERS

A. Dampers shall be fabricated of galvanized steel, two gages heavier than duct in which installed.

B. Maximum blade width is 12 inches; fabricate multi blade dampers with opposed blade pattern for ducts larger than 12" x 48".

C. Damper regulator sets shall have quadrant dial regulator with locking nut, square end bearing one side, and spring round end bearing other side (small sizes) or open end square bearing (larger sizes), axis of blade the long dimension. Regulator sets shall be Duro Dyne Model numbers as follows:

Max. Blade Dimension	Duro-Dyne Regulator Set	Shaft Size
10" and less	KS 145, 145L	1/4"
11" to 14"	KSR 195, 195L	3/8"
15" to 23"	SRS-388, SB-138, KP105	3/8"
24" and larger	SRS-128, SB-112, KP105	1/2"

D. Multiple blade dampers shall have individual quadrants for each blade or one quadrant with interconnected blades.

E. Flush mounted concealed type damper quadrants shall have prime paint finish, and shall be Ventfabrics No. 666 or Young Regulator Co. No. 301.

2.5 MOTORIZED DAMPERS

A. Ruskin Model CD51 (or equal) low leakage control damper, with blade and jamb seals, Class II (or better) leakage rated, with factory installed actuators and related accessories to operate properly and in accordance with code and listing requirements. Where damper occurs immediately behind a wall inlet/outlet, damper shall be Ruskin Model CD51 (or approved equal), Class 1 leakage rated.

B. Actuator shall be for use with 24 volt AC, 24 volt DC, or 120 volt AC power, and shall be the fail close type (close upon loss of power).

C. Unit shall have a switch package to allow remote indication when the damper is in any position other than full open. Reference Section 230900 for connections and remote indicating devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof hood at locations as shown on the drawings. Install hoods in accordance with Manufacturer's recommendations and instructions. Where hoods are not sized on drawings, select for maximum pressure drop of 0.5" at full flow.

B. Install duct flexible connections at all duct connections to equipment. Installation shall not allow any "grounding" of vibrating machinery to ducts.

C. Provide balancing dampers where shown and as required to perform balancing.

END OF SECTION

SECTION 233400 – FANS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Ceiling Exhaust Fans.

B. Cabinet Exhaust Fans.

C. Sidewall Propeller Fans.

1.2 QUALITY ASSURANCE

A. Fans shall bear the AMCA certified seal unless indicated otherwise.

1.3 SUBMITTALS

A. Submittals shall comply with Section 230500.

B. Submit fan curves showing SP vs. CFM and BHP vs. CFM with system operating point clearly marked.

C. Submit sound power level data showing sound power levels in decibels referenced to 10 watts for each of the eight octave bands (not required for fans under 1500 CFM). Submit sound power levels in sones for fans under 1500 CFM (or decibel values if available).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 230500, Acceptable Manufacturers.

B. Ceiling Exhaust Fans: Nutone, Cook, Greenheck, Acme, Penn.

C. In-line Cabinet Exhaust Fans: Nutone, Cook, Greenheck, Acme, Penn.

D. Sidewall Propeller Fans: Cook, Greenheck, Penn.

2.2 GENERAL

A. Motors: Shall be U.L. listed and as specified in Section 230500. Motors shall have adjustable supports for adjusting belt tension. Provide explosion proof motors in accordance with NEC Class 1 group D standards where indicated on the drawings.

B. Capacity: Fan capacity shall not be less than the values listed in the Fan Schedule on the drawings.

C. Outlets and Inlets: Equipment shall be furnished with attachment angles and/or flanges as required for attaching ductwork flexible connections as shown on the drawings.

D. Fan Types: The type of each fan is indicated on the Fan Schedule, under the "Type" column, and corresponds to the types specified herein.

E. Fan Performance Ratings: Shall be based on laboratory tests conducted in accordance with AMCA Test Codes.

F. Fan Arrangement and Drive: Shall be as shown on the drawings.

G. Electrical: Fan disconnects and motor starters shall comply with Division 26 specifications. Disconnects furnished with fan shall come factory wired to motor.

H. Finish: All fans shall have factory applied enamel finish (manufacturer's standard color) over a rust inhibiting primer base coat.

I. Backdraft Dampers: Provide all exhaust fans with backdraft dampers, constructed of aluminum or galvanized steel, having felt or neoprene lined edges. Shall be "butterfly" type where used on fans with round connections. Backdraft dampers shall be gravity type unless indicated to be motorized type.

J. Weatherproof: Where installed exposed to weather, fans shall have weatherproof enclosure, preventing any wind driven water entry into unit or drive assembly.

2.3 CEILING EXHAUST FANS

A. Type: Ceiling Exhaust fan. Nutone QTXEN or approved.

B. Housing: Shall be constructed of galvanized steel, with inlet and outlet duct connection collars, spring-loaded discharge damper, adjustable mounting brackets for wall or ceiling mounting, and minimum 1/2" – 1-1/2" lb./cubic foot density fiberglass duct liner insulation. Fan shall have access panel allowing access to fan motor and scroll without disturbing fan housing, ductwork, or wiring.

C. Fan Wheel(s): Unit shall have forward curved centrifugal type fan wheel(s). Wheel(s) shall be statically and dynamically balanced. Provide twin fan wheels when indicated on the Fan Schedule or where required to provide capacity indicated.

D. Drive: Fan shall be direct drive, with drive assembly mounted on vibration isolators.

E. Accessories: Provide the following accessories where indicated on the fan schedule or shown on the drawings:

1. Speed Controls: Solid state speed controller allowing speed reduction down to 50% of maximum.
2. Disconnect Switch: Factory mounted on side of cabinet or within unit but so as to be accessible when unit is installed. Disconnect shall consist of switch or receptacle and plug-in power cord assembly; no added field devices shall be needed.

2.4 IN-LINE CABINET EXHAUST FANS

A. Type: In line, centrifugal cabinet fan. Greenheck model CSP or approved.

B. Housing: Shall be constructed of galvanized steel, with inlet and outlet duct connection collars, spring loaded discharge backdraft damper, adjustable mounting brackets for wall or ceiling mounting, and minimum 1/2" 1-1/2 lb/cubic foot density fiberglass duct liner insulation. Fan shall have access panel allowing access to fan motor and scroll without disturbing fan housing, ductwork or wiring.

C. Fan Wheel(s): Unit shall have forward curved centrifugal type fan wheels(s). Wheel(s) shall be statically and dynamically balanced. Provide twin fan wheels when indicated on the Fan Schedule or where required to provide capacity indicated.

D. Drive: Fan shall be direct drive, with drive assembly mounted on vibration isolators.

E. Accessories: Provide the following accessories where indicated on the Fan Schedule or shown on the drawings:

1. Speed Controls: Solid state speed controller allowing speed reduction down to 50 percent of maximum.
2. Disconnect: Factory mounted on side of cabinet or within unit but so as to be accessible when unit is installed. Disconnect shall consist of switch or receptacle and plug-in power cord assembly; no added field devices shall be needed.

2.5 SIDEWALL PROPELLER FANS

A. Type: Axial fan, for sidewall mounting. Greenheck Model S1 or approved.

B. Housing: Shall be constructed of galvanized steel, with factory weather hood and motorized damper. Fan shall have access panel allowing access to fan motor and drive assembly without disturbing fan housing, ductwork, or wiring. Provide bird screen on fan discharge.

C. Fan Wheels: Shall be aluminum or steel, axial type; dynamically and statically balanced.

D. Drive: Fan shall be direct drive, with permanently lubricated motor.

E. Accessories: Provide the following accessories where indicated:

1. Disconnect Switch: Factory mounted on side of cabinet or within unit but so as to be accessible when unit is installed. Disconnect shall consist of switch or receptacle and plug-in power cord assembly; no added field devices shall be needed.
2. Speed Controls: Solid state speed controller, allowing speed reduction down to 50 percent of maximum. Controller shall be for mounting in a standard wall box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fans at locations and as shown on the drawings.

B. Install fans in accordance with Manufacturer's recommendations and instructions.

C. Fans with solid state speed controllers shall have the speed controller mounted on the fan housing unless another location is indicated on the drawings (for use by Balancer).

D. Provide flexible connections in ductwork connections to all fans.

E. Install all fans with vibration isolators so that no sound or vibration is transmitted to the structure. See Section 230548 for vibration isolation specifications.

F. Prior to air balancing, check fans for correct rotation, tighten belts to proper tension, adjust fan rpm to value shown on drawings, and lubricate bearings per manufacturer's recommendations.

END OF SECTION

SECTION 233700 – AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Supply Outlets.

B. Return Inlets.

C. Exhaust Inlets.

D. Louvers.

E. Wall Caps.

F. Roof Hoods and Vents.

1.2 REFERENCES

A. SMACNA HVAC Duct Construction Standards, Current Edition.

1.3 SUBMITTALS

A. Shall comply with Section 230500.

B. Submit product information on all items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 230500.

B. Diffusers, Grilles, Registers, and Door Louvers: Carnes, Anemostat, Titus, Metal-Aire, Krueger, J & J Register, Price, Tuttle & Bailey.

C. Outside Louvers: Ruskin, American Warming and Ventilating, Air Balance, Penn, Dowco, Wonder-Metals, Vent Products.

D. Wall and Roof Caps: Greenheck, Penn, Nutone, Carnes.

E. Roof Hoods and Vents: Pace, Penn, Greenheck, Carnes.

2.2 GENERAL REQUIREMENTS

A. Air outlets shall be of the size, type, and with number of throws as shown on the drawings; and shall match the appearance and performance of the manufacturers' models specified and scheduled on the drawings.

B. Air outlet application shall be based on a noise level of NC 35 maximum.

C. Furnish all necessary screws, clips, duct collars, and transitions required to allow for the air outlet installation and connection to ductwork.

D. Finish: Factory enamel finish, color as selected by Architect/Engineer, except that LSG type and any other wall inlets/outlets used in the same room/area as the LSG shall have brushed aluminum finish.

E. Frame Style: Provide air outlets and inlets with frame style to match ceiling or wall construction installed in. Where supply air outlets or inlets are installed in T-bar ceiling systems, they shall be factory installed in 2' x 2' or 2' x 4' metal panel to match ceiling layout. Where installed against gypsum board surface, brick or similar hard surface or, where exposed, provide with 1-1/4" wide outer border. Where space does not permit installing 2' x 2' metal panel, provide outlets or inlets with 1-1/4" wide outer border. Where air outlets are installed adjacent to surface mounted light fixtures, outlets shall have 4-inch deep drop frames. (See reflected ceiling plan and/or electrical lighting plan for ceiling type and allowable space).

F. Contractor shall measure actual louver wall openings prior to ordering or fabricating louvers. Notify Architect/Engineer of any discrepancy between actual wall opening and specified opening.

G. Ceiling transfer grilles (TG) shall be same as CEG's unless specifically shown otherwise; wall transfer grilles (WTG) shall be same as WEG unless specifically shown otherwise.

2.3 SUPPLY AIR OUTLETS

A. Ceiling Diffuser (CD): Shall be of aluminum or steel construction, have louver face and square neck (integral round neck is acceptable provided that performance equal to specified diffuser is provided). Cores shall be easy snap-in/out core installation - with no tools required. Provide with air flow grid to allow uniform airflow. Grids shall be comprised of a single set of extruded aluminum vanes set on 2/3" centers and tapered to a semi-air-foil shape for greater performance efficiency. Titus TDC.

B. Wall Supply Grill (WSG): Shall be of aluminum or steel construction, double deflection type, with horizontal face bars and vertical rear bars. Unit shall have outer frame borders 1-1/4" wide, gasket to prevent air leakage and minimize smudging. Deflecting bars shall be rigid extruded aluminum of semi-air-foil design, on 3/4" centers. Vertical and horizontal bars shall be adjustable. Titus 300RS.

2.4 RETURN AIR INLETS

A. Ceiling Return Grille (CRG): Aluminum construction, "cube-core" or "egg-crate" type, with 0.025" thick X 1/2" deep strips mechanically joined to form 1/2" x 1/2" x 1/2" cubes, and opposed blade damper operable from face of register. Titus 50F.

B. Ceiling Return Grille – Type A (CRG-A): Steel construction, with 5/16” diameter perforations on staggered 7/16” centers in faceplate. Titus SG-PR.

2.5 EXHAUST AIR INLETS

A. Ceiling Exhaust Grille (CEG): Same as CRG.

B. Ceiling Exhaust Grille – Type A (CEG-A): Same as CRG-A.

2.6 4-INCH DEEP LOUVERS – ALUMINUM BLADES

A. Type: High performance, 4-inch deep, stationary, drainable louvers. Ruskin Model ELF375D or approved.

B. Frame: 4-inch deep, constructed of a minimum 0.090-inch, 6063 extruded aluminum, with integral caulking slots and downspouts in jambs and mullions.

C. Blades: Shall be constructed of minimum 0.081-inch, 6063 extruded aluminum, at 37.5 degree angle, on approximately 3-inch centers, with drain gutter.

D. Bird Screen: Shall be constructed of 1/2-inch mesh, 0.051-inch aluminum.

E. Performance: Nominal free area of 50 percent with pressure drop and water penetration equal to specified manufacturer's model.

F. Wind Loading: Louver shall incorporate structural supports required to withstand a wind load of 30 pounds per square foot.

G. Finish: Provide with standard mill finish.

2.7 WALL CAPS

A. Masonry Walls:

1. For Airflows of 500 cfm and Less: Anodized aluminum brick vent, with birdscreen. 16" wide x 8" high, Greenheck Model No. BV-16x8 or approved equal.
2. For Airflows of 501 cfm up to 1000 cfm: Shall be 4" deep extruded louvers, drainable type, 24" wide x 18" high, Ruskin ELF811D-55 or approved.

B. Non-Masonry Walls:

1. For Airflows of 250 cfm and Less: Wall caps shall be constructed of anodized aluminum, with bird screen and built-in backdraft damper, 10" wide x 3" high, Greenheck Model No. WL-10x3.
2. For Airflow of 251 cfm up to 500 cfm: Wall caps shall be constructed of anodized aluminum, with bird screen and built-in backdraft damper, 16" wide x 8" high, Greenheck Model No. WL-18x6.
3. For Airflows of 501 cfm up to 1000 cfm: Shall be 4" deep extruded louvers, drainable type. 24" wide x 18" high, Ruskin ELF375DX or approved.

2.8 ROOF CAPS

A. Type: Small fan roof caps, Penn "Zephyr" accessory type, or approved.

1. Sloped Roof:

a. 250 cfm and less: Penn SL20.
b. 251 to 800 cfm: Pen Sl30.
c. Greater than 800 cfm: Use multiples of Penn SL90 or Sl30.

2. Flat (or low slope roof) Roof, or where curb is used:

a. 250 cfm and less: Penn 11FR.
b. 251 to 800 cfm: Penn 15FR.
c. Greater than 800 cfm: Use multiples of Penn 11FR and 15FR.

B. Construction: Aluminum construction, with integral bird screen and minimum 6" wide flashing collar all around. Where installed on roof curbs (reference drawings), provide with turned-down cap flashing to go over curb.

C. Size: Cap throat shall be sized to provide same free area (or more) as connecting ductwork.

D. Roof Curb: Shall be constructed of minimum 18 gauge galvanized steel or 0.064-inch thick aluminum, of all-welded construction, with top wooden nailer (as required by roof/flashing type) held in place by metal wrap-around, and internally insulated with minimum 1/2-inch thick rigid fiberglass. Size of curb shall match roof vent and/or extended base used with. Provide curb type (i.e., with built-in cant, base flashing, step height to allow for roof insulation, etc.) as required to match roof type (coordinate with Roofing Contractor). Greenheck Model GPR, GPS, GPF, or approved equal.

2.9 ROOF VENTS

A. Construction: Roof vents shall be constructed of aluminum or fiberglass, and shall be designed for mounting on roof curbs. Roof vents shall have 1/2" mesh 19 gauge galvanized steel bird screen. Greenheck Model GFH, Model GRS, or approved.

B. Finish: Fiberglass, or fiberglass coated metal, color gray unless indicated otherwise.

C. Size: Roof vents shall be of size, and maximum pressure drop as shown on the drawings.

D. Curb: Furnish with insulated roof curb, constructed of minimum 18 gauge steel or 0.064" aluminum, to match roofing system. Provide aluminum curb on aluminum roof vents. Greenheck Model GPR, Model GPF, or approved.

E. Provide screened openings (s.o.) on all duct openings where indicated and where openings do not have grilles or registers. Screen shall be 1/2" mesh, 19 gauge galvanized steel wire.

2.10 FAN WEATHER CAP

A. Type: Stationary ventilator, Greenheck "GS" type, or approved equal.

B. Construction: Roof cap shall be constructed of galvanized steel, minimum 28 gauge up through 12 inch diameter throat size and 26 gauge on larger sizes. Cap shall have deep wind band for weather protection, heavy gauge braces, bottom storm baffle, bird screen (1/2-inch mesh), and be of all-welded construction.

C. Size: Cap throat size shall match connecting duct size as shown on the drawings.

2.11 FAN ROOF CAPS

A. Type: Small fan roof caps, Penn "Zephyr" accessory type, or approved.

B. Construction: Aluminum construction, with integral bird screen. Where installed on roof curbs (reference drawings), provide with turned-down cap flashing to go over curb.

C. Size: Cap throat shall be sized to provide same free area (or more) as connecting ductwork.

2.12 DRYER VENT CAPS

A. Dryer Vent Caps: Shall be of aluminum construction with integral backdraft damper. Nutone No. 885-AL (wall) or 841-AL (roof) or custom fabricated type to suit application. Provide painted finish to match adjacent surface area color.

2.13 MISCELLANEOUS

A. Goosenecks: Shall be made of minimum 18 gauge galvanized steel, in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, and as shown on the drawings.

B. Screen: 1/2-inch mesh, constructed of either 0.051-inch aluminum wire or 19-gauge galvanized steel wire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air outlets in locations shown on the drawings and so as to conform with architectural features and lighting arrangements.

B. Paint ductwork which is visible behind air inlets and outlets flat black.

C. All outlets and inlets exposed to the weather shall be adequately flashed and installed in a manner to assure complete weatherproofness.

D. Sealing and caulking of all outlets and inlets exposed to the weather shall conform to Division 7 requirements.

E. Provide screened openings (SO) on all duct openings where indicated and where openings do not have grilles or registers.

F. Coordinate with the Division 9 Contractor for any necessary painting of air inlets/outlets/louvers/etc. prior to installation.

END OF SECTION

SECTION 238110 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC) **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 WORK IN THIS SECTION

A. Scope: This section covers supply and installation of heating and ventilation equipment as shown on the Drawings and as specified herein.

B. Equipment List: See Heating and Ventilation schedule at the end of this section.

1.02 SUBMITTALS

A. Submittals shall be provided in accordance with Section 013300 – Submittal Procedures, and shall include the following:

1. Manufacturer's certificates of conformance and certified copies of test reports.
2. Documentation Including: Name of manufacturer, type and model, design rotative speed, BHP, rated motor HP, performance characteristics including capacity and pressures, materials used, weight of assembled unit, list of accessories to be furnished with unit, finish, and voltage.
3. Fabrication drawings for supports, vibration isolators, and similar items especially fabricated for this installation.
4. Complete assembly and installation drawings for all rotating equipment.
5. Layout showing type, spacing, maximum loads, and materials of hangers supports.
6. Calculations for design of all hangers, supports, seismic anchorage and bracing.
7. Electrical and control requirements and wiring diagrams, demonstrating coordination and interconnections with other system components and devices.
8. Manufacturer's warranty statements.
9. Operating and Maintenance Manuals (by the equipment supplier) for all pieces of equipment shall be submitted in conformance with this section.

1.03 PAYMENT

A. No separate or additional payment will be made for the work specified herein. All costs for heating, ventilation, and air conditioning, as specified herein, shall be included in the appropriate lump sum price bid.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Refer to Table 238110-1, Equipment Schedule, for acceptable manufacturers for each type of equipment.

B. Filters: Farr 30/30, American Air Filter or approved substitute.

C. Should equipment which differs from these Specifications be offered and determined to be the approved equal of that specified, such equipment will be acceptable only on the basis that any revisions in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc. required to accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer.

2.02 GENERAL

A. Electric Motors:

1. Motors shall conform to requirements in the Washington Energy Code and the following:

   a. Type: Squirrel cage, low starting current, induction type with starting torque characteristics suitable for equipment served. Constructed and rated in accordance with latest NEMA motor standards.
   b. Guards: Heavy sheet metal OSHA approved drive guards with 2-1/2-inch-diameter access openings at shaft ends for speed counter.

B. Vibration Isolators: All HVAC equipment shall be provided with vibration isolation (see Paragraph 3.03.G).

C. All fans shall bear the AMCA Certified Ratings Seals for Sound and Air Performance.

D. Where there is contact between dissimilar metals, provide insulators to prevent galvanic corrosion.

E. All fasteners shall be 316 stainless steel.

F. Filters and Housing:

1. Required at all air intake louver locations.
2. Camfil Farr 30/30 Two-inch, throw-away filters.
3. Filters shall be provided with single stage side-access filter housing constructed of 16-gauge galvanized steel with predrilled standing flanges to facilitate attachment to other system components. Filter housing shall not be used to support other system components.
4. Filters shall be sized to the intake louvers or connecting ductwork.
5. Filter housing shall be 4p glide/pack by Camfil Farr, or approved equal.

G. Electric Heaters:

1. Heaters shall be furnished and installed where shown and as specified herein. All units shall be heavy duty and rated for continuous service.
2. Where indicated, heaters shall be controlled from wall-mounted thermostats furnished under this section.
3. Electric heaters shall have built-in magnetic contactors and safety devices to meet UL listing, National Electrical Code, and local regulations.
4. All heaters shall be UL or ETL listed.
5. Heater capacity and size shall be as specified or shown in the table at the back of this section.

H. Fans:

1. Location, type, capacity, and motor horsepower shall be as specified or shown.
2. All units shall be heavy duty, rated for continuous 24 hours per day service and of totally enclosed (waterproof) design.
3. Fans shall be complete with motors, flexible connections to supply and suction ducts, vibration isolators, and necessary accessories.
4. Aluminum 1/2-inch mesh screen across fan inlet.
5. Padlockable safety disconnect switch mounted in motor compartment.
6. Integral self-resetting overload protection on motors.
7. Fans shall be furnished with back draft dampers where indicated. All exposed fan propellers located 8 feet or less above working floor elevation, or otherwise easily accessible, shall be provided with a finger-proof wire guard.
8. All fans shall be UL listed.
9. For louver specifications, see Section 089000 – Louvers – Schedule B Only.
10. Materials of Construction:

    a. Unless otherwise indicated, all fans shall be constructed of the following materials:
    b. Shafts: High strength aluminum or stainless steel.
    c. Impeller: Aluminum or steel.
    d. Housing: Aluminum or steel.
    e. Impeller Rotation: Stamp clearly proper direction of rotation.
    f. Balancing: Dynamically and statically balanced.
    g. Bearings shall be prelubed or pressure lubricated, antifriction, self-aligning ball and/or roller bearings.

2.03 ELECTRIC FAN FORCED UNIT HEATERS

1. Unless otherwise shown, all unit heaters shall be of the electric, horizontal discharge type, with enameled steel cabinet, mounting bracket, adjustable two or four-way louvers, spiral finned, enclosed heating element, automatic reset overheat protection, thermal-protected permanently lubricated fan and motor, fuses, and contactors.
2. Heat radiation fins shall be corrosion resistant or stainless, furnace brazed steel.
3. Unit heaters shall be supplied with wall-mounted thermostats where indicated or integral low voltage thermostats (when wall thermostat not shown).
4. The heaters shall be equipped with control transformers.
5. Integral heavy-duty contactors and local disconnect shall be included.
6. Heater fans shall be dynamically balanced.
7. Electric characteristics shall be in accordance with the Heating and Ventilation schedule.
8. Corrosion Resistant Unit Heaters:

    a. As indicated in the equipment schedule in the back of this section.
    b. All necessary safety and temperature controls shall be included in a single package.
    c. Single point electrical hook-up.
    d. Stainless steel construction, epoxy-coated aluminum fan blade, and nonmetallic NEMA 4X terminal enclosure resist corrosion found in sewage treatment plants.
    e. Washable/Watertight.

9. All unit heaters shall be as manufactured by Indeeco, King, Chromalox, or equal.

2.04 DUCTLESS SPLIT SYSTEM HEAT PUMP (ELECTRICAL ROOM)

A. Split system heat pumps shall be Mitsubishi PEAD and TPEFY series for the two Electrical Rooms and one Mechanical Room.

B. Rated Corrected Capacity: Refer to Table 238110-1.

1. Features shall include zone control; automatic fan speed control; hard-wired, wall-mounted remote controller (PAR-21MAA); and auto changeover for cooling and heat.
2. Refrigerant Type: 410a.
3. Air filter on indoor unit made of honeycomb polypropylene.
4. Noise Level: 43-49 dB (at 3 feet).5.
5. SEER/EER: 14/6.8.
6. HSPF/COP (47 Degrees F): 9.3/3.0.
7. Warranty: 5 years on parts and defects, 7 years on compressor.
8. Electrical requirement 208 V single phase.
9. Electrical Contractor to provide 240 V fused disconnect switch sized to interrupt the available fault current.
10. electrical Room split system to be set to only provide room heating, not cooling.
11. Mitsubishi wall thermostats shall be hard wired to the unit control system. Wireless not acceptable.

2.05 ELECTRIC WALL FAN FORCED HEATERS

1. Arranged for horizontal air distribution.
2. Constructed of 20-gauge electro-galvanized steel.
3. Low surface temperature electric heating coils with sheath elements inserted in finned-tube coils.
4. Factory wiring shall include operating and safety controls required by UL and NEC, and carry the UL label.
5. Direct-drive, shaded pole motor with oil-lubricated sleeve bearings and built-in thermal overload protection.
6. Single-power supply connection.
7. Integral thermostat.
8. Capacity: As scheduled.

2.06 RESTROOM CEILING FAN

A. Ceiling mounted exhaust fan shall be direct driven.

B. Housing shall be constructed of heavy-gauge galvanized steel.

C. Housing interior shall be lined with 1/2-inch acoustical insulation.

D. Fan wheel shall be of the forward-curved centrifugal type and dynamically balanced.

E. Return grille shall be constructed of aluminum.

F. Access for wiring shall be external.

G. Mounting shall be on vibration isolators.

H. Provide a hooded wall cap for exhaust air termination.

1. Provide ductwork from fan to the wall cap.
2. Wall cap shall be constructed of aluminum.
3. Wall cap shall be designed for outside wall applications.
4. Built-in bird screen and damper.

I. Fan shall bear the AMCA Certified Ratings program AMCA sound and Air Performance seal.

J. Fan shall be UL Listed.

K. Capacity: As scheduled.

L. Acceptable Manufacturers:

1. Greenheck Fan Corporation, SP Series.
2. Loren Cook Company, Gemini GC Series.
3. Or approved equal.

2.07 CENTRIFUGAL INLINE FANS

A. Drive: Direct-driven fan suitable for duct mounting, as scheduled.

B. Fan and Motor Housings:

1. Square, aluminum arranged for horizontal discharge and shall include square duct mounting collars.
2. Fan Wheel: Aluminum, backward-inclined, and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances.
3. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel.
4. FAN-3 and attached accessories shall be coated with Hi-Pro Polyester powder coating or equal to protect against corrosion.

C. Noise Level: Sound level shall be 76 LwA or less and 65 dBA or less at duty point.

D. Motor (FAN-1 and FAN-3):

1. Motor shall be a dc electronic commutation type motor specifically designed for its application, FAN-1 Single speed motor and FAN-3 variable-speed motor.
2. Motor shall be permanently lubricated with heavy duty ball bearings to match fan load and prewired to the specific voltage and phase.
3. Internal motor circuitry shall convert ac power supplied to the fan to dc power to operate motor.
4. FAN-3 - Motor shall be controllable down to 20 percent of full speed.

a. Speed controls shall be integral to the fan and require only a single point of connection for the entire motor/fan/controls assembly.

b. Contractor shall furnish a thermostat that is compatible with the unit and meets the requirements listed within this specification.
c. Motor shall be Vari-Green or equal.

E. Capacity: As scheduled.

F. Acceptable Manufacturers:

1. Greenheck Fan Corporation, SQ Series.
2. Loren Cook Company, SQND Series.
3. Or approved equal.

2.08 INSTRUMENTS

A. All control system components shall be of the latest, state of the art, in manufacture and performance.

B. All necessary control, power, time delay relays, and control transformers shall be provided to make a complete and operable system as called for in the Sequence of Operation.

C. Thermostat:

1. Capillary coil sensor type.
2. Adjustment Range: 45 degrees F to 90 degrees F.
3. Located as indicated on the Plans.
4. Provide insulation between wall and thermostat.
5. Shall be compatible with the equipment it controls.
6. Minimum deadband of 3 degrees.
7. Steel case.
8. Mounting height shall be 5 feet above finished floor.
9. Designed for commercial and industrial applications.
10. UL and SA listed.

PART 3 – EXECUTION

3.01 CODES, ORDINANCES, STANDARDS AND PERMITS

A. Comply with all local, state, and national code restrictions and requirements. In case of conflict between the Contract Documents and a governing code, the higher standard shall prevail. Extra payment will not be allowed for work or changes required by local code enforcement authorities.

3.02 SEQUENCE OF OPERATION

A. Fans 1 runs continuously at one speed. Fan 2 runs off wall switch in WC. Fans 3 runs at low speed typically, but when Mechanical Room thermostat senses a temperature of 80 degrees or more the fan ramps up to maximum speed speed.

B. WH 1, 2, and 3 turn on when temperature in the room drops below 52 degrees F and turn off when temperature in the room reaches 65 degrees F.

C. HTR 1 turns on when Mechanical room thermostat measured temperature drops below 45 degrees and turns off when room temperature reaches 50 degrees.

D. Electrical Room shall be heated and cooled with a package split system AHU-1 and CON-1. Heating and cooling is provided based on the temperature differential between the set point and the actual temperature reading per the room sensor. Room temperature to be between 60 degrees F and 78 degrees F. AHU 1 shuts down when there is fire detected in this zone.

3.03 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's requirements. Units shall be level and aligned as shown on the Drawings. Units shall be installed in locations shown on Drawings and as detailed. Units installed inside the building need not be weather tight. Units shall be supported and braced as required or as detailed on the Drawings and to be level and aligned as shown on the Drawings. Power hook-up shall be by the Contractor.

B. Location and Access: Observe good common practice in locating and installing mechanical equipment and accessories so that completed installation presents the least possible hazard. Maintain adequate clearances to all fixtures, valves, and equipment so as to permit ready access to all parts requiring adjustments, inspection, service, and repair. Installation of any equipment with less than minimum clearances indicated by manufacturer as required for proper maintenance will not be accepted.

C. Connections: Indicated equipment connections are necessarily based on equipment of a given manufacturer. Contractor assumes responsibility for proper arrangement of ducts, pipes, valves, power connections, etc., to connect approved equipment in a proper and approved manner. Follow equipment manufacturer's detailed instructions and recommendations in the installation and connection of all equipment. No equipment installation or connections shall be made in manner that voids the manufacturer's warranty. In line fans shall have flexible ducting connections at both ends.

D. Miscellaneous Hardware: Provide all required trim including sturdy and adequate bases or support systems, braces, supports, inserts, flashing, floor, ceiling and wall plates, valves, fittings, sleeves, accessories, etc., necessary for a complete installation.

E. Motor Starters:

1. General: Furnish each motor with starter or switch where starters are not included in motor control centers, as approved and recommended by manufacturer of motor or equipment of which motor is a part.
2. Labeling: Label all mechanical equipment starters and switches with equipment identification name and mark number. Use Bakelite labels.

F. Drives and Guards:

1. Direction of Rotation: Before installing, check motor direction of rotation against that marked on driven equipment.
2. Clearances: Maintain proper clearances between stationary and rotating parts.

G. Vibration Isolators:

1. General: Mount all rotating or reciprocating mechanical equipment to be isolated from the building structure by vibration isolators.
2. Type A Mounting: Required where equipment is mounted on elevated floors, walls, or roofs. Type A mounting shall be double deflection neoprene mountings having a minimum static deflection of 0.35 inches.

3.04 TESTING

A. Subsequent to installation, the Contractor shall perform functional tests and start-up for a minimum period of three days with various thermostat settings to ensure proper operation over the full design range.

B. When functional tests are complete, a final air balance test and report shall be submitted. Testing shall be done by a certified test and balancing engineer.

3.05 FINAL ADJUSTMENTS

A. Direction of Rotation: Check direction of equipment rotation against that marked on it.

B. Alignment: Check and adjust alignment between motor/drive/equipment.

C. Bolt Tension: Check and tighten as required.

D. Fan Systems:

1. Adjust and balance all portions of the systems to produce indicated or specified results within the limits of minus 5 percent or plus 10 percent or as subsequently directed by Engineer.
2. Record: Submit complete record of all data concerned with testing and balancing to Engineer.
3. Required Data: Minimum information includes exact motor loadings, fan RPM and drive sizes, airflow in CFM at all ventilation openings, and outdoor weather conditions at time of test.

E. Training: Provide 3 hours of on-site training to operators on system operation, maintenance, and troubleshooting.

Table 238110-1. Heating and Ventilation Equipment Schedule

Equip. No.	Description	Heating Capacity (BTU/Hr)	Cooling Capacity (BTU/Hr)	CFM	Voltage	Phase	Mounting Height (Base)	Equipment Model	Remarks
FAN-1	Elec/Control Rm Exhaust Fan			300	120	1	See Drawings	Greenheck SQ-90-VG	0.25 HP; SP = 0.35 inch w.c.
FAN-2	Restroom Exhaust Fan			50	120	1	Ceiling Mount	Greenheck SP-B50-QD	SP = 0.13 inch w.c.
FAN-3	Mechanical Room Exhaust Fan			500/1230	120	1	8’-6”	Greenheck SQ-100-VG	0.5 HP; SP = 0.5 inch w.c. with Wall Thermostat Variable speed
HTR-1	Rest Room Wall Heater	0.75 kW		65	120	1	3’-0”	King PZ1207	Integral thermostat
HTR-2	Control Room Wall Heater	1.0 kW		65	120	1	3’-0”	King PZ1210	Integral thermostat
HTR-3	Equipment Room Wall Heater	1.0 kW		65	120	1	3’-0”	King PZ1210	Integral thermostat
AHU-1	Electrical Room Split System Air Handler	14,000	12,000	385	208	3	8’-0”	Mitsubishi TPKA0A0121LA00A	MCA 1, Ceiling Mount
CON-1	Electrical Room Split System Condenser	14,000	12,000	385				Mitsubishi TPKA0A0121KA70NA	MCA 11, Pad Mount
HTR-4	Mechanical Room Unit Heater	10.0 kW			208	3	9’-0”	INDEECO TRIAD 234-U11N-0100U	Washdown/ Corrosion Resistant Unit Heater. Integral thermostat.

END OF SECTION

SECTION 238300 – ELECTRIC SPACE HEATING EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Radiant Electric Heaters.

1.2 QUALITY ASSURANCE

A. Units shall be UL listed and labeled.

1.3 SUBMITTALS

A. Submittals shall comply with Section 230500.

B. Provide complete product information submittals on all units; include heater capacities; electrical requirements (voltage, amps); and information on all accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 230500, Acceptable Manufacturers.

B. Infrared Radiant Heaters: King, Cadet, BBC Industries.

C. Radiant Cove Heaters: King, Qmark.

2.2 GENERAL

A. General: Unit shall provide equivalent performance and capacity to scheduled units and shall have equivalent or superior features (not all such features are specifically listed in this section). Unit shall be factory assembled, factory tested, self-contained package, ready for field connection of ductwork, plumbing, and electrical services.

B. Capacity: Unit capacity shall not be less than the values listed in the Electric Heater Schedule on the drawings.

C. Heater Types: The type of each unit is indicated on the Electric Heater Schedule, under the "Type " column, and corresponds to the types specified herein.

D. Electrical: Unit disconnects shall comply with Division 26 specifications. Disconnects furnished with unit shall come factory wired to unit. Thermal overload protection shall be furnished for each unit. Unit shall be provided with knockouts for field wiring entrance or with factory-wired cabling for field connections.

E. Finish: All units shall have factory applied enamel finish (manufacturer's standard color) over a rust inhibiting primer base coat.

2.3 INFRARED RADIANT HEATER

A. Type: Radiant electric heater, for overhead mounting. BBC Industries Thermazone series or approved.

B. Construction: Infrared heater shall be designed to radiate heat across entire surface. Panel shall require no reflector. Heater shall have modular design and packaged controls.

C. Accessories: Provide the following accessories where indicated:

1. Disconnect Switch: Factory mounted on rear or side of cabinet or within unit but so as to be accessible when unit is installed. Disconnect shall consist of switch or receptacle and plug-in power cord assembly; no added field devices shall be needed.
2. Temperature Controls: SPDT line-voltage thermostat. Thermostat shall be for mounting in a standard wall box.

2.4 RADIANT COVE HEATERS

A. Type: Radiant electric cove heater. King KCV series or approved.

B. Construction: Shall be constructed of extruded aluminum, with factory mounting tabs. Rear of casing shall be rated for zero clearance to combustibles.

C. Heating Elements: Shall consist of insulated electric resistance wire affixed to radiating surface of panel.

D. Accessories: Provide the following accessories where indicated:

1. Disconnect Switch: Factory mounted on rear or side of cabinet or within unit but so as to be accessible when unit is installed. Disconnect shall consist of switch or receptacle and plug-in power cord assembly; no added field devices shall be needed.
2. Temperature Controls: SPDT line-voltage thermostat. Thermostat shall be for mounting in a standard wall box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install heaters at locations and as shown on the drawings.

B. Install heaters in accordance with Manufacturer's recommendations and instructions.

END OF SECTION

SECTION 260126 - MAINTENANCE TESTING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Bidding documents including Division 1 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

B. Perform tests of the electrical system to assure NEC, WAC, WSNREC code compliance and proper system operation according to the intent of the contract documents.

C. Applicable Codes, Standards & References for Tests:
All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.

1. National Electrical Code - NEC
2. National Electrical Manufacturer's Association - NEMA
3. American Society for Testing and Materials - ASTM
4. Institute of Electrical and Electronic Engineers - IEEE
5. National Electrical Testing Association - NETA
6. American National Standards Institute - ANSI
7. Washington Administrative Code - WAC
8. Insulated Cable Engineers Associate - ICEA
9. Association of Edison Illuminating Companies – AEIC
10. Washington State Non-Residential Energy Code - WSNREC

1.2 CIRCUIT TESTS

A. Contractor shall perform routine insulation resistance, continuity and grounding tests for all distribution and utilization equipment prior to connection and energization. A standard megger-type instrument shall be used to demonstrate insulation values are acceptable, ground system is continuous and the neutral system is isolated from the grounding system except at the electrical systems' single ground point.

B. System defects, indicated by the circuit tests, shall be corrected by the Contractor. Tests and corrections shall be repeated by the Contractor until satisfactory results are obtained.

1.3 GROUNDING TEST

A. Measure the ohmic value of the Electrical Service Entrance "System Ground" with reference to "Earth Ground" using multiple terminal, fall of potential methods and suitable test instruments.

B. Maximum resistance to ground shall be less than 10 ohms unless lower values are specified in the contract documents. Notify the Architect/Engineer if this resistance value is not obtained for the initially installed system. Contractor shall provide corrective measures required to reduce ground resistance to less than 10 ohms.

1.4 MOTOR AND EQUIPMENT TESTS

A. Request and obtain approved mechanical shop drawing submittals prior to electrical rough in and notify Engineer of any discrepancies.

B. Verify proper rotation of all motors before placing into service.

C. Measure and record electrical data for each motor installed under this contract. Data shall include these items:

1. Motor description
2. Controller description
3. Motor nameplate amperes
4. Actual measured motor running amperes
5. Overload heater manufacturer and catalog numbers
6. Overload heater ampere range
7. Voltage (measured) and phase

D. Motor controller overload heaters shall be sized to the actual motor nameplate full load current; do not oversize overload heaters.

1.5 PHASE BALANCE TESTS

A. Verify the balance of the electrical system's phase currents. Reassign load connections necessary to obtain a balance acceptable to the Electrical Inspector and Engineer.

1.6 WSNREC – Systems Commissioning – C408

A. Perform and document WSNREC systems commissioning requirements for lights, lighting controls and switched receptacles.

PART 2 - PRODUCTS

2.1 MATERIALS AND INSTRUMENTATION

A. Contractor and/or testing agency shall supply all apparatus and materials required for indicated tests.

B. Contractor shall include all costs associated with testing in bid proposal.

2.2 TEST REPORT(S)

A. Furnish electronic PDF copy of test reports and documentation for inclusion into the project operation and maintenance manuals. Each test report shall include the following items:

1. Name, address and telephone number of the testing agency.
2. Name(s) of personnel conducting the tests
3. Type of test
4. Description of test procedure
5. List of items tested
6. List of actual test equipment including make, model(s), serial number(s) and calibration date(s) as applicable.
7. Test results
8. Conclusion and recommendations
9. Appendix, including appropriate test forms

B. Provide test reports for all tests listed above in paragraphs 1.3, 1.4, 1.5 and 1.6.

PART 3 - EXECUTION

3.1 TESTING PROCEDURE

A. All tests shall be conducted according to applicable industry standards.

3.2 SCHEDULING

A. Notify Architect/Engineer and Owner at least five (5) working days prior to performance of any recorded test.

END OF SECTION

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. Bidding documents including Division 1 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

B. General requirements for materials and installation methods.

1.2 DEFINITIONS

A. The term "provide" shall mean furnish, install and connect equipment and materials complete in operating condition.

B. The term "approved" as used herein shall mean the written approval of the Engineer.

C. The term "Contractor" as used herein shall mean the organization responsible for accomplishing all work within the contract documents. The plural term "contractors" as used herein shall include all of the trade organizations that comprise the project workforce.

D. The term "drawings" as used herein shall mean all contract drawings for all divisions of work.

E. The term "code" as used herein shall mean all applicable National, State and local codes.

1.3 SCOPE OF WORK

A. The Electrical work consists of furnishing, installing, testing and placing in satisfactory operation all equipment, materials, devices and appurtenances, necessary to provide complete systems according to the intent of the Drawings and Specifications. In general this includes all labor, materials, equipment, tools, etc. to complete the electrical work.

B. Electrical work requirements and products are not limited to electrical drawings and specifications. There is additional electrical work required to be included in the bid, indicated on the architectural, landscape, civil and mechanical drawings and respective specification sections. Contractor shall review all civil, landscape, architectural, structural, mechanical drawings and specifications for additional electrical information prior to bid and include the necessary costs to complete the electrical work in the electrical bid.

C. Contractor shall coordinate with OHOP Mutual and Rainier Connect. Provide for their services (power/communications) to the site and project in the electrical bid.

1.4 INTENT OF DRAWINGS

A. The Electrical drawings are intended to serve as working drawings for general layout. Equipment, receptacles, tele/data, fire alarm, switches, panels, lights, lighting controls, disconnects and raceways are partially diagrammatic and do not necessarily indicate actual routings or all appurtenances required for a complete installation. Do not scale electrical drawings. Take all measurements from field measurements.

B. The drawings and specifications are complementary. What is called for in either is binding as if called for in both. In case of conflict within the drawings, specifications or between drawings and specifications the Architect/Engineer will select the method to be taken. Contractor shall have assumed prior to bid most expensive method is to be used and included in the bid.

C. Take all working dimensions, device heights, door swings and the like from architectural drawings and check them against device locations or heights shown on the electrical drawings. In the event of conflict, report discrepancies to the Architect/Engineer for resolution before proceeding with the rough in work. Do not scale electrical drawings.

D. Minor changes in the locations of raceways, devices and the like, from those shown on the plans, shall be made without extra charge if so directed by the Architect/ Engineer before installation.

E. Motor horsepower and apparatus wattages indicated on the plans are estimated requirements of equipment furnished under other Divisions of this contract. Contractor shall review all approved equipment shop drawings prior to rough in. Advise the Architect/Engineer in writing of any deviations in actual equipment supplied affecting the electrical installation.

1.5 MANUFACTURERS' RECOMMENDATIONS

A. Make all installations in strict accordance with manufacturers' published recommendations, approved shop drawings and details. All equipment and materials recommended by manufacturer shall be considered as part of this contract.

1.6 WORK RELATED TO OTHER DIVISIONS

A. TEMPORARY CONSTRUCTION POWER & LIGHTING

1. Arrange with the serving Utility (OHOP Mutual (253) 847-4363) for 120/240 Volt or 208Y/120 Volt service adjacent to construction site.
2. Contractor is responsible for all costs associated with setup and removal of the temporary construction equipment.
3. Provide, maintain and remove, when no longer required, temporary electrical construction wiring from the construction service meter to and within the building for the number of lights and receptacles required. Wiring to construction sheds, outdoor construction machinery, and temporary exterior work areas shall be the responsibility of individual contractors.
4. Provide construction lighting with portable wiring and temporary energization of the permanent building wiring, complete with lamps. Suitable construction lighting shall be

provided in each room where lighting is required for any of the contractors on the job. See NEC ARTICLE 590. Temporary wiring.

5. Provide adequate feeders, circuit breakers and duplex 15-ampere 120-volt receptacles at locations as required. Note: 120 volt construction receptacles shall provide Ground Fault circuit protection in accordance with applicable WISHA safety standards.
6. Portable power cords from the outlets specified herein shall be the responsibility of individual contractors using the cords.
7. Responsibilities outlined in the Paragraph Temporary Construction Power and Lighting are delineated herein to avoid conflicts between the various contractors. Assume all responsibility for safety, Electrical and Safety Code compliance, performance and adequacy of the construction power and lighting installation. The Architect and Engineer assumes no responsibility for the performance or safety and will not inspect nor design this temporary installation as it is not part of the completed structure.

B. MECHANICAL CONTROL WIRING

1. See Division 23.

C. EQUIPMENT FURNISHED BY OTHERS

1. All electrical equipment furnished for this project shall be coordinated with the drawings to insure correctness of Voltage, Phase and Ampacity. Equipment served by single circuit or feeder shall be provided with appropriate internal wiring including fusing of multiple circuits.
2. Contractors supplying equipment incompatible with the designed electrical service voltage or phase shall be responsible for arranging and providing necessary changes in their supply wiring to suit the equipment.
3. Contractor prior to equipment rough-in shall verify (request approved shop drawings) dimensions of equipment to be furnished by others to insure correct clearances, connections and UL labeling.
4. Control Voltages shall not exceed 120 volts. Contractor supplying equipment shall provide control transformers for higher line voltages for connection by electrical contractor or equipment manufacturer. Control transformers shall be connected from phase to neutral.

1.7 SUPERVISION AND COORDINATION

A. Coordinate work with local power (OHOP Mutual 253-847-4363), telephone, cable and data (Rainier Connect 253-683-4100) utilities to ensure compliance with their specific requirements. Before starting work, contact both power and communications utilities and make arrangement for their services to this project.

B. Contact Washington State Labor and Industries Electrical Inspection. Obtain and pay for permit before starting work.

C. Maintain adequate supervision of the Division 26 work and have a responsible person in charge at the site any time work is in progress or when necessary for coordination with other trades.

D. Schedule work to best serve the interests of the Owner. Do not scale electrical drawings. Lay

out work by referring to Civil, Landscape, Architectural, Structural, Mechanical and other Contractors to anticipate their movements. Cooperate with the other contractors on the job and coordinate work to avoid interference with them.

E. Determine a satisfactory space allocation arrangement where electrical material is installed in proximity to work of other trades. No extra payments will be allowed to relocate work that interferes with that of other trades. Corrections shall be made at no cast to Owner.

1.8 CODES AND REGULATIONS

A. All work shall conform to current applicable National, State and local Codes; these shall be regarded as the minimum standard of quality for material and workmanship. Contractor shall provide all Labor and Material required for compliance with Code Requirements or Code Interpretations, although not specifically detailed on the Drawings or in the Specifications. Contractor shall become familiar with all the following codes prior to bidding.

ASTM	American Society for Testing and Materials
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
WSNREC	Washington State Non-Residential Energy Code
NESC	National Electrical Safety Code
NEMA	National Electric Manufacturers Association
NFPA	National Fire Protection Association
UL	Underwriters Laboratories, Inc.
ICEA	Insulated Cable Engineers Associations
CBM	Certified Ballast Manufacturers
IBC	International Building Code
IFC	International Fire Code
ETL	Electrical Testing Laboratories
WAC	Washington State Administrative Code
---	Service Policies of the Serving Electrical Utility (OHOP Mutual) and Communications Company (Rainier Connect)

B. Nothing in these Drawings and Specifications shall be construed as permitting work not conforming with governing codes.

C. The Contractor shall not be relieved from complying with any requirements of these contract documents which may exceed, but not conflict with, requirements of the governing codes.

D. Contractor shall include in bid all costs to have a Department of Labor & Industries approved firm to evaluate the installation safety, and compliance with code as required per WAC 296-40-100 for any equipment specified or furnished that is not UL labeled.

E. For equipment furnished by others not UL labeled the electrical contractor shall not connect the equipment to the electrical system until receiving written approval by the electrical authority having jurisdiction.

1.9 PERMITS & FEES

A. Obtain and pay all fees for licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work and provide inspectors with all necessary assistance.

B. New service connection fees for OHOP Mutual and Rainier Connect have been paid directly by Owner. Trenching, conduit, vaults, handholes indicated on the drawings and work associated with these systems are the responsibility of the Contractor and shall be included in the bid. Coordinate and schedule medium voltage cable, padmount transformer, meter installation and connections with OHOP Mutual.

1.10 WORKMANSHIP

A. All work shall be done by competent craftsmen skilled in the specific work to be done. Equipment shall be installed in a neat and workmanlike manner following the best practice of the trade.

1.11 COST BREAKDOWN

A. Furnish cost breakdown for electrical per Specification Section, 01 00 00, General Requirements.

1.12 OPERATING INSTRUCTIONS

A. Fully instruct the Owner's designated representatives in the operation and maintenance of all components of the electrical system upon completion of the work and after all tests and final inspection(s) by the Authority(s) Having Jurisdiction.

B. Provide scheduled instruction as follows:

1.	Lighting Control & Distribution System	1 hour
2.	Security Cameras	1 hour

All costs for contractor's instruction are to be included in the bid proposal. These costs are in addition to contractors' costs for commissioning required by the Washington State Non-Residential Energy Code for compliance.

C. Instructors shall be contractor's superintendents or foreman knowledgeable in each system and equipment suppliers' representatives for special systems.

1.13 RECORD DRAWINGS

A. Continuously maintain a set of as-built drawings to indicate all significant deviations from the original design and the actual placement of equipment and underground conduits. (Location of conduit stubouts shall be dimensioned from accepted reference lines). Changes shall be shown with red colored pencil while work is in progress. This "Record" set shall be clearly marked:

"RECORD DRAWINGS - Do Not Remove From Office."

B. Final "Record" electronic PDF (AutoCAD) shall be prepared by a competent drafter and provided electronically to the Engineer for review. Date, firm name, and drafter's name shall be included with title "CORRECTED RECORD DRAWINGS" on each drawing. If there are no changes, drawing shall be marked "NO CHANGES, INSTALLATION PER PLAN."

C. "Record Drawings" (Field Set) and "Corrected Record Drawings" (electronic PDF) via electronic transfer to the Engineer for transmittal to the Owner.

1.14 ELECTRICAL EQUIPMENT OPERATION AND MAINTENANCE (O&M) MANUALS

A. Prepare electronic PDF copy of O & M manuals that contain operating and maintenance information, replacement parts list, shop drawings, wiring diagrams and equipment test data for all equipment and systems installed under this contract. Manuals shall be organized as follows:

1. All information contained in the manuals shall be grouped by specification section categories. Manual shall be provided with a typewritten index identifying divider tabs to facilitate future references.
2. Maintenance Information shall pertain to the exact equipment installed, not to the complete "line" of a manufacturer. Actual installed equipment shall be neatly and clearly identified on catalog sheets. All equipment in the O & M manuals shall be identified in exactly the same manner as installed and used in the contract documents.
3. Parts list shall give original manufacturers ordering information. Parts information relabeled or renumbered by the equipment supplier will not be acceptable. The following information shall be provided as a minimum for each item:

    a. Manufacturer's name, address and phone number.
    b. Local supplier's name, address and phone number.
    c. Complete parts lists including quantities and manufacturers part numbers.
    d. Installation instructions.
    e. Maintenance recommendations including maintenance procedure and recommended maintenance intervals listed in hours of operation, calendar units or similar time units.

4. Shop drawings and wiring diagrams shall be complete for the specific system installed under the contract. "Typical" drawings and diagrams will not be acceptable unless properly marked to indicate the exact field installation. Equipment control diagrams shall be accompanied by written descriptions to familiarize maintenance personnel with proper equipment operation. Diagnostic "trouble-shooting" information shall be included where applicable.
5. Provide electrical equipment test data, as applicable, and for all motors according to Section 26 01 26 - "Maintenance Testing of Electrical Systems." Tabulation shall be in columnar format; equipment designations shall correspond to those used on installed identification nameplates.
6. Each O & M manual shall be assembled in a single electronic PDF file.

    a. The cover shall have a typewritten label with the name of the Project, Owner, Electrical Engineer, Division 26 Contractor and year of completion.

7. Submit a preliminary electronic PDF copy, complete, for review and comments 20 days prior to completion of the project.

    a. Deliver complete electronic PDF approved O & M manuals to the Engineer for transmittal to Owner at least 10 days prior to the specified scheduled instruction periods.

1.15 FINAL INSPECTION

A. The electrical foreman or superintendent shall accompany the Engineer on the Final Inspection, and on any necessary Post-Final Inspections, to confirm all work has been satisfactorily completed.

B. Defects and deficiencies found during this Final Inspection shall be corrected within 15 days of Contractor's receipt of Engineer's final punch list.

1.16 FINAL ACCEPTANCE

A. These items are a prerequisite for final acceptance and payment:

1. Electronic PDF of Electrical Equipment operation and Maintenance Manuals which will also include the items listed below.
2. Certificates of Final Inspection

    a) Electrical Inspector permit sign off
    b) Fire Department permit sign off
    c) Written statement the WSNREC lighting and controls commissioning requirements were complied with.

3. Guarantee to Owner
4. Motor and other test data
5. Record drawings including "field" and "clean" sets.

B. Satisfactory Final Inspection and Transmittal of these items to the Engineer will indicate the Contractor has fulfilled all the requirements of the project documents.

1.17 GUARANTEE

A. The Division 26 Contractor shall provide written guarantee to repair or replace (without additional expense) any defective materials or workmanship which become evident within a period of one (1) year after final acceptance or for such longer period as elsewhere specified. All warranty work shall be to the satisfaction of the Owner.

B. Any material guaranteed by a specific manufacturer for a period in excess of one year shall be specifically noted on the Owner's written guarantee. LED light fixtures shall be minimum 5 years including removal and installation labor.

C. The Division 26 Contractor will not be expected to perform normal equipment maintenance, 60 days beyond date of Beneficial Occupancy by Owner or Final Acceptance, whichever date is earlier.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall be new, free from defects, of the quality specified herein and on the drawings. Materials shall be designed to ensure satisfactory operation and rated life in the prevailing environmental conditions where installed. Materials shall be listed by Underwriter's Laboratories or a recognized testing laboratory for use under these conditions.

B. Each type of material shall be of the same make and quality throughout the job. The materials furnished shall be the latest standard design products of manufacturers regularly engaged in their production.

2.2 TECHNICAL DATA

A. Technical information contained herein relies entirely on tests and ratings provided by manufacturers who are solely responsible for their accuracy. The Engineer, by use of this information in no way implies the results of published manufacturer’s information has been verified.

2.3 AS SPECIFIED EQUIPMENT

A. This specification generally lists only one make and model number for each item of equipment or material required for the project. This is not intended to be restrictive but is intended to indicate the standard of quality, design and features required. In addition, the listed product is the basis of the design regarding physical size, electrical power requirements and performance. The product so identified is designated "as specified."

2.4 SUBSTITUTION OF MATERIALS

A. Listing of approved materials is not intended to prevent acceptance of other materials provided the substitute products are submitted for approval and have been approved in accordance with the Substitution of Materials requirements.

B. Substitute Equipment Requests prior to bid opening will not be considered.

C. Approval Prior to Installation

1. All substitution requests shall be made on the substitution request form.
2. The Contractor shall be responsible for a substitute item suiting the space limitations

shown and for any additional installation costs incurred by the substitution.

3. Approval of substitute materials shall not be construed as authorizing any deviation from the contract drawings and specifications except where such deviation is clearly described in writing by the Contractor on the substitution request form and is approved in writing by the Engineer.
4. Requests shall clearly define and describe the proposed substitute product. Such requests shall be accompanied by samples, record of performance, certified test reports and such additional information as the Engineer may require to satisfactorily evaluate the substitute product(s).

D. Approval After Contract Award: Substitute products will be considered after contract award only under these conditions:

1. Non-Availability of Specified Materials: The Contractor shall have placed orders for specified materials within ten days after notice to proceed and received written confirmation of non-availability from the supplier(s). The reason of non-availability shall be beyond the contractor's control such as: discontinuation of manufacture, strikes and acts of God.
2. Contract Price Adjustments: The Contractor may submit substitution requests for Owner cost savings. All substitute request forms submitted after award of contract shall clearly indicate the proposed contract price change or the request will not be considered.
3. Where Permitted in the Specifications: For items identified as “or equal”. It shall be the contractors' responsibility to show that a substitute item is equal or superior in performance and quality to the specified item.

E. No Substitute:

1. It is the intent of this specification to require specific materials to be compatible with the existing installation. Certain materials and systems, consequently, are indicated "No Substitute" and shall be provided as specified.

2.5 COMPLETE SYSTEMS

A. All systems specified herein and shown on the drawings shall be complete and operational in every detail. Mention of certain materials in bidding documents shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide a complete and operable system.

2.6 SUBMITTALS

A. Purpose of Submittals

1. Submittals processed by the Engineer are not change orders. The Contractor, by the submittal process, demonstrates an understanding of the design concept by indicating equipment and materials intended to be provided and fabrication/installation methods intended to be utilized to meet all requirements of the contract documents.
2. The Engineer's review is for general conformance with the design concept and the contract documents. Markings or comments shall not be construed as relieving the

Contractor from compliance with the contract documents.

B. General Requirements: The Contractor shall provide electronic PDF submittal as follows:

1. Material Lists and Catalog Data: Submit, within 10 days after contract award, complete lists of materials, marked catalog sheets, dimensions and other information necessary to properly identify each item. Submittals shall include the most significant materials for each section of these Division 26 specifications.
2. Shop Drawings: Submit, within 20 days after contract award, shop drawings for equipment and materials unique to this installation.

C. Submittal items: Submittals shall include, but not be limited to the following items:

Raceways	Disconnects
Switchboards	Fused Disconnects
Panels	Fire alarm
Fuses	Nameplates
Wires and Cables	Time Switch
Wiring Devices	Data Cat 6 Cabling
Lighting Fixtures	Data Fiber Optic Cabling
Lighting Standards & Poles	Security Cameras
Lighting Control	3 Cell Inner Duct
Pre-cast Concrete Vaults/Covers	Items Requested by Engineer
Pre-cast Concrete Handholes/Covers	

D. Submittal Format

1. A transmittal letter with reference identification (i.e., Electrical Submittal No. 1, material lists and catalog data, etc.) shall accompany all submittals.
2. Submittal brochures shall be separately combined in electronic PDF format. Provide typewritten identification labels on each cover that include Project Name, Electrical Submittal Reference and Contractor's Name.
3. All information contained in the submittal shall be grouped by specification sections. Provide a typewritten index and identifying sections for all project submittal items to facilitate future reference.

E. Submittal Completeness

1. The Contractor shall make every effort to ensure the completeness of the initial submittal. Availability of certain shop drawings and catalog materials, however, may prevent this. Submittal shall not be delayed past specified time periods to await delivery of the missing items. The Contractor, instead, shall identify missing items on the transmittal letter and provide index listings and divider tabs for later insertion of these materials into the completed submittal brochure.
2. Contractor shall state as part of the submittal, the contractor has responded to all vendor questions and contractor has reviewed each item of equipment for compliance with contract drawings and specifications.

F. Engineer's Selection of Materials for Installation: The Engineer may select specified items that the Contractor shall provide, without change in contract price or time of completeness, under

these circumstances:

1. Late and/or Unqualified Partial Submittals: Submittals must be made within the specified time periods; all partial submittals shall indicate manufacturer(s) catalog numbers, pertinent technical information and status of missing items.
2. Failure to follow Re-submittal Procedures: Contractor, within 14 days after the Engineer rejects any items, shall re-submit new materials for approval.
3. Materials have been submitted and rejected twice by the Engineer.

G. Contractor's Responsibilities: The Contractor is responsible for all submittal details, accuracy of quantities and dimensions, selection of fabrication processes and techniques of assembly.

1. The Contractor shall furnish equipment/material suppliers with all Drawings and Specifications pertinent to their work.
2. The Contractor shall review and sign all submittals and shop drawings, prior to submitting shop drawings to the Engineer for review. Contractor shall correct shop drawings and catalog data to ensure compliance with the specifications and drawings prior to initial submittal to Engineer for review. Obtain Engineer's written approval before ordering equipment or manufacture is started on any special equipment.
3. Deviation from Shop Drawings in fabrication and/or installation of equipment is not permitted unless proposed changes are clearly noted in writing by the Contractor and approved in writing by the Architect/Engineer at the time of submittal.
4. Maintain at least one complete approved submittal brochure on the jobsite for reference during construction.

2.7 ELECTRICAL EQUIPMENT IDENTIFICATION

A. General: These items shall be provided with nameplates:

1. All motors, motor starters, pushbutton stations, control panels and time switches.
2. Disconnect switches, switchboards, panelboards, time clocks, low voltage control panels and circuit breakers, contactors, and relays in separate enclosures.
3. Wall switches controlling receptacles, lighting fixtures or equipment where the receptacles are not located within sight of the controlling switch.
4. Special systems shall be properly identified at outlets, junction and pull boxes, terminal cabinets and equipment racks.

B. Nameplate Inscription

1. All nameplates shall adequately describe the function or operation of the identified equipment as required.
2. Panelboard and Switchgear nameplates shall include equipment designation, voltage and phase of supply, i.e., Panel A, 208/120V, 3 phase, 4 wire. Switchgear nameplate shall include Contractor, Engineer, date and AIC rating of switchboard.
3. Nameplate designations shall be consistent for all components of a particular piece of equipment, such as starter, disconnect switch, Push Button control station(s) and the like.
4. Contractor shall submit a complete list of nameplates for approval.

C. Nameplate Construction

1. Nameplates shall be laminated phenolic plastic with minimum 3/16" high black engraved characters on white background (alternate background colors shall be provided as noted in the specifications or drawings for special applications).
2. Nameplates shall be securely fastened to the equipment with No. 4 round-head phillips, cadmium plated steel, self-tapping screws. Contact cement adhesive only is not acceptable.
3. Motor nameplates may be non-ferrous die-stamped metal, minimum 0.03 inch thick, in lieu of separate phenolic nameplate. Device plates may be identified by engraving directly on the plate. All engraved or stamped lettering shall be filled with contrasting enamel.

PART 3 - EXECUTION

3.1 PROTECTION OF WORK

A. Protect all work, wire, cable, materials and equipment installed under this division against damage by other trades, weather conditions or any other causes. Equipment found damaged or in other than new condition will be rejected as defective.

B. Switchgear, panels, light fixtures, conduits, vaults, handholes and electrical equipment shall be kept covered or enclosed to exclude moisture, dust, dirt, plaster, cement, or paint and shall be free of all such contamination before acceptance. Enclosures and trims shall be in new condition, free of rust, scratches or other finish defects. Properly refinish in a manner acceptable to the Engineer if damaged.

C. Keep conduit and raceways closed with suitable manufactured plugs or caps during construction to prevent entrance of dirt, moisture, concrete or foreign objects. Raceways shall be clean and dry before installation of wire and at the time of acceptance. Proof all raceways with a properly sized mandrel prior to installation of wire.

D. Make up and insulate wiring promptly after installation of conductors. Wire shall not be pulled-in until raceways are complete, all bushings are installed, and raceway terminations are completed. Wire shall not be pulled into conduit embedded in concrete until after the concrete is placed and forms are removed.

3.2 EXISTING CONDITIONS

A. Examine the structure, building, and conditions under which Division 26 work is to be installed for conditions detrimental to proper and timely completion of the work. Do not proceed with work until deficiencies encountered in installation have been corrected. Report any delay or difficulties encountered in installation of Division 26 work which might be unsuitable to connect with work by other Divisions in this specification. Failure to report conditions shall constitute acceptance of other work as being fit and proper for the installation of Division 26 work.

3.3 CUTTING AND PATCHING

A. Obtain permission from the Architect/Engineer prior to cutting. Locate cuttings to not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or saws except where space limitations prevent the use of such equipment.

B. Penetrations of fire rated elements shall be carefully made to main fire that rating after the installation is complete.

C. All construction materials damaged or cut into during the installation of Division 26 work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.4 EXCAVATIONS

A. The contractor shall be fully responsible for the location and protection of all existing utilities. The contractor shall verify all utility locations prior to construction by calling the underground locate line at 1-800-424-5555 a minimum of 48 hours prior to any excavation. The contractor will also be responsible for maintaining all locate marks once the utilities have been located.

B. All excavations are to be so conducted that no walls or footings shall be disturbed or injured in any way.

C. Remove all surplus earth not needed for backfilling and dispose of same as appropriate at a licensed disposal facility.

3.5 PAINTING

A. Painting in general will be covered under another Division of this specification. Items furnished under this Division scratched or marred in shipment or installation are to be refinished by the Contractor to the satisfaction of the Engineer.

3.6 CLEAN UP

A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by work. Such clean up shall be done at sufficient frequency to minimize hazard to the public, other workmen, the building and the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean switchboard, panels, vaults, handholes, wiring devices, coverplates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces or apparatus shall be removed and new finish equal to the original applies.

3.7 LABELING

A. Clearly and properly label the complete electrical system, as specified herein, to indicate the loads served or the function of each item of equipment connected under this contract.

B. Control circuits shall utilize combinations of colors with each conductor identified throughout using wrap around numbers or letters. Identification shall be consistent with the contract drawing requirements and operation and maintenance shop drawings.

3.8 MECHANICAL EQUIPMENT CONNECTIONS

A. Provide complete electrical connections for all items of equipment, including incidental wiring, materials, devices and labor necessary for a finished working installation.

B. Mechanical/Electrical equipment connection coordination shall be as follows:

ITEM	FURNISHED BY	INSTALLED BY	POWER WIRING BY	CONTROL WIRING BY
Mechanical Equipment Motors	MC	MC	EC	--
Fused & Unfused Disconnect Switches, Thermal Overload & Heaters	EC	EC	EC	--
Motor Starter & Overload Heaters	MC	EC	EC	MC
Manual Operating & Speed Switches	MC	EC	EC	EC
Control Relays & Control Transformers	MC	MC	EC	MC
Low Voltage Thermostats	MC	MC	EC	MC
Line Voltage Thermostats Specified In Division 26	EC	EC	EC	EC
Temperature Control Panels	MC	MC	EC	MC
DDC Panels	MC	MC	EC	MC
Motor & Solenoid Valves, Damper Motors, PE & EP Switches	MC	MC	--	MC
Fire/Smoke Dampers (Actuators)	MC	MC	EC	MC/EC*
Duct-Mounted Smoke				

Detectors	EC/MC**	MC	--	MC/EC*

MC = Division 23
EC = Division 26

* Motor interlock by MC, Fire Alarm System Interconnection by EC.
** When there is no building fire alarm system present in the project.

3.9 SUPPORT AND ALIGNMENT

A. Each fastening device and support for electrical equipment, fixtures, panels, outlets and cabinets shall be capable of supporting not less than four times the ultimate weight of the objects fastened to or suspended from the building structure.

B. Install panels, cabinets and equipment level, plumb, and parallel with structural building lines. Switchgear, panels and all electrical enclosures shall fit neatly without gaps, openings or distortion. Properly and neatly close all unused openings with approved devices. Switchgear shall be seismically braced to building structure.

C. Fit surface panels, devices and receptacles with neat, appropriate trims, plates or covers, (without over-hanging edges, protruding corners or raw edges) to leave a finished appearance.

D. All junction boxes, pull boxes or other conduit terminating housings located above a suspended ceiling shall be securely suspended from structure or ceiling grid system to prevent sagging or swaying.

3.10 NOISE CONTROL

A. Back-to-back or straight-through installation of wall or partition boxes is not permitted to minimize noise transmission between occupied spaces.

B. Contactors, transformers, starters and similar noise producing devices shall not be placed on walls which are common to occupied spaces. Where such devices must be mounted on walls common to occupied spaces, they shall be shock mounted or isolated in such a manner as to effectively prevent the transmission of their inherent noise to the occupied space.

C. Ballasts, contactors, starters, transformers and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.

END OF SECTION

SECTION 260511 – BASIC ELECTRICAL METHODS AND MATERIALS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Provide electrical materials and labor to satisfactorily complete electrical work shown on the Drawings, specified, or neither shown nor specified but necessary for a complete and fully operating facility.

B. Mounting details of equipment, devices, light fixtures, raceways, junction boxes, etc., are not usually shown or specified, provide per industry standard practice and code requirements as necessary for proper installation and operation, shall be included in the Contractor's estimate, the same as if specified or shown.

1.02 SUBMITTALS

A. Procedures: See Section 013300 – Submittal Procedures.

B. Submittal package shall be organized by equipment type. Include separators and tabs or other means of identifying each item.

C. Shop Drawings: Show dimensions, physical configurations, methods of connecting equipment, mounting details, and wiring schematics. Drawings shall be complete with device numbers, wire numbers, and terminal board numbers. Submit fabrication details and nameplate legends. Include material lists and/or bills of material. Submit manufacturer's catalog cuts for each item for which shop drawings are not required. Manufacturer's catalog cuts, specifications, or data sheets shall be clearly marked to delineate the options or styles to be furnished.

1. Contractor shall submit shop drawings showing conduit installation and routing to Owner for review and approval prior to installing the conduit. Shop drawing shall show as a minimum but not limited to the following: conduit bodies, conduit type, pull boxes, wall penetrations, entry locations to electrical equipment.
2. Contractor shall submit shop drawings for each concrete equipment pad as shown on the Drawings. The shop drawings for the concrete equipment pads shall also include dimensions and means to anchor to concrete foundation.

D. Bill of Material (BOM): BOM shall include equipment item number, quantity, manufacturer, part number, model number, and descriptions.

E. Nameplate schedule.

F. Conduit tag schedule.

G. Qualifications of testing organization and personnel meeting requirements of ANSI/NETA ATS 2021, Section 3.

H. Inspection and acceptance testing reports for new electrical equipment per ANSI/NETA ATS 2021, Paragraph 5.4 for equipment for which tests are required in this and other Division 26 sections.

I. Submit field test results specified in Part 3 this section.

J. Applicable operation and maintenance information on an item-by-item basis in accordance with Division 1. Operation and maintenance information shall be provided at the time of equipment, device, or material site delivery, or at a certain stage of project completion as required by Division 1, whichever is the earlier. Full-size drawings shall be reduced to 11 by 17 inches. Provide electronic copy of all application software with the software comments on a memory stick.

K. Description of functional checkout procedures, specified in this specification, 30 days prior to performing functional checkout tests.

L. Nameplate abbreviations, if required.

M. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

N. Record Drawings:

1. Contract Drawings – Upon completion of the work, transfer the Contractor maintained as-built drawings to a clean set of full-size drawings with red ink to indicate additions and green ink to indicate deletions. Submit these full-size drawing markups to the Engineer and copy to the Owner.

    a. Illegible and not clear as-built drawings will be rejected and the Contractor shall resubmit legible and clear as-built drawings.

2. Equipment manufacturer shop drawings – Upon completion of the work, submit the as-built drawings from the equipment manufacturer with any modifications performed in the field. Submit these drawings in both an Adobe Acrobat [*.PDF] format and an Autodesk AutoCAD [*dwg] format.

1.03 QUALITY ASSURANCE

A. Variances: In instances where two or more codes are at variance, the most restrictive requirements shall apply.

B. Standards: Equipment shall conform to applicable standards of American National Standards Institute (ANSI), Electronics Industries Association (EIA), Institute of Electrical and Electronics Engineers (IEEE), and National Electrical Manufacturers Association (NEMA). The revisions of these standards in effect on the date of issuance of the Contract Documents shall apply.

C. Electrical equipment, materials, and installation methods shall conform to applicable local and state codes as well as the editions of the following in effect on the date of issuance of the Contract Documents:

1. National Electrical Code (NEC).
2. National Electrical Safety Code (NESC).

D. Electrical equipment must be listed or labeled by a Nationally Recognized Testing Laboratory (NRTL). An NRTL is recognized by Occupational Safety and Health Administration (OSHA) as being capable of independently assessing equipment for compliance to safety requirements and applicable standards. UL is an example of an NRTL.

E. Provide equipment with service entrance labels in those cases where the NEC requires such labels.

F. Series short circuit ratings for protective devices are not allowed.

G. For new equipment acceptance testing, studies, and reports per ANSI/NETA ATS-2021 for equipment for which tests are required in this and other Division 26 sections.

1. Testing organization and personnel performing tests shall meet the qualifications of ATS 2021, Section 3 and will be certified per ANSI/NETA ETT 2018, Standard for Certification of Electrical Testing Personnel.

1.04 DRAWINGS

A. The Drawings are diagrammatic; exact locations of products shall be verified with the Engineer prior to installation. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or material, the requirements or descriptions in this and other Division 26 Sections shall take precedence in the event of conflict.

B. Field-verify scaled dimensions on Drawings.

C. Review the Drawings and specification divisions of other trades and perform the electrical work that will be required for the installations.

D. Submit in writing to the Engineer details of any proposed changes in or departures from these Contract Documents along with the reasons, therefore. Make no changes or departures without the prior written favorable review of the Engineer.

1.05 JOB CONDITIONS

A. Operations:

1. The normal power source is supplied by a new utility transformer provided by the utility company. The Contractor shall provide power conductors, as specified and without splices,

from the utility transformer to the disconnect switch located in the Operations Building Electrical Room.

a. The Contractor shall install an underground utility conduit duct bank between the existing and new utility transformers, and the new utility transformer and the Operations Building Electrical Room as shown on Drawings.
b. The Contractor shall coordinate with the utility company to excavate at new utility transformer location for utility company's placement of the transformer and its vault. Utility company will also be providing and installing the primary wire between the existing and new utility transformers, and a meter at the Operations Building.

2. The standby power source is supplied by a new standby generator. The Contractor shall provide power and signal conductors, as specified and without splices, between the generator and the Operations Building Electrical Room.

a. The Contractor shall provide underground conduit duct bank between the new standby generator and the Operations Building Electrical Room.

3. Contractor shall plan scheduled power outages for each electrical shutdown required to connect the existing utility transformer to the new utility transformer.

a. The scheduled power outage plan shall be submitted to and approved by the Owner 2 weeks ahead of the planned power outage. The date and time shall be agreed upon and approved by the Owner.
b. The scheduled power outage plan shall contain the following information:

1) Date in which the scheduled power outage plan is prepared.
2) Electrical Contractor's name and mobile phone number.

a) Contact information (name and mobile phone number) for Electrical Contractor who will be present on site during the power outage.

3) Detailed description of the work to be done including a list of equipment that will be powered off during the scheduled power outage.
4) Estimated power outage duration, including start time and estimated completion time.
5) List other resources required during the scheduled power outage (Owner, generator, utility provider, etc.)

B. Construction Power:

1. Contractor is responsible to provide construction power. Contractor shall plan for construction power as follows:

a. Contractor may provide their own engine generator for use on the construction site at no cost to the Owner. Temporary power distribution and equipment shall comply with NEC, local, and state codes.
b. Contractor can coordinate with the utility provider for temporary construction power at no cost to the Owner. Contractor shall submit to the Owner the location of where

the temporary power pole will be located. Submit a copy of the electrical site plan with the location of the temporary power pole marked on the drawing.

2. Upon completion of the project, remove temporary construction power equipment, material, and wiring from the site as the property of the Contractor.

C. Storage: Provide conditioned storage for equipment and materials per manufacturer's requirements that will become part of the completed facility so that it is protected from weather, dust, water, construction, and plant operations.

1.06 DAMAGED PRODUCTS

A. Notify the Owner in writing if any equipment or material is damaged during construction.

B. Obtain prior favorable review by the Owner before making repairs to damaged products.

1.07 MATERIALS

A. Provide first quality, new materials, free from defects, and suitable for the intended use and space. Where two or more units of the same class of material are required, provide products of a single manufacturer.

B. Unless otherwise indicated, provide materials and equipment that are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these Specifications.

1.08 SEISMIC SUPPORT

A. Mechanical, instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 130541.

1.09 WARRANTY

A. The electrical equipment and installation shall begin after Substantial Completion of construction.

1. This warranty is applicable for equipment installed, tested, and commissioned during that phase.
2. Warranty period shall be a minimum of 1 year, unless otherwise specified.
3. Warranty shall include repair parts, labor, and travel expenses.

1.10 LOCATIONS

A. General: Use equipment, materials, and wiring methods suitable for the types of locations in which they are located, as defined in Paragraph B herein.

B. Definitions of Types of Locations:

1. Dry Locations: Indoor areas which do not fall within the definitions below for Wet, Damp, or Corrosive Locations and that are not otherwise designated on the Drawings.
2. Wet Locations: Locations exposed to the weather, whether under a roof or not, or designated as Wet Locations by applicable codes and regulations, unless otherwise designated on the Drawings.
3. Damp Locations: Location wholly or partially underground, or having a wall or ceiling forming part of a channel or tank, or designated as Damp Locations by applicable codes and regulations, unless otherwise designated on the Drawings.
4. Corrosive Locations:

    a. The space inside the Chemical Solution Tank and with the Fine Screening and anoxic tank. For this project, conduit and cable support hardware inside or within 3-foot envelope of the equipment openings shall be PVC coated. Fastening hardware shall be stainless steel. See Section 260533 – Raceway and Boxes for Electrical Systems, for conduit inside and within 3-foot envelope.
    b. The space outdoors at the Fine Screening, Anoxic Basins, Aerations Basins, and MBR Basins is corrosive to metal. For this project, conduit and cable support hardware outdoors at this area shall be PVC coated.

5. Classified Locations: See electrical power plans for areas designated at classified spaces. Inside classified spaces, the Contractor shall use wiring methods and electrical equipment listed for use in designated classified spaces in accordance with the NEC.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall ensure electrical equipment received is stored in a dry, secured, safe location, protected for water, rain, dirt, construction debris, and traffic.

B. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

PART 2 – PRODUCTS

2.01 STANDARD OF QUALITY

A. It is the intent of these Specifications and Drawings to secure high quality in materials, workmanship, and equipment in order to facilitate operation and maintenance of the facility. Equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product. Equipment shall be designed for the service intended

and shall be of rugged construction, of ample strength for stresses that may occur during fabrication, transportation, erection, and continuous or intermittent operation. Equipment shall be adequately stayed, braced, and anchored and shall be installed in a neat and workmanlike manner. Appearance, as well as utility, shall be given consideration in the design of details.

B. Components and devices installed shall be standard items of industrial grade or better, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light-duty, fragile, and commercial grade devices of doubtful durability shall not be used.

2.02 PAINTING AND COATING

A. Equipment: Refer to each electrical equipment section of these Specifications for painting and coating requirements of equipment and enclosures. Repair any final finish that has been damaged or is otherwise unsatisfactory using touchup materials approved by the manufacturers, to the satisfaction of the Owner.

PART 3 – EXECUTION

3.01 PERMITTING

A. Electrical Permit: Owner will submit plans to Washington State Labor and Industries for review, apply, coordinate, and pay for electrical permit.

3.02 GENERAL

A. Work shall be performed by craftsmen skilled in their trade. Work shall present a neat, finished appearance.

B. Install equipment in strict accordance with the manufacturer's instructions unless directed otherwise. Wherever a conflict occurs between manufacturer's instructions, codes and regulations, or these Contract Documents, follow Engineer's direction. Keep a copy of manufacturer's installation instructions on the job site available for review at times.

C. Provide protection for materials and equipment against loss or damage. Protect everything from the effects of weather. Prior to installation, store items in indoor locations. In addition, items subject to corrosion under damp conditions, and items containing insulation, such as transformers, motors, and control, shall be stored in indoor, heated, dry locations.

D. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction.

E. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore

surfaces neatly to original condition using skilled craftsmen of the trades involved at no additional cost to the Owner.

F. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of devices and equipment. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

G. Label electrical and control equipment, including electrical Motor Control Center (MCC), VFD panels, motor starter panels, automatic transfer switches, control panels, equipment within electrical and control panels, disconnect switches, motors, pumps, local control stations, instrument transmitters, analytical controllers.

H. Concrete Equipment Pads: Contractor shall prepare shop drawings detailing the construction method of the concrete equipment pad for the electrical equipment. The Electrical Drawings show the locations of the electrical equipment concrete equipment pads.

1. Shop drawings for concrete equipment pads shall be submitted after the equipment submittals from the equipment manufacturers have been approved by the Owner. Construction for the equipment pads shall not begin until equipment submittals and shop drawings are approved.

3.03 GROUNDING

A. Bond and ground equipment for which a ground connection is required per NEC whether or not specifically shown on the Drawings.

3.04 START-UP FIELD SERVICE

A. Contractor shall support start-up of new equipment or equipment and provide assistance where and when needed.

1. Contractor shall ensure manufacturer of new equipment shall support the start-ups.

3.05 FIELD TESTS

A. Perform inspection and acceptance testing and submit test reports as specified in all Division 26 sections.

B. Give a 2-week notice to the Engineer and Owner prior to any test to permit witnessing the test.

C. Retesting will be required for unsatisfactory tests after the equipment or system has been repaired. Retest related equipment and systems if required by the Engineer. Repair and retest equipment and systems that have been satisfactorily tested but later fail, until satisfactory performance is obtained.

3.06 FINAL CLEANING

A. Contractor shall provide final cleaning of electrical equipment and workspaces and work areas.

B. Contractor shall clean all items worked on under this Contract. Contractor shall leave work areas free of stains, damage, or other defects prior to final acceptance.

1. Cleaning shall include wiping, sweeping, and vacuuming to leave work areas and equipment free of dust, debris, and moisture.

C. Operations Building Electrical Room:

1. Contractor shall clean the exposed concrete equipment pad of all construction debris.
2. Prior to energizing, the Contractor shall wipe clean the interior of the service entrance disconnect switches, ATS, motor control center (MCC), electrical panelboards, and control panels (including all the compartments behind covers and access doors) using a dry, clean cloth. Replace cloth frequently to prevent spreading of debris and lubricating oil.
3. Contractor shall vacuum all sections (interior and on top) of the electrical equipment prior to energizing.
4. Contractor shall clean and vacuum the Electrical Room floor.

3.07 RECORD DRAWINGS

A. Maintain a set of as-built drawings on site that documents changes made to both the Contract Drawings and approved equipment manufacturer shop drawings.

B. At the completion of the project, Contractor shall submit a set of as-built drawings which include the as-built red-lines from the project. Contractor shall submit red-lines and manufacturer's shop drawings. If red-lines are illegible or cannot be read, they will be rejected and the Contractor shall re-submit legible and clear red-lines.

END OF SECTION

SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Bidding documents including Division 1 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical

B. Provide all wire, cable and terminations for a complete installation.

PART 2 - PRODUCTS

2.1 PACKAGING

A. Conductors shall be delivered to the job site in approved original cartons, or on reels as recommended by the manufacturer, and shall bear the Underwriter's Label. Reels shall be provided with suitable protection to prevent fork-lift damage to conductors during shipment or storage prior to use.

2.2 SPECIALIZED CONDUCTORS

A. Conductors for specialized systems shall be as recommended by the equipment manufacturer.

2.3 CONDUCTORS - 600 VOLTS

A. Stranded copper, insulated for 600 volts.

B. Insulation types THW, THHN, THWN, XHHW, RHH, RHW, or as required to suit installation conditions.

C. Aluminum: Stranded electrical grade, insulated for 600 volts. See installation section for permitted use.

2.4 CONNECTORS - 600 Volts

A. Branch circuit conductor splices:
Pre-insulated "twist-on" type or "crimped-on" type as approved (Scotch-lok, Ideal or equal).

B. Cable Splices:

Split-bolt or tool applied sleeves with pre-formed insulated cover, heat shrinkable tubing or approved plastic insulating tape.

C. Terminator lugs of No. 12 wire and smaller:
Spade, insulated type to be tool applied.

D. Terminator lugs for No. 10 wire or larger:
Two bolt (or approved positive restraint), tool applied compression type (Burndy or equal).

2.5 INSULATING MATERIALS

A. Insulating tape or heat shrink tubing shall have the equivalent rating of the applicable conductor insulation (Scotch 3M, RAYCHEM or equal).

2.6 PLASTIC CABLE TIES

A. Nylon, or equivalent, locking type (T&B or equal).

PART 3 - EXECUTION

3.1 GENERAL

A. Install all wiring in raceway.

3.2 MINIMUM WIRE SIZE

Lighting and Power System ..... No. 12 AWG
Fire Alarm Line Voltage Wiring ..... No. 14 AWG
Low Voltage Wiring ..... As recommended by Mfgr

3.3 CONDUCTOR TYPES, REFERENCED ON PLAN

A. Conductors shall be copper.

B. Aluminum may be substituted for copper conductors size #0 and larger unless specifically noted as copper only on the drawings. All ground conductors shall be copper. Comply with 3.04 below.

3.4 ALUMINUM CONDUCTORS

When applicable or called for on drawings are subject to the following requirements:

A. Increase wire size for same current capacity as copper. Increased conduit size as necessary for code compliance.

B. Minimum size of aluminum conductors where use of aluminum is allowed shall be #1/0 AWG.

C. Insulation requirements are the same as for copper conductor wires and cables.

3.5 CONDUCTOR COLORING CODE

Conductor color coding shall be as follows:

A. 208/120 volt system
A Phase - Black
B Phase - Red
C Phase - Blue
Neutral – White
Grounding – Green
Switched wires – Other colors

B. Conductors shall have colored insulation except wires larger than #8 may be black with colored tape identification at all terminations and splices.

C. Additional colors may be used where such colors will help in identifying wires and different systems.

3.6 CONDUCTOR INSTALLATION

A. Raceways shall be complete, clean and free of burrs before pulling conductors.

B. U.L. approved pulling compounds may be used with the residue cleaned from the conductors and raceway entrances after the pull is made.

C. Contractor shall obtain the manufacturer's published recommendations for the handling, pulling and terminating of the cable. Contractor shall perform work in accord with manufacturer's recommendations and accept all responsibility for work not in accord with manufacturer's recommendations.

D. Pulleys or blocks shall be used for alignment of the conductors when pulling. Pulling shall be in accordance with manufacturer's specifications regarding pulling tensions, bending radius of the cable and compounds. No mechanical pulling means shall be used for wires No. 8 AWG and smaller. Cables shall be pulled by the conductor, not by the insulation or shielding.

3.7 MOISTURE PROTECTION

A. Cable ends shall be protected at all times from moisture. Provide approved heat-shrink end caps or equivalent for all unterminated cable ends.

3.8 CONDUCTORS IN PANELS AND SWITCHBOARDS

A. Conductors in panels, switchboards and terminal cabinets shall be neatly grouped and formed in a manner to "fan" into terminals with regular spacing.

3.9 CABLE SUPPORTS

A. Provide conductor support devices as required by code in vertical cable runs.

3.10 INSULATION REMOVAL

A. Insulation shall be removed with approved wire stripping tools. Conductors that are nicked or ringed are unacceptable and shall be cut off and re-stripped.

3.11 INSULATION OF ENERGIZED TERMINATIONS

A. Insulate all exposed energized connections and splices with approved tape or heat shrink tubing. Tape, if used, shall be half-lapped in two directions.

3.12 TERMINATIONS - COPPER CONDUCTORS 600 VOLTS

A. Control and special systems wires shall be terminated with a crimped on lug when terminating at a screw connection.

B. All screw and bolt type connectors shall be made up tight and retightened after an eight hour period. Tighten all bolted connections with a ratcheting type torque wrench per manufacturer's standards.

C. All tool applied crimped connectors shall be applied per manufacturer's recommendations and physically checked for tightness.

3.13 TERMINATION - ALUMINUM CONDUCTORS 600 VOLTS

A. Aluminum conductors shall be terminated or spliced using hydraulic crimped aluminum lugs filled with a contact aid compound (Penetrox A or equal). They shall not be terminated or spliced with bolted pressure fittings. Where a device is available with bolted lugs only, a short length of copper conductor may be spliced to the aluminum conductor and the copper connected to the bolted pressure lug. A special type crimped aluminum lug with aluminum or copper "finger" manufactured for this purpose may be used.

B. Hydraulic crimped fittings shall be sized for the conductor used and shall be made with a tool which assures a preset deformation before release.

C. Aluminum lugs shall be plated.

D. Provide Belleville washer system where bolting to aluminum lugs or bus unless specifically

permitted otherwise. (Belleville washer bearing on a chrome plated or stainless steel washer.)

E. Because aluminum oxidizes rapidly, and aluminum oxide is an insulator, contractor shall prepare aluminum wire for terminations by cleaning it with a wire brush immediately before inserting it into aluminum lugs.

END OF SECTION

SECTION 260519.1 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide low-voltage electrical power conductors and cables as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Comply with the following standards:

1. UL 83 and ICEA S-61-402 for thermoplastic insulated wire and cable.
2. UL 44, ICEA S-19-81 and ICEA S-66-524 for rubber or rubber-like and cross-linked thermosetting polyethylene insulated wire and cable.

B. Provide copper wire only.

C. No underground splices allowed unless approved by the Engineer.

2.02 WIRE AND CABLE IN RACEWAY

A. Power, Light, and Control Conductors:

1. Insulation: Rated for 600 V.

a. Use dual rated type THHN/THWN in temperature controlled indoor locations.
b. Use Type XHHW in underground locations and unheated concrete structures.

2. Use stranded wire for control conductors.

B. Variable Frequency Drive (VFD) Multi-Conductor Cable:

1. Conductor: 3C-7 strand copper conductors to ASTM B8.
2. Insulation: 600 V, flame retardant, cross-linked polyethylene (FR XLPE), 90 degrees C, wet/dry (UL44) XHHW-2.
3. Grounding Conductors: Three-stranded bare copper grounds symmetrically located in continuous contact with a copper tape shield.
4. Shielding: Dual copper tape shields helically wound with 50 percent overlap.
5. Assembly: Three-phase conductors with symmetrically located tri-sectional grounding conductors in continuous contact with a copper tape shield.
6. Overall Jacket: 90C-25C flame retardant yellow PVC LAG (Low Acid Gas) sunlight resistant.
7. Temperature: 90 degree C wet/dry.
8. Voltage Class: 600 V.
9. Approvals: IEEE 383, 70,000 BTU flame test; UL 1277 and UL 1581; tray cable rated (TC).
10. Manufacturer:

a. Anixter-Shawflex VFD Cable.
b. Belden VFD Cable.
c. Or approved equal.

2.03 JOINTS, TAPS, SPLICES, AND TERMINATIONS

A. Conductors No. 10 AWG and Smaller: Use twist type insulated wire nut solderless connectors.

B. Conductors No. 8 AWG and Larger: Use solderless compression type connectors of type that will not loosen under vibration or normal strains.

C. Control and Instrumentation Conductors: Use crimp type spade connectors where control wires are connected to screw terminals of equipment.

D. Joints, Taps, and Splices Located in Enclosures Subject to Moisture: Use watertight splice kits.

2.04 PERMANENT WIRE MARKERS

A. Wire markers shall be heat shrink type (Raychem; T&B; or equal). Wire numbers shall be permanently imprinted on the markers.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install wiring system in accordance with manufacturer's recommendations.

B. Install wire and cable in conduit unless otherwise shown on the Drawings.

C. Maintain barrier or conduit separation between power conductors and instrumentation conductors to avoid magnetic interaction where such conductors enter and pass through same manhole, handhole, casing pipe, box, or enclosure.

D. Provide individual wiring compartments or barrier for separation between intrinsically safe and non-intrinsically safe conductors inside enclosures.

E. Provide the following types and sizes of conductors for the uses indicated for 600 V or less:

1. Solid Copper, Sizes No. 12 and No. 10 AWG: Circuits for receptacles, switches, and light fixtures with screw-type terminals.
2. Stranded Copper, Size No. 14 AWG and Larger, Individual Conductors. Control of motors or other equipment. Size No. 14 shall not be used for power supplies to any equipment.
3. Stranded Copper, Sizes No. 12 AWG and Larger: Motors and other power circuits.
4. Fixture Wire: For connections to all fixtures in which the temperature may exceed the rating of branch circuit conductors.

F. Color Coding:

1. Provide color coding for all circuit conductors. Insulation color shall be white for neutrals and green for grounding conductors. An isolated ground conductor shall be identified with an orange tracer in the green body. Ungrounded conductor colors shall be as follows:

a. 208Y/120 V, Three-Phase: Red, black, and blue.
b. 240/120 V, Single-Phase: Red and black.

G. Color coding shall be in the conductor insulation for all conductors No. 10 AWG and smaller. For larger conductors, color shall be either in the insulation or in colored plastic tape applied at every location where the conductor is readily accessible (e.g., enclosures, pull boxes, and junction boxes).

H. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables, or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL-listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling to avoid damage to conductors.

I. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length unless splices are approved by Engineer.

J. Provide an equipment-grounding conductor, whether it is shown on the Drawings, in all flexible conduits and all raceways.

K. In panels, bundle incoming wire and cables, No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees, and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

L. For cables crossing hinges, utilize extra-flexible stranded wire, make up into groups not exceeding 12, and arrange so that they will be protected from chafing and excess flexing when the hinged member is moved.

3.02 WIRE AND CABLE IDENTIFICATION

A. Install permanent wire markers on wire and cable in junction boxes, pull boxes, wireways, and wiring gutters of panels. Markers to identify wire or cable number.

B. Provide schedule identifying various power and lighting conductors from power source to equipment or device served.

3.03 FIELD TESTS

A. Insulation Resistance Tests: For all circuits 150 V to ground or more, and for all motor circuits over 1/2 hp, test cables per NETA Paragraph 7.3. The insulation resistance shall be 20 megohms or more. Submit results for review.

B. Phase Rotation: The phase rotation of all circuits shall be clockwise in sequence. The Contractor shall verify that each three-phase service, feeder, and branch circuits meet this requirement. A record shall be kept at each circuit tested and, on completion, submitted to the Engineer for review.

END OF SECTION

SECTION 260523 – SIGNAL CABLE (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies products and procedures for furnishing, installing, and connection of conductors and cables for signal circuits.

B. Provide low-voltage wire and cable as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.03 SUBMITTALS

A. Shop Drawings: Submit product information/data shop drawings for materials in accordance with Section 260511 – Basic Electrical Methods and Materials and Section 013300 – Submittal Procedures.

B. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 00 and Division 01.

1.04 WARRANTY

A. Manufacturer warrants their product will be free from defects in material or workmanship for a 2-year period. The product warranty shall begin at time of equipment start-up.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall ensure electrical equipment received is stored in a dry, secured, safe location, protected for water, rain, dirt, construction debris, and traffic.

B. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

PART 2 – PRODUCTS

2.01 GENERAL

A. Comply with the following standards:

1. UL 83 and ICEA S-61-402 for thermoplastic insulated wire and cable.
2. UL 44, ICEA S-19-81 and ICEA S-66-524 for rubber or rubber-like and cross-linked thermosetting polyethylene insulated wire and cable.

B. Provide copper wire only.

2.02 WIRE AND CABLE

A. Multi-conductor Tray Cable (600 V TC):

1. 600 V Rated:

a. Cable shall be a multi-conductor, tray rated, with minimum wire gauge 18 AWG unless specified on Drawings, UL Listed.
b. Jacket Insulation: Jacket shall be sunlight-resistant PVC per UL Standard 1277.
c. Conductor: Soft bare annealed copper per ASTM B3, Class B stranding per ASTM B8.
d. Conductor Insulations: Flame-retardant PVC per UL Standard 83 for Type THWN wire.
e. Standards: UL Type TC per Article 336 of the NEC, IEEE 383 (70,000 BTU/hour) Flame Test, ICEA (210,000 BTU/hour) Flame Test.
f. Approved for Use: Indoors and outdoors, aerially, in conduits, ducts, cable trays, or direct burial in circuits not exceeding 600 volts, UL approved for use in continuous operation at 75 degrees C in wet locations, 90 degrees C in dry locations, 130 degrees C for emergency overload conditions.
g. Acceptable Manufacturers: General Cable, Okonite, Southwire, or approved equal.

B. Twisted Shielded Pairs Cable (TSP):

1. 600 V Rated:

a. Cable shall be single twisted, shielded pair, cable tray rated (Type TC), 16AWG, instrumentation cable, UL listed.
b. Insulation: 45-mil PVC, 600 V rated.
c. Conductor: Bare annealed copper, stranded in accordance with ASTM B8.
d. Conductor Insulation: 15-mil, 90 degree C, polyvinylchloride (PVC).
e. Shield and drain wire integral to cable.
f. Standards: UL 1277, IEEE383, UL listed as Type TC.
g. Approved for Use: Indoors or outdoors; wet or dry locations; in cable trays; in raceways; for direct burial; and in Class I, Division 2 location (NEC Article 501).
h. Acceptable Manufacturers: Okonite, General Cable, Southwire, or approved equal.

C. Triad Cable:

1. 600 V Rated:

a. Cable shall be twisted, three conductor shielded wire, cable tray rated (Type TC), 16 AWG, instrumentation cable, UL listed.
b. Cable outer jacket: 47-mil polyvinyl chloride (PVC).
c. UL Voltage Rating: 600 V rated.
d. UL Temperature: 90 degrees C Dry, 75 degrees C Wet.
e. Conductor: Bare annealed copper, stranded.
f. Conductor Insulation: 17-mil, 90 degree C, PVC/Nylon – Polyvinyl Chloride + Nylon.
g. Shield and drain wire integral to cable.
h. Standards: UL 1277, IEEE383, UL listed as Type TC.
i. Approved for Use: Indoors or outdoors; wet or dry locations; in cable trays; in raceways; for direct burial; and in Class I, Division 2 location (NEC Article 501).

2. Acceptable Manufacturers: Belden, Okonite, General Cable, Southwire, or approved equal.

D. Ethernet Cable:

1. CAT6:

a. Cable shall exceed Category 6 component transmission requirements specified in ANSI/TIA/EIA-568-C.2 and shall be tested to 100 MHz.
b. UL 1277 Listed, Type TC (Tray Cable) 600 V, 90C cable.
c. Cable shall exceed IEEE 802.3 DTE Power specification to the rated current limits with no degradation of performance or materials.
d. Cable shall be error free Gigabit Ethernet performance to IEEE 802.3.
e. Cable shall exceed the requirements of TIA/TSB-155: 1 Gb/s Ethernet Operation over 55 Meters Channel Length.
f. Cable shall meet or exceed the 4-connector channel performance requirements of Category 6, per the ANSI/TIA/EIA-568-C.2 standard.
g. Product: Construction shall be four twisted pairs of 22 – 24 AWG insulated solid conductors.
h. Overall Cable Insulation Voltage Rating: 600 V.
i. Connector: 50-micron gold plated RJ-45.
j. Warranty: Lifetime.

E. Singlemode Fiber Optic Cable (SMF):

1. Number of Fibers in Cable: 6 fibers.
2. Type of Fiber (optical): Singlemode non-dispersion shifted, 9/125 micrometer (core diameter/cladding diameter).
3. Jacket:

a. Polyvinyl chloride (PVC).
b. Color: Black.

4. Constructed with a central strength member/filler and optical fibers within Aramid Yarn strength member/WB with a ripcord and all enclosed with the PVC outer jacket.
5. Storage and Operating Properties: -40 to +85 degrees C.
6. Rated for both indoor and outdoor application and burial in conduit.
7. UV, water, and fungus resistant.
8. Flame resistance UL 1666.
9. Helically stranded core for flexibility and mechanical protection of the optical fibers.
10. Glass fiber core.
11. Installation minimum Bend Radius no smaller than 8 inches.
12. Fiber color code shall conform to TIA/EIA 598-C.
13. Acceptable Manufacturer:

    a. Optical Cable Corporation.
    b. Belden.
    c. General Cable.
    d. Or approved equal.

2.03 COPPER WIRE JOINTS, TAPS, SPLICES, AND TERMINATIONS

A. Conductors No. 10 AWG and Smaller: For terminations, Contractor shall use crimp-type spade connectors where control wires are connected to screw terminals of equipment.

B. Contractor shall obtain written approval from Owner prior to splicing instrumentation and control conductors.

C. Control and Instrumentation Conductors: Use crimp-type spade connectors where control wires are connected to screw terminals of equipment.

D. Joints, Taps, and Splices Located in Enclosures Subject to Moisture: Use watertight splice kits.

2.04 FIBER OPTICS SPLICES AND TERMINATIONS

A. Connectors:

1. Type ST or as specified.
2. Connectors shall be tool-affixed and listed for the specific application as recommended by the utilization equipment manufacturer.
3. Single-fiber cables with factory installed connectors of suitable type are acceptable.
4. Acceptable manufacturers: Amp, Amphenol, or approved equal.

B. Breakout Kits:

1. Shall consist of heat-shrinkable, polymeric insulating material over the connection area and a high dielectric strength mastic to seal the ends against ingress of moisture and contamination.
2. Shall accommodate a range of cable sizes for both in-line and stub-type configurations.
3. Shall be independent of cable manufacturer’s tolerances.
4. Acceptable manufacturers: Belden, Alpha, or approved equal.

C. Splice boxes:

1. DIN-rail mountable, IP20 protection, sheet steel construction.
2. M20 cable gland connection. Fiber optic cable entry above or below splice box enclosure.
3. Acceptable manufacturer: Phoenix Contact, Corning, or approved equal.

2.05 PERMANENT WIRE MARKERS

A. Provide as specified in Section 260553 – Identification for Electrical Systems.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install wiring and cable as specified in the Drawings.

B. Signal cable shall be installed by personnel who have had a minimum of 3 years of experience in terminating and splicing twisted shielded conductors.

C. Adequate care shall be exercised by the installers to prevent cable damage or sheath distortion. Bending radius shall be per manufacturer's recommendations and not be less than 10 times the cable's overall diameter.

D. Cables shall be continuous from initiation to termination without splices except where specifically indicated.

E. Cable shielding shall be grounded at one end only of the cable. Bonding shall be to a single ground point only. Bonding from cable-to-cable in multiple-run installations shall not be permitted.

F. Heat-shrinkable sleeves shall be installed on cables to insulate shielding at the ungrounded cable terminations.

G. Where installed in control consoles containing power circuits, cables shall be routed a minimum of 2 inches distant. Color-coding shall be strictly observed throughout the installation.

1. Maintain barrier, physical separation, or conduit separation between instrumentation conductors and power conductors to avoid magnetic interaction where such conductors enter and pass through the same electrical trough or enclosure.

H. Manufacturer's cable-pulling tension shall not be exceeded.

I. Fiber Optic Cable Pulling:

1. Complete the pulling of optical fiber cable into conduit or trays without damaging or putting undue stress on the cable insulation.
2. Soapstone, talc, or UL listed pulling compounds are acceptable lubricants for pulling optical fiber cable.

3. Grease is not acceptable.
4. Raceway construction shall be complete, cleaned, and protected from the weather before cable is placed.
5. Whenever a cable leaves a raceway, provide a cable support.

3.02 CONDUCTOR SPLICES AND TERMINATIONS

A. Copper Conductor Splices:

1. Install conductors without splices, unless necessary for installation, as determined and approved in writing by the Engineer. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice cables as follows:

   a. Watertight Splices: Splices in concrete pull boxes, for any type of cable or wire, shall be watertight. Make splices in low-voltage cables using epoxy-resin splicing kits rated for application up to 600 V.
   b. Shields shall be handled as a separate conductor. Use manufacturer's compression sleeve and insulated pigtail. Keep pigtail as short as possible. Terminate pigtail with marker sleeve and tug.

B. Copper Conductor Terminations:

1. Crimp-type terminals shall be Listed, self-insulating, sleeve type with ring or rectangular tongue, suitable for size and material of the wire to be terminated and for use with stranded wire. Spade type lugs are acceptable with telephone cable (TC) systems only.
2. Crimp with manufacturer's recommended ratchet-type tool with calibrated dyes. Crimp shall follow manufacturer's termination instructions.

C. Fiber Optic Cables:

1. Lacing and Bundling:

   a. Lace and bundle individual optical fiber cables in panels and electrical equipment at intervals not greater than 6 inches, spread into trees and connected to their respective terminals.
   b. Lacing shall be made up with plastic cable ties.
   c. Lacing is not necessary in plastic panel wiring duct.
   d. Bundle individual optical fiber cables crossing hinges into groups not exceeding eight fibers and arrange so that they will be protected from chafing when the hinged member is moved.

2. Slack:

   a. Provide slack in junction and pull boxes, handholes, and manholes.
   b. Slack shall be sufficient to allow cables to be routed along the walls of the box.
   c. Amount of slack shall be equal to largest dimension of the box.
   d. Where plastic panel wiring duct is provided for wire runs, lacing is not required.
   e. Do not use plastic panel wiring duct in manholes and handholes.

3. Individual Fibers:

    a. Break out individual fibers from multi-fiber cables utilizing Breakout Kits as specified by cable manufacturer.
    b. Terminate individual fibers with connectors as required by the utilization equipment.
    c. Install connectors using manufacturer's recommended tools.

4. Raceway fill limitations shall be as defined by NEC and the following:

    a. Optical fiber cables may be run in the same raceway with electrical conductors provided derating requirements of the NEC are observed.

5. Unless otherwise indicated, bond armoring of multi-fiber cables to the chassis ground bus at the control panel or per NEC at other locations. Provide terminals for running grounding wires through junction boxes.
6. Terminal Boxes:

    a. Provide at optical fiber cable splices.
    b. If cable is buried or in raceway below grade at splice, provide an instrument stand as specified with terminal box mounted approximately 3 feet above grade.

7. Install and terminate cable in compliance with the manufacturer's recommendations.

3.03 CONDUCTOR IDENTIFICATION

A. Install as specified in Section 260553 – Identification for Electrical Systems.

3.04 FIELD TESTS

A. Perform inspection and acceptance testing and submit test reports for the equipment specified in this section and other Division 26 sections.

1. A field test report shall be prepared and submitted as a single bound submittal package and shall include each test specified in this section and other Division 26 sections. Include separators and tabs, or other means of identification, for each individual test.
2. The test data records shall include the following:

    a. Identification of the testing technician and organization.
    b. Equipment identification.
    c. Description of test method and equipment, including test equipment calibration dates.
    d. Identification of conditions that may affect the test results, such as humidity and temperature.
    e. Date and time.
    f. Inspection and test results. For each test, include range of acceptable test values.
    g. Indication of "as-found" and "as-left" results, as applicable.
    h. Comments and test summary.

B. Continuity Testing:

1. Perform a continuity test on control and signal copper wiring.

   a. Verify single conductors are not accidentally shorted to ground or to each other.
   b. Insulation resistance test for each conductor with a circuit voltage above 150 V to ground.

2. Verify shielded cables have the shield grounded.

C. Fiber Optic Cable:

1. General: The Contractor shall test optical fibers and cable in accordance with the industry standards such as:

   a. TIA/TSB 140 Optical Loss Test Set for attenuation.
   b. Optical Time Domain Reflectometer (OTDR).
   c. Fiber optic power meter.
   d. Fiber optic light source.
   e. Fiber fault locator.

2. Individual fibers:

   a. Test each individual fiber for end-to-end attenuation at the wavelength specified. Verify that the utilization equipment attenuation budget is not exceeded.
   b. Test armoring sheath for continuity and resistance to ground at each end. Resistance to ground grid shall not exceed 1 ohm.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Bidding documents including Division 1 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

B. Provide a complete grounding system that complies with the current edition of the National Electrical Code (NEC), and all applicable regulatory codes.

PART 2 - PRODUCTS

2.1 GROUND RODS

A. Minimum size: 3/4" diameter by 10'-0" long, copper clad steel rods.

2.2 GROUND CONDUCTORS

A. Grounding conductors shall be soft drawn, bare, stranded copper unless otherwise noted. Size as shown on the plans and per the National Electrical Code (NEC) Article 250.

1. GROUNDING ELECTRODE CONDUCTORS FOR A.C. SYSTEMS: See NEC table 250.66.
2. EQUIPMENT GROUNDING CONDUCTORS:
   See NEC table 250.122.
   Equipment grounding conductors may be insulated; provide green insulation and/or approved permanent identification for conductors larger than No. 6 AWG.

2.3 GROUND ELECTRODE CONNECTORS

A. Connectors for grounding electrode conductor to ground rod shall be of the thermal fusion type; conductor-to- conductor connections may be either thermal fusion or approved hydraulically applied compression type.

2.4 GROUNDING BUSHINGS

A. Grounding bushings shall be matched to the ampacity of the grounding conductor and shall have approved set-screw type grounding lug connectors.

2.5 GROUNDING CONNECTORS

A. Shall meet the requirements of ground bushings, cast, set-screw or bolted type.

2.6 GROUNDING CLAMPS

A. Clamps shall be matched to the ampacity of the grounding conductor. Provide approved raceway hub where grounding conductor is shown protected by conduit or armored cable. Clamps shall be U-bolt type for connection to waterpipes.

PART 3 - EXECUTION

3.1 GROUND CONTINUITY

A. Maintain ground continuity throughout the entire electrical system.

B. Permanently connect the electrical system neutral to the water service. The system shall be grounded only at transformer secondaries and at the main distribution board. Branch panel neutrals must be isolated from additional points of grounding.

C. Provide approved grounding bushings or locknuts on all conduits terminating in panelboards, pullboxes or other enclosures to ensure continuity of conduit grounding connections.

D. Securely ground lighting fixtures via the conduit system or by a separate suitable grounding conductor where flexible conduit is used.

E. Provide a separate grounding conductor in all non-metallic conduits and in all flexible metallic conduit runs. Connect to the grounding system in an approved manner.

F. All plug-in receptacles shall be bonded to the box and raceway ground system.

G. Provide a ground conductor in all drop cords and properly connect to grounding type wiring devices or equipment

3.2 GROUNDING CONNECTIONS

A. All grounding connections shall be carefully made to insure low system impedance. Locate grounding connections to allow future servicing and expansion.

3.3 PREPARATION

A. Prior to making mechanical or thermal connections, all conductors shall be clean, dry and bright with the bonding surface thoroughly cleaned of any oxides, mill, scale or other foreign matter.

3.4 PROTECTION

A. Ground conductors shall be protected from mechanical injury during construction. Provide protective coverings or rigid non-ferrous conduit.

3.5 GROUND RODS

A. Ground rods shall be driven into undisturbed soil to full depth. Provide additional rods, ionic salt solutions and the like where special low-resistant grounds are specified.

3.6 CONCEALED GROUND ELECTRODE SYSTEM

A. Concealed ground electrode systems, shall be installed, inspected, tested and certified for low resistance connections and low resistance to earth ground prior to being covered.

3.7 THROUGH-SLAB GROUND PENETRATIONS

A. Ground conductors extending through the slab shall be protected by a rigid conduit sleeve; the void portion of the sleeve shall be packed with a non-hardening type duct seal.

3.8 TESTING

A. Shall conform to Section 26 01 26.

END OF SECTION

SECTION 260526.1 – GROUNDING AND BONDING OF ELECTRICAL SYSTEMS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide grounding and bonding as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.
3. Utility company providing electrical service.

PART 2 – PRODUCTS

2.01 GENERAL

A. Ground Clamp Fittings, Connections, and Joints:

1. Provide interlocking listed clamp fabricated from high strength corrosion-resistant metal.
2. Use irreversible compression-type connectors listed for grounding.
3. Use high strength silicon bronze U-bolt, nuts, and lock washers.
4. Use high strength cast bronze ground rod clamp listed for direct burial for ground rod.

B. Ground Rods:

1. Provide copper or copper-clad steel core.
2. Use 5/8-inch diameter minimum and 10-foot long.

C. Ground Wires:

1. Use bare copper wire only.
2. Size as shown on the Drawings.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Grounding Electrode System:

1. Attach ground wire to a point ahead of water meter or service shut-off valve, when available.
2. Attach ground wire to building steel where available.

B. Main and Supplemental Grounding Electrode Conductors:

1. Install jumper or shunt around water meter and/or shut-off valve when applicable.
2. Attach nonferrous metal tag at water pipe connection to warn against removal.

C. Install properly terminated equipment grounding conductor in all flexible conduits.

D. Drive ground rod to a depth that allows for physical protection and concealment below finished floor or grade. Leave approximately 4 inches of rod exposed for inspection prior to concealment.

E. Make connections to ground rods with molded exothermic weld process, or a listed and approved ground rod clamp.

3.02 ELECTRIC MANHOLE AND HANDHOLE

A. Drive ground rod at convenient point close to wall inside of structure.

B. Connect ground rod to metal cable supports, groundable end bushings on conduits, non-PVC coated metal manhole steps, and cover frame with No. 4 AWG, stranded copper cable.

C. Attach ground wire(s) neatly and firmly to walls.

3.03 FIELD QUALITY CONTROL

A. Perform and record resistance-to-earth measurements witnessed by Engineer with all grounding electrode conductors.

1. Isolate ground under test from other grounds.
2. Measure in normally dry conditions not less than 48 hours after rainfall.
3. Measure at each ground rod and other ground connections when applicable.

B. Maximum resistance allowable is 5 ohms.

C. Use the three-point method of measurement, unless specified otherwise.

END OF SECTION

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide hangers and supports as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 SEISMIC REQUIREMENTS:

A. The installed equipment shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) and the Site Seismic Criteria specified in Section 130541. The Contractor shall submit anchorage and bracing drawings and calculations as specified in Section 130541.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide hot-dipped zinc galvanized, stainless steel, cadmium plated steel, or malleable iron supporting devices.

B. Provide factory PVC-coated metal supports, clamps, and hardware when PVC-coated, galvanized rigid steel conduit is used.

1. Comply with Section 260533 – Raceways and Boxes for Electrical Systems.

C. Provide PVC supports, clamps and hardware for nonmetallic conduit system.

D. Provide drilled expansion insert type sleeve anchors, lag shields, or plastic anchors suitable for load and application.

2.02 LIGHTING FIXTURE SUPPORT

A. Provide stems, hickeys, bar hangers, clips, etc. as required to securely attach light fixtures to ceilings or walls.

B. Provide auxiliary supports where required to allow fixtures to be drawn up tightly, tilted or rotated, and not be affected by vibrations.

C. Provide fixture grid hangers for mounting surface fluorescent fixtures to exposed grid ceilings.

D. Provide arms, supports or support clips as required for lay-in troffers in exposed grid ceilings.

2.03 SUPPORTING STRUCTURES

A. In corrosive locations, provide rack supports of stainless-steel channels with adequate feet for secure mounting. Otherwise, hot-dipped zinc galvanized channels shall be used.

2.04 MOUNTING PANELS

A. Provide adequately braced and sized equipment mounting panels where required to mount equipment.

B. Paint surfaces of panel to comply with Section 099000 – Painting and Coating.

2.05 CONDUIT SUPPORTS

A. Provide continuous or T-slot concrete insert channel.

B. Provide one-hole or two-hole conduit straps as required.

2.06 TRANSFORMER MOUNTING BRACKETS

A. Provide mounting brackets fabricated of galvanized steel channel section designed to support size of transformer.

PART 3 – EXECUTION

3.01 PREPARATION

A. Determine if ceiling channel system is adequately supported to receive and support lighting fixtures.

1. Where deemed inadequate, provide additional support to prevent ceiling from sagging.

3.02 INSTALLATION

A. Install supporting devices in accordance with manufacturer's recommendations.

B. Do not use perforated hanger iron.

C. Pass conduit through pitch pocket at roof line when extending conduit through roof. Minimize roof penetrations for conduit.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Bidding documents including Division 1 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

B. Provide all raceways for a complete electrical system. Include all fittings, hangers and appurtenances required for a complete installation.

C. Provide outlet and pull boxes required to enclose devices, permit pulling conductors, for wire splices and branching.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide boxes suitable for the location. Boxes shall meet NEMA Standards for various types.

2.2 CONDUITS

A. Galvanized Rigid Steel, thick wall (GRS)

B. Intermediate Metal Conduit (IMC)

C. Electrical Metallic Tubing (EMT)

D. Flexible Aluminum Metal Clad (MC) Armored Cable with ground wire with and without polyvinyl chloride jacket

E. Non-metallic, polyvinyl chloride (PVC), schedule 40. Use schedule 80 under roadways.

2.3 FITTINGS

A. GRS and IMC couplings and connectors shall have threaded connections. Galvanized malleable iron or non-corrosive alloy compatible with galvanized conduit. Running thread or set screw type fittings are not permitted.

B. EMT - Couplings and connectors shall be rain tight, steel or malleable iron, utilizing a split corrugated compression ring and tightening nut or stainless-steel locking disk. Set screw fittings are permitted in dry locations. Set screw fittings are not permitted in wet locations or in

concrete. Zinc, pot metal, die cast fittings and indenter fittings are not acceptable.

C. Flexible Metal Conduit

1. Dry Locations: malleable iron or steel, Thomas & Betts "Squeeze" type or equal.
2. Damp or Wet Locations: Thomas & Betts "Super Liquid-Tight" with external ground lug.

D. PVC Fittings shall be solvent welded types.

E. Sealoff fittings shall be with filler fiber, poured compound and removable cover.

F. Expansion Couplings shall be O.Z. type EX with ground jumper.

2.4 INTERIOR WIRING, NEMA 1

A. Flush and concealed outlet boxes shall be galvanized stamped steel with screw ears, knock-out plugs, mounting holes, and fixture stud.

B. Surface outlet boxes shall be galvanized stamped steel same as above for use on ceilings and in accessible locations. Contractor shall provide cast iron galvanized for use on walls below 8 feet.

C. Boxes exceeding 4-11/16 inches square shall be welded steel construction with screw cover and factory painted.

D. Surface Metal Raceway boxes shall be of same manufacture to match raceway. Boxes shall accommodate standard devices and device plates.

E. Boxes for casting in concrete or mounting in masonry walls shall be galvanized steel (not aluminum or zinc die castings), specifically designed and listed for that purpose.

2.5 SPECIAL LOCATIONS

A. For outdoor equipment where a drain is appropriate provide NEMA 3R boxes.

B. For outdoor locations requiring dust and water protection provide NEMA 4 or 4X boxes.

C. For hazardous locations, provide boxes rated for the class and division, as defined in the National Electrical Code.

2.6 BELOW GRADE

A. Where exposed to earth, boxes (handholes or vaults) shall be constructed of precast concrete with hinged and locking cover. Structural loading shall be minimum H25 traffic rating. Provide stamped or welded bead labels (ID same as drawings) on lid and lid frame.

PART 3 - EXECUTION

3.1 GENERAL

A. Install raceways concealed in construction of finished spaces.

B. Cut conduit ends square, ream smooth and extend maximum distance into all couplings and connectors.

C. Provide and install manufactured end caps on all conduit ends during construction to prevent the entrance of water or dirt. Tape, as a cover, is not acceptable.

D. Pull a properly sized mandrel through each conduit prior to installation of conductors or pull-lines to remove any materials trapped within the conduit run.

E. All PVC elbows shall be factory made.

F. Field made elbows are acceptable for steel conduits when made with approved bending tools. Bends that show conduit flattened or deformation are unacceptable and shall be replaced.

G. Conduits shall maintain a minimum 12" clearance from any high temperature surface.

H. The conduit layout shall be carefully planned by the contractor to ensure neat and workmanlike installation. Conduit runs shall be parallel and perpendicular to building structure.

I. Any work showing inadequate planning may be ordered removed by the Architect/Engineer and shall be replaced in a neat and proper manner at no additional cost to the owner.

3.2 CONDUIT SIZING

A. Conduits shall be sized per code for conductors with type THW insulation, although thinner insulation types are permitted in some cases. Conduit size shall not be reduced if large size is specified on the drawing. Minimum interior conduit size shall be 3/4” trade diameter. Interior conduit 1/2” trade diameter may be used for dead end receptacles and switch runs.

B. Minimum exterior conduit size shall be 1” trade diameter.

3.3 GRS AND IMC

A. Install GRS or IMC for all conduits in wet locations, concrete, underground, exposed to weather, hazardous locations, where subject to physical damage and as noted on drawings.

B. Connections shall be watertight in damp locations.

3.4 EMT

A. EMT may be installed for wiring in masonry block, frame construction, furred ceilings, above

suspended ceilings and exposed dry location unfinished spaces not subject to physical damage. EMT shall not be installed underground, under concrete slabs-on-grade, in concrete slabs-on-grade, exposed to weather, on exterior of buildings or on roofs.

B. Contractor shall coordinate assembly and installation of EMT in masonry block construction to avoid construction delays. Avoid surface cut masonry units wherever such masonry units are to remain unplastered or exposed.

3.5 FLEXIBLE CONDUIT AND METAL CLAD (MC) CABLE

A. Provide flexible conduit connection to motors and equipment subject to vibration with at least a 60 degree loop to allow for isolation and flexibility. Use liquid-tight for pumps, equipment which is regularly washed down, and for equipment in damp locations. Provide bonding jumper as required by N.E.C.

B. Metal clad cable with ground wire may be used for branch conduit wiring. Do not use for home runs to panels.

3.6 PVC CONDUIT

A. PVC conduit may be used underground when permitted by code and where designated as an acceptable substitute for GRS or IMC on the drawings. Field bends, less than 45 degrees, when necessary, shall be formed with factory recommended heater. PVC bends 45 degrees or greater shall be factory made.

3.7 SURFACE METAL RACEWAY

A. Install only in unfinished areas where conduits cannot be concealed in finished spaces. Install raceways parallel to a building surface, (i.e. wall, ceiling, floor) and fasten to the surface as recommended by the manufacturer. Mount exposed raceway in the least obvious location.

3.8 UNDERGROUND RACEWAYS

A. Burial depth of underground raceways shall be not less than NEC minimums and shall be deeper where so noted herein or required to avoid conflicts.

B. Arrange and slope conduits entering buildings to drain away from the point of entry.

C. Conduits passing through the exterior walls below grade and/or bridging areas of naturally unstable soil conditions or previously filled areas shall be placed in a manner to avoid crushing from ground settlement. Backfill under conduit shall be thoroughly compacted. Provide approved 360 degree deflection fittings on conduits passing through seismic joint areas design to accept movement.

3.9 CONDUITS IN FOUNDATION AREA

A. Conduits in foundation areas shall be installed so as not to undermine the footings. Check

structural drawings for any specific instructions. Backfill over conduits under footings and concrete slabs shall conform to the requirements of the Architect/Structural Engineer.

B. Conduits passing through conduit footings require approval by Structural Engineer.

3.10 STUBUPS THROUGH CONCRETE SLABS

A. Conduits through concrete slabs shall be steel. Install at such depth so the exposed conduit is vertical and curved section of the elbow is below the concrete slab.

3.11 INSERTS AND SLEEVES

A. Furnish and install all inserts and sleeves necessary for Division 26 installation prior to pouring of concrete slabs and walls.

B. In existing concrete slabs and walls utilize drilled-in threaded inserts, installed as recommended by the manufacturer, where additional supports are required. Neatly core drill openings where additional sleeves are required.

3.12 SEALING RACEWAY PENETRATIONS

A. Exterior Wall Surface Above Grade:

1. For concrete construction above grade, cast raceway or sleeve in wall or core drill wall and hard pack with a mixture of equal parts of sand and cement. Seal around all penetrations, with caulking approved by Architect/ Engineer.

B. Exterior Surface Below Grade:

1. Cast raceway into wall/floor or use manufactured seal assembly cast in place. OZ type "FSK" or equal. Change from PVC to steel conduit (couplings or bushings) where necessary to obtain a watertight seal in poured concrete wall or floors.

C. Roof:

1. Conduits passing through building roof shall be flashed using a 4 lb. per square foot lead plumbing vent flashing extending not less than 10" from the conduit under the roofing, and not less than 10" above the roof around the conduit. Flashing shall be attached by an approved galvanized or stainless-steel clamping band.

D. Fire Rated Construction

1. All seals and products must meet with the approval of the local Fire Marshal.
2. Concrete or Masonry

    a. Seal around raceway with an approved firestop compound that passes UL test 1479 (ASTM E814) DOW CORNING 3-6548, T & B FLAME SAFE, 3M Fire Barrier Caulk, 3M #Fire Barrier Putty, or equal.

3. Plaster or Gypsum Wallboard

    a. Seal around raceway penetration with plaster and approved fire tape.

E. Acoustical Sealing

1. Provide Acoustical Sealing of all wiring and raceway openings in ceilings, walls and floors which are critical barriers for noise transfer. Acoustical sealing shall consist of resilient caulking to seal all openings around wiring and electrical raceways.

3.13 SEALING CONDUITS

A. Seal interior of all conduits which enter the building through floor, roof or outside walls and may carry water into the building. Seal on the end inside the building, using duct sealing mastic, non-hardening compound type, specifically designed for such service. Pack around wires in the conduit.

B. For exterior wall penetrations below grade, install OZ type "CSB" sealing bushing at interior end of penetrating conduit. Threaded fittings-only are permitted in entering conduits ahead of the sealing bushing.

C. Provide for water drainage away from building so no electrical problems will result if seals leak.

3.14 CONDUIT HANGERS

A. General

1. Provide for supporting all conduits from the building structure. Space supports per NEC. Contractor shall provide supports adequate for the loads and resistant to earthquake forces.
2. Contractor is responsible to calculate lbs/sq ft of proposed main conduit runs and verify with project structural engineer if acceptable or additional structural bracing is required. Contractor shall alter conduit route or provide additional bracing acceptable to the structural engineer.
3. Conduits shall be fastened with approved pipe straps or separate suspension hangers to ceiling metal inserts and/or structural members.

B. Hangers for Direct Mounted Conduits

1. Hangers attached directly to building surface shall be two hole sheet steel or one hole malleable iron, all galvanized, pipe clamps. (Thomas & Betts or approved equal).
2. Hangers for ground cable and PVC conduit supporting ground cable shall not encircle the cable or conduit in metal but shall be 2-hole plastic or 1-hole metal clamps.

C. Hangers for Single Suspended Conduit

1. Hangers suspended below ceilings shall utilize steel rods and malleable iron pipe rings

sized for the application (Grinnell No. 97 or approved equal). Provide concrete hanger inserts as required.

D. Trapeze Type Suspended Supports

1. Trapeze type supports shall be used where two or more conduits use the same routing. Such hangers shall utilize steel rods, structural steel channels, and clamps of Kindorf, Unistrut or approved equal, sized for the application.

E. Support of Conduit in Steel Stud Walls

1. Attach conduits to studs with approved straps or 18 gauge steel wire secured to steel bars.

3.15 CONTINUITY OF CONDUIT SYSTEM

A. Conduits shall be assembled continuous and secured to boxes, panels, etc., with appropriate fittings to maintain electric continuity.

3.16 PULL-LINES

A. Provide 150 pound plastic pull-lines in conduit-only systems and spare conduits to facilitate future conductor installation.

3.17 ANCHORING

A. All interior boxes shall be firmly anchored directly or with concealed bracing to building studs or joints. Boxes must be so attached not "rock" or "shift" when devices are operated.

B. Exterior boxes shall be fastened to approved hot dipped galvanized mounting supports and racking appropriate for size of enclosure.

3.18 FLUSH MOUNTING

A. All boxes shall have front edge (box or plaster ring) even with the finished surface of the wall or ceiling. Use of long screws with spacers or shims will not be acceptable.

3.19 RECEPTACLES, SWITCHES, VOICE/DATA OUTLETS

A. Coordinate the work of this Section with the work of other Sections and trades. Study all drawings that form a part of this contract and confer with the various trades involved to eliminate conflicts between the work of this Section and the work of other trades. Check and verify locations with respect to door swings, installation details, cabinet work, and suspended ceilings indicated on contract drawings. Review and coordinate locations of all plumbing, heating, and ventilating equipment and other equipment indicated on the contract drawings of all trades.

B. Centered on Built-In Work: In the case of doors and cabinets, where devices are centered

between two such features, rough-in these device locations exact. Relocate any devices which are located off center at no additional cost to the owner.

C. Where more than one device is shown or specified to be at the same elevation or one above the other, align them exactly on centerlines horizontally or vertically. Relocate as directed all such devices including light switch receptacles, voice/data, signal and thermostat devices which are not so installed, at no additional cost to Owner.

D. Device Outlet Height: Measure from the finished floor to the centerline, unless otherwise noted on electrical or architectural drawings, or required to serve specific equipment.

Switches	42 inches, set vertically
Receptacles	18 inches set vertically. 30 inches in shop and exterior to building
Voice/Data	18 inches, set vertically
Other	As shown on the plans or as directed by the Architect/Engineer

3.20 LIGHTING FIXTURES

A. Locate in accordance with approved architectural ceiling layout plans. Notify Architect/Engineer of any conflicts between plans prior to rough-in. Contractor shall relocate light fixtures at no additional charge if field coordination is not done prior to installation.

3.21 ELECTRICAL WORK IN COUNTERBACKS, MILLWORK AND CASEWORK

A. Provide templates, where required, to other trades for drilling and cutting to insure accurate location of electrical devices as field verified prior to rough-in with the Architect.

3.22 CONNECTION TO EQUIPMENT

A. Provide device back boxes of size and at locations necessary to serve equipment furnished under this or other Divisions of the specifications or by others. A device box is required if equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring or requires wire different from circuit wiring used. Study equipment details to assure proper coordination.

3.23 BLANK COVERS

A. Provide blank cover or plate over all boxes.

END OF SECTION

SECTION 260533.1 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide raceway and boxes as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide conduit system of the types of conduit as indicated in the Conduit Usage Schedule in Part 3 of this section.

B. Provide junction boxes as necessary to facilitate pulling and/or splicing of wires.

C. Provide factory PVC-coated boxes of same coating thickness as conduit system where PVC-coated conduit is used (except hazardous classified areas).

D. Provide PVC boxes where non-metallic conduit system is used.

2.02 METAL CONDUIT AND FITTINGS

A. Galvanized Rigid Steel Conduit (GRC) and Fittings:

1. Conduit: Comply with ANSI C80.1 and UL 6 standards.
2. Fittings: Comply with UL 514B and NEMA FB1 and FB2.10 standards.

B. Electrical Metallic Tubing (EMT) and Fittings:

1. Conduit: Comply with ANSI C80.3 and UL 797 standards.
2. Fittings: Comply with UL 514B and NEMA FB1 and FB2.10 standards.

C. Polyvinyl-Chloride Coated Galvanized Rigid Steel Conduit (PVC-R) and Fittings:

1. Conduit: Comply with ANSI C80.1, UL 6, and NEMA RN1 standards.

    a. Galvanized rigid steel conduit with full weight 40 mil thick PVC exterior coating.
    b. PVC bonding to galvanized metal shall be stronger than plastic tensile strength.
    c. Provide nominal 2 mil thick urethane, or equal, coating to inside of conduit.

2. Fittings:

    a. Comply with UL 514B and NEMA RM1 standards.
    b. Threaded with full weight 40 mil thick PVC exterior coating.
    c. Inside Coating: Nominal 2 mil thick urethane, or equal.
    d. Provide pressure sealing sleeves on all conduit openings.

3. Accessories: Provide straps, clamps, and screws with full weight 40 mil thick PVC exterior coating.
4. Provide factory-installed PVC coating on all components of PVC coated conduit system:

    a. Use coating in field only for touch-up of components.

2.03 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Liquidtight, Flexible Metal Conduit and Fittings:

1. Conduit: Comply with UL 360 standards.

    a. Galvanized flexible steel core.
    b. Provide outer liquidtight, PVC sunlight resistant jacket.

2. Fittings: Comply with UL 514B and NEMA FB1 standards.

B. Flexible Metal Conduit and Fittings:

1. Conduit: Comply with UL 1 standards.
2. Fittings: Comply with UL 514B and NEMA FB1 standards.

2.04 NON-METALLIC CONDUIT AND FITTINGS

A. Polyvinyl-Chloride (PVC) Conduit: Comply with ANSI C80.3, ASTM F512, NEMA TC-2, and UL 651 standards.

1. Use heavy wall, sunlight resistant, PVC Schedule 40 (PVC40) or 80 (PVC80) as shown on the Drawings.
2. Rated for use with 90 degree C conductors.

B. Liquid Tight, Flexible Conduit: Comply with ANSI-79 and UL 1660 standards.

1. Fittings: Liquid-tight.

C. Fittings:

1. Comply with UL 514C and NEMA TC3 standards.
2. Schedule 40 or 80 to match conduit.

2.05 CONDUIT BODIES

A. Metallic Conduit Bodies: Comply with ANSI C80.4 and C33.84, and UL 514 standards.

1. Use galvanized or cadmium plated malleable iron, or copper-free aluminum material.
2. Provide factory PVC-coated conduit bodies of same coating thickness as conduit where PVC-coated conduit is used.

B. Non-Metallic Conduit Bodies: Comply with ASTM F512 and UL 514 and 651 standards.

1. Compatible with Schedule 40 or 80 conduit.
2. UL listed for use.

C. Provide removable cover with gasket and corrosion-resistant screws.

2.06 EXPANSION FITTINGS

A. Expansion Fittings: Comply with UL 514 standards.

1. Provide copper grounding strap and clamps.
2. Use Crouse-Hinds Type XJ, or equal.

B. Expansion/Deflection Fitting:

1. Comply with UL 514 and 467 standards.
2. Use Crouse-Hinds Type XD, or equal.

C. Provide factory PVC-coated fittings of same coating thickness as conduit where PVC-coated conduit is used.

D. For nonmetallic conduit system, use expansion fittings of material to match conduit installed.

2.07 DRAINS AND BREATHERS

A. Automatic Drain-Breather: Use Crouse-Hinds Type ECD, or equal.

B. Condensate Drain:

1. Use conduit outlet body, Type T.

a. Provide threaded, galvanized plug with 3/16-inch drilled hole through plug.

C. Provide factory PVC-coated fittings of same coating thickness as conduit where PVC-coated conduit is used.

D. For non-metallic conduit system, use drains and breathers of material to match conduit system installed.

2.08 HAZARDOUS LOCATION SEALING FITTINGS

A. Comply with UL 886 standard.

B. Use malleable iron, zinc plated, or copper-free aluminum fittings.

C. Use O-Z/Gedney Type EY, EZS, EYD, EYDX, or equal.

D. Use O-Z/Gedney Type EYF fiber packing, or equal, to form dam inside fitting.

E. Use O-Z/Gedney Type EYC sealing compound, or equal.

2.09 FLEXIBLE SEALING COMPOUND

A. Use Panduit DS-5 duct sealing compound, or equal, where air and vaportight conduit sealing is required.

2.10 OUTLET BOXES AND JUNCTION BOXES

A. Flush Mounted: Provide galvanized steel boxes and accessories suitable for application and type construction.

B. Surface Mounted: Provide corrosion-resistant single or multiple gang malleable iron or aluminum Type FS or FD cast boxes with threaded hubs, or pressed steel boxes as permitted under Part 3 of this section.

C. Weatherproof Boxes: Provide gasketed covers and corrosion-proof fasteners.

2.11 PULL BOXES AND SPECIAL PURPOSE OUTLET BOXES

A. Provide pull boxes with covers held in place by corrosion-resistant machine screws, and of type or NEMA rating as shown on the Drawings.

B. Provide special purpose outlet boxes furnished with fixtures and devices where standard outlets are not applicable.

2.12 HAZARDOUS LOCATION JUNCTION BOXES AND PULL BOXES

A. Comply with UL 886 standard.

B. Provide surface mounted, corrosion-resistant, malleable iron or aluminum boxes properly sized for wire fill, listed for Class I, Division 1, Group D locations, and suitable for wet locations where required and shown on Drawings with (XP) symbol.

C. For small applications, NEMA 4/7 conduit bodies may be used. Acceptable manufacturer: Appleton or approved equal.

2.13 ELECTRICAL HANDHOLES

A. Provide electrical handholes as shown on the Drawings and as follows:

1. Heavy duty, precast, stackable type, constructed of polymer concrete and reinforced with heavy-weave fiberglass.

    a. Stack sections to accommodate depth of conduits sloped from buildings to electrical handholes where shown on the Drawings.

2. Heavy duty covers having service load of 15,000 pounds over a 10-inch square area. Tier 15 (ANSI/SCTE77).
3. Embossed cover logo to read ELECTRIC.
4. Stainless steel, hex-head cover bolts and stainless steel threaded inserts.
5. UL Labeled with ANSI/SCTE77 Application Tier Rating.

B. Acceptable Manufacturers:

1. Quazite Corporation, “Composolite” “LG” style (stackable) with covers.
2. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION – RACEWAY

A. Install conduit and fittings in accordance with manufacturer’s recommendations.

B. Run exposed conduits parallel to or at right angles with lines of building or structure.

C. Route conduit runs above suspended panel ceilings so as not to interfere with panel removals.

D. Keep conduit plugged, clean, and dry during construction.

E. Install wall sleeves as shown on the Drawings where conduits pass through foundation walls below grade.

F. Install expansion fittings in the following locations:

1. Conduit runs crossing structural expansion joint.
2. Conduit runs attached to two separate structures.
3. Conduit runs where movement perpendicular to axis of conduit may be encountered.

G. Conduit runs extending through areas of different temperature or atmospheric conditions, or partly indoors and partly outdoors must be sealed, drained, and installed in a manner preventing drainage of condensed or entrapped moisture into cabinets, boxes, fixtures, motors, or equipment enclosures.

H. Conduits Run in Concrete Structures:

1. Comply with applicable provisions of ACI 318 for conduits embedded in structural frame slab.
2. Install conduits parallel to each other spaced on center of at least three times conduit trade diameter with minimum 2-inch concrete covering.
3. Conduits over 1-1/2 inches may not be installed in slab without approval of Engineer.

I. Install bushings with ground lugs and integral plastic linings at equipment with open-bottom conduit entrances.

J. In precast areas, run conduits in roof insulation space. Use 3/4-inch maximum conduit size.

K. Exterior Underground Conduit:

1. Comply with pertinent provisions of Section 312000 – Earth Moving.
2. Provide conduits or ducts terminating below grade with means to prevent entry of dirt or moisture.

3.02 INSTALLATION – BOXES

A. Install boxes in accordance with manufacturer's recommendations.

B. Use weatherproof boxes for interior and exterior locations exposed to weather or moisture.

C. Do not install boxes back-to-back or through wall. Off set outlet boxes on opposite sides of wall minimum 12 inches.

D. Set outlet boxes parallel to construction.

E. Thoroughly clean boxes prior to installing wiring devices.

F. Maintain minimum 4-inch separation between exposed power wires and control/instrumentation wires inside electrical handholes.

G. Provide wall mounted supports for all exposed control/instrumentation wires and cables in electrical handholes as shown on the Drawings.

H. Provide water resistant label on each individual wire and cable in each electrical handhole to designate potential and function per examples as follows:

1. "208 V PHASE A-CLARIF.1 DRIVE MOT," "208 V PHASE C-FEEDER," 120VBR.CCT.20," "4-20MA-FLO.SIG.," "FIBER OPTIC-COMM," etc.

I. Provide water resistant label on each group of wires and cables in each electrical handhole to designate origin and destination per examples as follows:

1. "MCC-1 to MCC-2," "SCP-2 TO CP-1," etc.

3.03 CUTTING AND PATCHING

A. Make provisions for openings, holes, and clearances through walls, floors, ceilings, and partitions in advance of construction.

B. Core drill through reinforced concrete with approval of Engineer.

3.04 RESTRICTIONS

A. Cross high temperature piping or ducts with 12-inch clearance.

B. Do not route conduit over boiler, incinerator, or other high temperature equipment, piping, or ducts.

C. Do not route exposed conduit below and parallel to, or adjacent to water piping.

D. Do not use EMT indenter-type fittings on EMT conduit.

E. Do not splice power wires, control/instrumentation wires/cables, or fiber optic cables in electrical handholes, except where otherwise permitted on Drawings.

3.05 EXISTING CONDUIT

A. The Drawings show the approximate location of existing conduit as indicated by available existing records. The proposed work may require crossing, relocating, and, in some cases, connecting to the existing conduits.

B. Expose carefully the existing conduits throughout the area of proposed work.

1. All existing conduits to remain undisturbed and in uninterrupted use until such time as a change is approved by the Engineer.

C. Where the conduits are to cross or be connected to existing conduit, make a field check to determine whether any conflict will be encountered in laying the new conduit.

1. Adjust the location of new conduits, if necessary, as authorized by the Engineer, to avoid conflict with existing conduits.

D. Where new conduits are to connect to existing conduits, provide all fittings required to complete the connection, and do the work as expeditiously and carefully as possible.

1. Inspect and clean existing conduit prior to installing new wire.

E. Remove and replace existing conduits, fittings, boxes, and all appurtenances as shown on the Drawings.

1. Do not remove and replace existing items shown to remain unless approved by the Engineer.

3.06 CONDUIT USAGE SCHEDULE

A. Underground conduit shall be PVC40 with GRC ells and GRC risers.

B. Install GRC in the following locations unless otherwise shown on the Drawings:

1. Concealed in poured concrete walls and floor or roof slabs.
2. Concealed in insulation above poured or precast concrete roof slabs.
3. Exposed.

C. EMT conduit may be installed in the following locations unless otherwise shown on the Drawings:

1. Only use in administrative / office type areas.
2. Above suspended ceilings.
3. In attic spaces.
4. Concealed in walls, hollow metal or wood framed floors, ceilings, soffits, and overhangs.
5. Concealed by counter base cabinets.
6. Inside exterior electrical enclosures.

D. Install liquid tight flexible metal conduit and fittings for connections to motors, instrumentation, and equipment subject to vibration and at locations shown on the Drawings.

3.07 EXPOSED OUTLET AND JUNCTION BOXES

A. Use cast boxes up to 45 inches above floor.

B. Pressed steel boxes acceptable over 45 inches above floor in dry, indoor locations.

C. Install weatherproof outlet, switch, and junction boxes outdoors and in any area where Drawings show weatherproof (WP) wiring devices.

3.08 OUTLET BOX ACCESSORIES

A. Provide outlet box accessories and mounting devices as required for each installation.

3.09 LIGHTING FIXTURE OUTLET BOXES

A. Securely mount with approved type bar hangers spanning structural members to support weight of fixture.

3.10 OUTLET BOX LOCATIONS

A. Location of outlets and equipment is approximate. Exact location to be verified and determined by:

1. Conflict with equipment of other trades.
2. Equipment manufacturer's drawings.
3. Engineer in field.

B. Minor modification in location of outlets and equipment is considered incidental up to distance of 10 feet with no additional compensation, providing necessary instructions are given prior to roughing-in of outlet boxes and equipment.

C. Nominal mounting heights for devices and equipment to be measured from either above finished floor (AFF) or above finished grade (AFG) to center line of device and, unless otherwise shown on the Drawings, are as follows:

1. Switches: 48 inches AFF OR AFG.
2. AC Receptacles and Telephone Outlets: 48 inches AFF or AFG.
3. Thermostats: 60 inches above floor.

END OF SECTION

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide identification for electrical systems as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 NAMEPLATES AND TAGS

A. Provide nameplates or tags for identification of panels, panel components, and field mounted devices with the following requirements:

1. Engraved laminated plastic.
2. White or black letters on background of opposite color. Match and coordinate color of nameplate or tag background with other panels.
3. Stainless steel screw fasteners.

B. Panel nameplates to have 1/2-inch-high letter engraving.

C. Device and component nameplates or tags to have 3/16-inch-high letter engraving.

D. Engravings include the following:

1. Alpha-numeric number.
2. Descriptive title.
3. Range, where applicable.
4. Engineering units, where applicable.

E. Nameplate schedule shall be included with all equipment submittals.

2.02 UNDERGROUND WARNING TAPE

A. Legend: “CAUTION: BURIED ELECTRIC LINE BELOW”.

B. Size: 6 inches wide.

C. Material: 4.0 mils thick polyethylene with 1,750 psi tensile strength.

D. APWA color-coded background.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install nameplates and tags on enclosures, panel mounted components, and field mounted devices.

B. Install underground warning tape above underground conduit and conductors.

1. Locate underground warning tap 12 inches below grade and still above underground conduit and conductors.

END OF SECTION

SECTION 260573 – OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section specifies the short circuit and coordination study for all voltage levels of the electrical power system. The "electrical power system" starts at and includes the highest voltage buses to the utility service entrance. Refer to one-line drawing of this Contract for details.

1.02 SUBMITTALS

A. Procedures: Section 013300 – Submittal Procedures.

B. Certified short circuit report and coordination study.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Prepared by the manufacturer of the switchboard gear or by an electrical testing service which is regularly engaged in power system studies.
2. Report to be stamped and signed by an electrical engineer registered in the State of Washington.

B. Certification: Short circuit report and coordination study to be stamped and signed by an electrical engineer registered in the State of Washington.

1.04 SHORT CIRCUIT REPORT

A. Prepare a report summarizing the short circuit and coordination study and conclusions or recommendations which may affect the integrity of the electric power distribution system.

B. As a minimum, include the following in the report:

1. Equipment manufacturer's information used to prepare the study.
2. Assumptions made during the study.
3. Short circuit calculations listing short circuit levels at each bus.
4. Evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system.
5. Time-current curves including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker.
6. Comparison of short circuit duties of each bus to the interrupting capacity of the equipment connected to that bus.
7. Coordination with local utility.

C. The report shall include but not be limited to the electrical power system components shown on the system one-line.

D. Submit the report 120 days before the electrical equipment shown on the system one-line drawing is shipped to the job site.

1.05 SHORT CIRCUIT STUDY

A. Provide One-Line Diagram including:

1. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc. Include type designation, current rating, range of adjustment, manufacturer's style, and instrument transformers.
2. Power, voltage ratings, impedance, and primary and secondary connections of all transformers.
3. Nameplate ratings of all motors and generators with their sub transient reactances.
4. Transient and synchronous reactances of generators.
5. Sources of short circuit elements such as utility ties, generators, and induction motors.
6. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc.
7. Standby as well as normal switching conditions.

B. Impedance Diagram:

1. Available MVA or impedance from the utility company.
2. Bus impedance.
3. Transformer and/or reactor impedances.
4. Cable impedances.
5. Equipment impedances.
6. System voltages.
7. Grounding scheme (resistance grounding, solid grounding, or no grounding).

C. Calculations:

1. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.
2. Calculate the maximum and minimum ground-fault currents.

1.06 COORDINATION STUDY

A. Provide an evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system

B. As a minimum, include the following on 5-cycle, log-log graph paper:

1. Time-current curve for each protective relay or fuse showing graphically that the settings will allow protection and selectively within Industry standards. Identify each curve and specify the tap and time dial setting.

2. Time-current curves for each device to be positioned for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, notify the Project Representative as to the cause.
3. Time-current curves and points for cable and equipment damage.
4. Circuit interrupting, device operating, and interrupting times.
5. Indicate maximum fault values on the graph.
6. Sketch of bus and breaker arrangement.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Perform the studies in accordance with IEEE Standards 141 and 242.

B. Perform the studies using actual equipment data and the data from the same manufacturer of protective relay devices as being provided by the switchgear manufacturer, where applicable.

END OF SECTION

SECTION 260913 – ELECTRICAL POWER MONITORING AND CONTROL (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide power monitoring as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Power monitoring equipment shall be factory installed in the electrical enclosure (e.g., motor control centers) that is being monitored.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 including electrical ratings, and manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide a microprocessor-based power monitoring instrument.

1. Front panel mounting style.
2. Compatible with communication protocol as shown on the Drawings.

B. Provide multi-function, 208 Y/120 V, 3-phase, 4 wire monitor that measures and displays the following power system information:

1. True RMS currents, including neutral current.
2. Voltages, both line-to-line and line-to-neutral.
3. KVA, KW, and KVAR.

4. Power factor.
5. Frequency.
6. KW hour and KVAR hour.
7. KW demand and amps demand.

C. Provide non-volatile memory for set-up parameters and historical data storage.

2.02 MULTI-FUNCTION POWER MONITOR INSTRUMENT

A. Provide a multi-function power monitor instrument that includes:

1. Three (3) Form C alarm relay outputs.
2. Minimum accuracies as follows:

a. Voltage and Current: 0.35 percent.
b. Power: 0.5 percent.
c. Power Factor: 1.0 percent.
d. Frequency: +0.2 Hz.

B. Acceptable Manufacturers:

1. Eaton, Model Power Xpert Meter 2000.
2. Square D, Model PowerLogic PM5000 Series.
3. Electro Industries/Gaugetech, Model Shark 200DMMS-300.
4. Or approved equal.

C. Provide CTs compatible with meter submitted and with MCC manufacturer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install power monitoring instrument in accordance with manufacturer's recommendations.

B. Program setpoints to activate alarm relays as follows:

1. Overvoltage: 110 percent.
2. Undervoltage: 90 percent.
3. Voltage Unbalance: 7 percent.
4. Phase reversal.

END OF SECTION

SECTION 260995 – PUSH BUTTONS, SELECTOR SWITCHES, AND PILOT LIGHTS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide push buttons, selector switches, and pilot lights as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

B. Provide two spare pilot light lamps of each type of pilot light installed. Package all spare parts and label all packages with quantity, item description, and part number.

C. Submit Legend Plate list with the descriptions and text used on the plates.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70, National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

1.05 SPARE PARTS

A. Provide the following spare parts: Two (2) pilot light lamps of each type.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide oil-tight, heavy duty NEMA 4X rated, 30 mm push-button switches, selector switches, and pilot lights.

B. Provide all devices with legend plates.

1. Material: Nontarnish metal or laminated plastic.
2. Use white or black letters on background of opposite color for laminated plastic.

C. Use two-circuit contact blocks (one N.O. and one N.C. contact set) for push-button switches and selector switches.

2.02 PUSH-BUTTON SWITCHES

A. Stop Push Buttons:

1. Provide nonilluminated momentary operation type operators.
2. Use red color button.

B. Start Push Buttons:

1. Provide nonilluminated momentary operation type operators.
2. Use black color button.

C. Stop-Hold Switches:

1. Use stop push button as specified above.
2. Include sliding latch with padlock provision to engage stop button in the OFF position.

D. Provide push buttons for other functions as shown on the Drawings.

2.03 SELECTOR SWITCHES

A. Provide selector switches including the operating knob, operating cam, and contact block(s).

B. Use black color operating knob.

C. Select operating cam and contact block combination to provide operating sequence as required.

2.04 PILOT LIGHTS

A. Provide pilot lights with colored plastic lens as shown on the Drawings.

B. Provide 120 V or 24 Vdc, push-to-test type with LED lamp.

2.05 ENCLOSURES

A. Provide for individual remote control or monitor stations the following type enclosure:

1. Indoor Locations: NEMA 1.
2. Outdoor or Wet Locations: NEMA 3R or NEMA 4 steel construction.
3. Corrosive Locations: NEMA 4X stainless steel construction.
4. Hazardous Locations: NEMA 7/9 cast iron, or copper free cast aluminum alloy.

B. Provide nameplate on enclosure for device being controlled.

1. Provide engraved laminated plastic type.
2. Use 3/16-inch-high white or black letters on background of opposite color.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install push-button switches, selector switches, and pilot lights in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 260996 – ELECTRICAL SYSTEMS CONTROL DEVICES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide electrical systems control devices as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70, National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide suitable mounting brackets in conformance with manufacturer's recommendation for each control device required.

2.02 LIMIT SWITCHES

A. Provide heavy duty, precision, oiltight limit switch as follows:

1. Die-cast zinc enclosure meeting NEMA 2, 4, or 13 requirements.
2. Snap action, single pole, double throw contacts.
3. Contacts rated to carry 10 A continuous load at 120 Vac.
4. Include adjustable, side roller arm type, spring return, turret head actuators.

B. Acceptable Manufacturer:

1. Square D Company, Class 9007, Type C.
2. Or approved equal.

2.03 KEY ENTRANCE SWITCH

A. Provide heavy-duty, security station type key-operated selector switch suitable for use in intrusion alarm circuits.

B. Provide double pole single throw (DPST) contacts rated for a minimum of 16 A at 120 Vac.

C. Provide four keys to match existing key system when required by Owner. Coordinate the tumbler with the approved building door hardware.

D. Provide switch so that keys are removable in either position.

E. Provide switch with weatherproof cover plate and tamper-proof screws, switch unit, neoprene gaskets, and seals.

F. Acceptable Manufacturer:

1. Stanley Best Access Systems, Model 1W7D2.
2. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install control devices in accordance with manufacturer's recommendations.

B. Adjust devices for proper operation as intended.

END OF SECTION

SECTION 262213 – LOW-VOLTAGE DISTRIBUTION TRANSFORMERS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide transformers as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including physical dimensions, nameplate data, electrical ratings, and manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL PURPOSE TRANSFORMERS

A. Provide transformers manufactured and tested to meet or exceed NEMA ST 20, UL 1562, ANSI C57.12, and IEEE standards.

B. Provide kVA rating and voltages as shown on the Drawings.

C. Provide overload capacity of not less than 10 percent for intermittent operation.

D. Construct transformer to include:

1. Below 30 kVA: Class F or better insulation having a 115 degrees C. rise average maximum over a 40 degrees C. ambient temperature.

2. 30 kVA and Above: Class H or better insulation having a 150 degree C. rise average maximum over a 40 degree C. ambient temperature.
3. High grade, non-aging cores with sheet silicone steel laminations having core plating insulation on both sides of each lamination.
4. Two 2-1/2 percent primary taps above and below nominal voltage.

E. Transformer Enclosure:

1. Provide sheet steel, phosphatized having one prime coat and two finish coats of baked enamel finish.
2. Maximum temperature for top of enclosure not to exceed 90 degrees C.
3. Indoor use NEMA 1.
4. Outdoor use NEMA 3R with rodent barrier.

2.02 CONTROL TRANSFORMERS

A. Provide UL listed transformers designed to handle high in-rush currents associated with contactors and relays.

B. Provide continuous VA rating: Size for 1.25 times capacity required for all components in circuit.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install transformers in accordance with manufacturer's recommendations.

B. Install wall-mounted transformers on prefabricated brackets designed for purpose.

C. Install floor-mounted transformers on 4-inch concrete pad.

D. Adjust voltage taps for required system voltage when necessary.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Bidding documents including Division 00 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

B. Provide all panelboard equipment complete. All equipment shall be dead front type construction and shall bear the U.L. label. Load centers will not be acceptable.

C. All panels provided for service entrance locations as defined by the NEC shall be provided with a UL label as Suitable for Use as Service Entrance Equipment (SUSE).

1.2 SHOP DRAWINGS

A. Prepare and submit for review prior to manufacture. Include front view, dimensions, device sizes and layout, list of nameplates and all other information required to demonstrate conformance with contract documents.

B. Dimensions of panelboards shall not exceed those noted on or scaled from the contract documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Siemens

B. General Electric

C. Square D

D. Cutler Hammer

2.2 PANELBOARD DESCRIPTION

A. Voltage, arrangement, and capacity of bus and overcurrent protective devices shall be as shown on the drawings. Bus shall extend behind all spaces ready for future overcurrent protective devices.

B. Buss bars shall be plated aluminum or copper with ampere density not-to-exceed 1200/1000 amperes per square inch. Bussing will generally be 3 phase, 4 wire, 100 percent neutral, braced to match the interrupting rating of the breakers.

C. Provide multiple lugs where parallel or "feed-through" connections are shown on drawings.

D. Provide separate neutral and ground buses at the bottom of each panelboard.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Provide thermal-magnetic type circuit breakers.

B. The AIC rating of the panel shall be as specified on the drawings.

C. Mount breakers in all panelboards so breaker handles operate in a horizontal plane. Provide common trip on all multiple pole breakers.

D. 120/208 volt circuit breakers shall be either plug-in or bolt-in type.

E. Circuit Breakers rated 15A through 30A shall be U.L. rated for 60/75 degree centigrade wire. Breakers 35A and larger shall be rated for 75 degree centigrade.

F. Circuit breakers intended for switching 120 volt loads shall be switching duty rated (SWD).

2.4 ENCLOSURE GENERAL CONSTRUCTION

A. Provide cabinets of sufficient dimensions to allow future expansion and addition of overcurrent devices within the panelboards. All panelboards shall be provided with door-in-door construction. Provide increased enclosure width required for installation of conduits.

B. Provide factory primer coat for cabinets located in finished areas. Where cabinets are located in unfinished areas, standard lacquer or enamel finish, gray or blue-gray color, shall be substituted for factory primer coat.

C. All electrical distribution equipment locks shall be keyed identically.

D. Fasten panelboard front with machine screws with oval counter-sunk heads, finish hardware quality, with escutcheons or approved trim clamps. Clamps accessible only when dead front door is open are acceptable.

E. Surface mounted panelboards with fronts greater than 48 inches vertical dimension shall be hinged at right side in addition to hinged door over dead front. Provide three point latching mechanism with one T-handle operator.

F. Provide matching trim of same height for adjacent panels or control devices in finished areas.

G. Special remote control switches, contactors, current transformers, transducers or TVSS

equipment where shown integral to a panelboard, shall be mounted on the same frame as the panelboard interior. Provide screw retained access door in the dead front shield. A common enclosure door shall cover both special integral device(s) and panelboard overcurrent protective devices.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Secure panelboards in place with top of cabinet at 6'-0", above finished grade unless otherwise noted. Top of cabinet and trim shall be level; trim and door shall fit neatly without gaps, openings or distortion.

B. Top edges of adjacent panels shall be even.

C. Securely anchor panelboards to structural framing or walls with approved fasteners and concealed bracing as required. Provide steel channel support framing where panelboard is free standing. Submit support rack shop drawings for approval prior to fabrication.

D. Install panelboard interiors only after building structure is completely enclosed.

3.2 CIRCUIT INDEX

A. Each panelboard shall be provided with a typewritten index listing each circuit in the panel by number, with its proper designation. Listing shall match circuit breaker arrangements, typically with odd numbers on the left and even numbers on the right. Room numbers shall be the final room numbers used in the building as verified with the Owner. Mount index with a transparent protective cover inside the cabinet door.

3.3 PANELBOARD NAMEPLATE

A. Provide phenolic engraved nameplate for each panelboard. See Section 26 05 00

3.4 SPACE

A. Verify space available with equipment sizes and code required working clearances prior to submittal of shop drawings.

END OF SECTION

SECTION 262416.1 – PANELBOARDS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide panelboards as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the following:

1. Cabinet dimensions.
2. Nameplate nomenclature.
3. Electrical ratings and characteristics.
4. Type, amperage rating, listing, and position of circuit breakers in panelboard.
5. Manufacturer's detailed specifications.

B. Submit seismic anchorage and bracing for equipment in compliance with pertinent provisions of Section 130541 – Seismic Restraint Requirements for Nonstructural Components.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.
3. Provide all panelboards of one manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Comply with the requirements of UL 50, 67, and NEMA PB1 standards.

B. Provide short circuit rating (integral equipment rating) for available fault current.

C. Provide panelboard construction with the following:

1. Neutral bus and ground bus with terminals and field removable jumper.
2. Plated or Tinned Copper Bussing:

    a. Distributed phase sequence type.
    b. Ratings as shown on the Drawings, 100 A minimum.

3. Branch Circuit Breakers:

    a. Comply with Section 262800.
    b. Ratings as shown on the Drawings.
    c. UL Class A ground fault circuit protection (GFP) as required.

4. Circuit Directory:

    a. Directory card suitable for complete descriptions.
    b. Clear plastic cover.
    c. Card holder attached to inside of panel door.
    d. Circuit descriptions on directory card shall be typed and not handwritten.

D. Provide main lugs or main circuit breaker rated as shown on the Drawings.

1. Main Circuit Breaker: Comply with Section 262800 – Low-Voltage Circuit Protective Devices.

E. Listed for non-linear loads.

F. Seismic Requirements: The installed equipment shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) and the Site Seismic Criteria specified in Section 130541. The Contractor shall submit anchorage and bracing drawings and calculations as specified in Section 130541.

2.02 FIELD MOUNTED PANELBOARDS

A. Provide galvanized steel enclosure with rust inhibiting primer and baked enamel finish.

B. Provide front with following features:

1. Dead front safety type.
2. Concealed adjustable trim clamps.
3. Concealed hinges.
4. Flush stainless steel cylinder tumbler type locks with spring-loaded door pulls.

    a. Locks keyed alike.

C. Provide engraved laminate plastic type nameplate identifying panelboard with 3/16-inch-high white or black letters on background of opposite color.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with manufacturer's recommendations.

3.02 RESTRICTIONS

A. Separation of hot wires and respective neutral wires where they enter a panelboard is not permitted.

1. All ungrounded and grounded (hot and neutral) conductors of each feeder circuit and each branch circuit must be grouped together where they enter through knock-outs or slots into a panelboard gutter area.

3.03 FIELD QUALITY CONTROL

A. Energize each circuit and check for complete and correct function.

END OF SECTION

SECTION 262419 – MOTOR-CONTROL CENTERS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide motor control centers (MCC) as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including schematic diagrams for each compartment; wiring and interconnection diagrams; frontal elevation and dimension drawings; listing of ratings, sizes, and style of all components, including bus work; nameplate listings; and manufacturer's detailed specifications.

B. Submit seismic anchorage and bracing for equipment in compliance with pertinent provisions of Section 130541 – Seismic Restraint Requirements for Nonstructural Components.

C. Submit operation and maintenance manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Comply with the requirements of UL 845 and NEMA ICS-18.

B. Rating: 208 Vac, 3-phase, 4-wire, 60 Hz unless otherwise shown on the Drawings.

C. Provide individual units in MCC sized and rated as shown on the Drawings and specified herein.

D. Seismic Requirements: The installed equipment shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) and the Site Seismic Criteria specified in Section 130541. The Contractor shall submit anchorage and bracing drawings and calculations as specified in Section 130541.

E. Acceptable Manufacturers:

1. Allen-Bradley.
2. Eaton/Cutler-Hammer.
3. Square D Company.
4. Or approved equal.

2.02 MATERIAL AND EQUIPMENT

A. Provide structure as follows:

1. Sectionalized construction of one or more totally enclosed, dead front, vertical sections joined together to form a rigid, free-standing assembly.
2. Steel base channels and steel lifting angles per manufacturer's standard.
3. NEMA 1A 20-inch wide by 20-inch deep basic sections with gasketing. Other widths and depths for special sections as required.
4. Provisions for future add-on of sections.
5. Laminated plastic engraved tag number identification nameplate on each MCC with 1/2-inch-high white or black letters on background of opposite color.
6. Prime coated, baked enamel finish.
7. Open bottom and removable top plate on each section for conduit entry.
8. Overall size not to exceed allocated space or maximum dimensions shown on the Drawings.
9. Labeled to indicate suitability for use as service entrance equipment when Drawings show service wires terminated to MCC.

B. Provide bus bars and terminations as follows:

1. Front accessible, silver or tin-plated copper over entire length, braced to withstand a fault current of 42,000 RMS symmetrical amperes.
2. Minimum 800 A continuous horizontal bus or greater as determined from frame size of protective device feeding bus.
3. Minimum 300 A continuous vertical bus or greater to accommodate total connected load with all connected circuit breakers or fuses considered at full rating.
4. Bus barriers with plug-in openings at 1/2 space factor intervals and snap-in closing plates for unused openings.
5. Bottom covers over vertical bus.
6. Continuous horizontal ground bus in bottom of MCC sized at 28 percent minimum of main horizontal bus cross-sectional area.
7. Provide line and load terminations accessible from front, suitable for the size, number of conductors, and conductor material as shown on the Drawings.

C. Provide wiring as follows:

1. NEMA Class II, Type B wiring.
2. Track-mounted, pull apart terminals in unit.
3. Vertical wireway with separate door in each section, isolated from bus and control units.
4. Continuous horizontal wireway, top and bottom, throughout entire length.

D. Provide MCC units as follows:

1. Combination Across-the-Line Starters:

    a. Comply with Section 262913.13 - Across-The-Line Motor Controllers.
    b. Use draw out type through NEMA Size 3 inclusive.

2. Molded Case Thermal Magnetic Circuit Breakers: Comply with Section 262800 – Low-Voltage Circuit Protective Devices.
3. Disconnect Switches: Comply with Section 262816 – Enclosed Switches and Circuit Breakers.
4. Operating Handles for Unit-Mounted Circuit Breakers and Disconnect Switches:

    a. Engaged with device at all times.
    b. Up and down motion with down as OFF.
    c. Interlocked with unit door.
    d. Position for padlocking in off position.
    e. Extension to handles at height equal to or greater than 6.5 feet.

5. Fuses: Comply with Section 262800.
6. Transformers: Comply with Section 262213.
7. Panelboards: Comply with Section 262416.
8. Pushbuttons, Selector Switches, and Pilot Lights: Comply with Section 260995.
9. Surge Protective Devices: Comply with Section 264300.
10. Power Monitoring Devices: Comply with Section 260913.
11. Self-aligning, silver or tin plated, plug-on connections to vertical bus.
12. Doors:

    a. Pan type.
    b. Rugged concealed hinges.
    c. 1/4 turn latches or captive knurled thumb screws engaging with cage nuts.

13. Padlock provision to lock unit with plugs disengaged from bus. Units supported and guided by unit support pan:

    a. Pan easily relocated without tools.
    b. Unit manufacturer’s identification tag fastened to unit saddle.

14. Engraved Laminated Plastic Unit Identification Nameplates:

    a. Use 3/16-inch-high white or black letters on background of opposite color.
    b. On each unit.

15. Unit compartments enclosed and isolated from adjacent units, busses, and wireways except for openings for conductor entrance into units.
16. General Purpose Relays, Time Delay Relays, Timers, and Power Control Relays: Comply with Section 269592.
17. Triplex pump controllers as specified in the Drawings, panel-mounted such that pump control switches and lights are accessible and visible without opening MCC bucket cover.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install MCC in accordance with manufacturer's recommendations.

B. Install on concrete pad as shown on the Drawings, and secure with steel bolts.

3.02 ADJUSTMENT AND CLEANING

A. Furnish to Owner one can spray paint matching original finish for future touch-up as required.

END OF SECTION

SECTION 262726 – WIRING DEVICES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide wiring devices as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide wiring devices in type and electrical rating for service indicated.

B. See symbol schedule on Drawings for identification of device type.

C. Acceptable Manufacturers:

1. Hubbell.
2. Leviton.
3. Or approved equal.

2.02 SWITCHES

A. General Use Lighting Switches:

1. Comply with UL 20, NEMA WD-1, and Federal Specification W-S-896 standards.
2. Provide industrial grade, 20 A, toggle type switches.

2.03 RECEPTACLES

A. Comply with UL 498, NEMA WD-1 and WD-6, and Federal Specification W-C-596 standards.

B. General Use Single and Duplex 125 V Receptacles: Provide industrial grade, NEMA 5-20R grounding type receptacles rated at 20 A.

C. General Use Single or Duplex 250 V Receptacles: Provide industrial grade, NEMA 6-20R, grounding type receptacles rated at 20 A, or as indicated.

D. Combination Duplex Receptacles: Provide industrial grade, grounding type receptacles rated at 20 A, consisting of one 120 V and one 250 V receptacle.

E. Ground Fault Circuit Interrupter Receptacles:

1. Comply with UL 943 Class A standard.
2. Provide industrial grade, GFCI duplex receptacles rated at 20 A, 120 V.
3. Provide construction as follows:

a. Shallow depth and NEMA 5-20R configuration.
b. Feed-through feature.

2.04 WIRING DEVICE PLATES AND COVER

A. Comply with UL 514D.

B. Provide wall plates for wiring devices with mounting screws colored to match plate finish.

C. Plates of Interior Flush-Mounted Devices: Provide high impact thermoplastic polycarbonate, nylon or stainless steel.

D. Device Plates for Surface-Mounted Type FS or FD Boxes: Provide type FSK galvanized steel covers.

E. Device Plates for Surface-Mounted, 4-Inch Square Boxes: Provide 1/2-inch raised galvanized steel covers.

F. Weatherproof (WP) Plates and Covers: Provide with gasketed lift cover.

1. Provide lift cover designed to be fully closed when plug for dedicated equipment is inserted in receptacle.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install wiring devices in accordance with manufacturer’s recommendations.

B. Install gasket plates for devices or system components having light emitting features, such as switch with pilot light.

C. Install devices at height as specified in Section 260533 – Raceway and Boxes for Electrical Systems, or as shown on the Drawings.

D. Do not use combination type switch/switch or switch/receptacle devices.

1. Provide separate box gang for each switch and receptacle.

E. Thoroughly clean box interiors from construction dust, debris, etc. prior to installing wiring devices.

3.02 FIELD QUALITY CONTROL

A. Provide operational testing for devices.

B. Test receptacles for correct polarity, proper ground connection, and wiring faults.

END OF SECTION

SECTION 262800 – LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide overcurrent protective devices as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including electrical ratings, physical size, interrupt ratings, trip curves, I^2t curves, and manufacturer's detailed specifications.

B. Provide three fuses of each type and rating installed. Package all spare parts and label all packages with quantity, item description, and part number.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.
3. Provide overcurrent protective devices by same manufacturer for each type of device.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 FUSES

A. General purpose fuses for protection of motors, transformers, feeders, and main service:

1. Use UL Class RK-1 Fuses:

a. Single end rejection or to fit mountings specified.
b. 0 to 600 A rating.
c. 200,000 A interrupting capacity.

d. Dual element, time delay.
e. Use Bussman Low Peak LPN-RK, or equal: 250 V rating.
f. Use Bussman Low Peak LPS-RK, or equal: 600 V rating.

2. Use UL Class L Fuses:

a. Bolt-in type.
b. 601 to 6,000 A rating.
c. 200,000 A interrupting capacity.
d. Time delay.
e. Use Bussman HI-CAP, KRP-C, or equal: 600 V rating.

B. General purpose fuses for protection of motor control circuits, lighting ballasts, control transformers, and street lighting fixtures:

1. Use UL Class CC, fast acting, single element fuses.
2. Rated for 0 to 30 A.
3. Provide 200,000 A interrupting capacity.
4. Use Bussman Limitron KTK-R, or equal: 600 V rating.

2.02 MOLDED CASE CIRCUIT BREAKERS

A. General:

1. Comply with UL 489 requirements.
2. Provide thermal and magnetic protection.

B. Provide permanent trip lighting panel circuit breakers as follows:

1. UL listed SWD (switching duty) on 120 V circuits where switched circuits are indicated.
2. Short circuit rating (integrated equipment rating):

a. Up to 240 V: 10,000 RMS symmetrical amps minimum.

C. Provide permanent trip power panel, enclosed service entrance, standby generator, and MCC circuit breakers as follows:

1. Single magnetic trip adjustment.
2. Bolt-on type.
3. Short circuit rating (integrated equipment rating):

a. Main: 42,000 RMS symmetrical amps minimum.
b. Branch: 14,000 RMS symmetrical amps minimum.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install overcurrent protective devices in accordance with manufacturer's recommendations.

3.02 ADJUSTMENT

A. Set and record adjustable settings on circuit breakers to provide selective coordination and proper operation. Refer to coordination study for settings.

END OF SECTION

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide enclosed switches and circuit breakers as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures including electrical ratings, physical dimensions, NEMA rating, and manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide disconnect with the following ratings:

1. 240 Vac as required by circuit voltage.
2. Ampere value as shown on Drawings.
3. UL listed short circuit rating of 200,000 RMS amps with Class R fuses where a fused disconnect is indicated.

    a. Comply with Section 262800 – Low-Voltage Circuit Protective Devices.

2.02 SAFETY SWITCH

A. Provide NEMA heavy-duty, quick-make and quick-break type:

1. Cover interlock mechanism with handle attached to box.

a. Handle position indication of ON in up position and OFF in down position.

2. Padlock provision in the ON and OFF positions.
3. Provisions for insulated or bonded neutral.
4. Provision for control circuit interlock.

2.03 ENCLOSED CIRCUIT BREAKER

A. Provide molded case circuit breakers:

1. Comply with Section 262800.
2. Cover interlock.
3. Handle position that indicates ON, OFF, or TRIPPED.
4. Padlock provision in the OFF position.
5. External trip indication.
6. Provision for insulated or bonded neutral.
7. Provision for control circuit interlock.

2.04 ENCLOSURES

A. Indoor: Provide NEMA 1 steel construction.

B. Outdoor area: Provide NEMA 3R or NEMA 4 steel construction.

C. Corrosive area: Provide NEMA 4X stainless steel construction.

D. Hazardous area: Provide NEMA 7/9 cast iron or copper free cast aluminum alloy.

2.05 NAMEPLATES

A. Provide engraved laminated plastic type.

B. Use 3/16-inch high white or black letters on background of opposite color.

C. Identify disconnect means as follows:

1. Disconnect: For purpose of switch or equipment controlled.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install motor and circuit disconnects in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 262913.13 – ACROSS-THE-LINE MOTOR CONTROLLERS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide motor starters as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures including enclosure dimensions, nameplate data, electrical ratings and characteristics, wiring diagrams and manufacturer's detailed specifications.

B. Submit operation and maintenance manuals in compliance with pertinent provisions of Section 017700 - Closeout Procedures.

1. Documentation showing final configuration of each solid state (electronic) overload relay if applicable.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

B. Provide all motor starters of one manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide motor starters as follows:

1. Comply with NEMA ICS-2 Standards.
2. International-European (I.E.C.) standards are not acceptable.

B. Provide overloads sized to match motor nameplate full load amps (FLA) rating.

2.02 MAGNETIC MOTOR STARTER

A. Minimum acceptable short circuit withstand rating in combination with motor circuit protective device: 22,000 symmetrical amps.

B. Provide Magnetic Motor Starter:

1. Mounted in vertical position, gravity dropout.
2. Double break silver alloy contacts.
3. Solid State (Electronic) Overload Relay:

   a. Manual reset button.
   b. Visible trip indication.
   c. Use NEMA Class 20 adjustment for general applications.
   d. Use NEMA Class 10 adjustment for submersible pump motors.

4. NEMA Size 1 minimum or as shown on the Drawings.

2.03 COMBINATION MOTOR STARTER

A. Inter-wired combination of magnetic motor starter and thermal-magnetic circuit breaker or fused disconnect switch within a common enclosure or motor control center unit.

B. Provide operating handle with means for padlocking in off position.

2.04 MANUAL MOTOR STARTER

A. Minimum acceptable short circuit withstand rating in combination with motor circuit protective device: 10,000 symmetrical amps.

B. Provide Manual Motor Starter:

1. Double break silver alloy contacts.
2. Thermal overload units.
3. Provision for padlocking in off position.
4. Green pilot light.

2.05 CONTROL CIRCUITS

A. Provide maximum 120 Vac, 60 Hz.

B. Size transformer for 1.25 times capacity required for all components in circuit.

2.06 CONTROLS

A. Provide running time meter mounted in enclosure cover when shown on Drawings as follows:

1. 6-digit, non-resettable.
2. Registered in hours and tenths of hour.

2.07 ENCLOSURES

A. Provide motor starter enclosures as follows:

1. Indoor locations: NEMA 1 steel construction.
2. Outdoor or wet locations: NEMA 3R or NEMA 4 steel construction.
3. Corrosive locations: NEMA 4X stainless steel.
4. Hazardous locations: NEMA 7/9 cast iron or copper free cast aluminum.

2.08 NAMEPLATES

A. Provide engraved laminated plastic type.

B. Use 3/16-inch high white or black letters on background of opposite color.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install motor starters in accordance with manufacturer's recommendations.

B. Coordinate electronic overload parameter settings with supplier of process control panels.

C. Nameplate shall be mechanically fastened to motor starter.

3.02 FIELD QUALITY CONTROL

A. Conduct field tests prior to energization as follows:

1. Megger check wire insulation levels (do not megger check solid state equipment).
2. Record and provide results of tests to Engineer.

END OF SECTION

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 263213 – ENGINE GENERATORS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide engine generator as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including engine-generator set, exhaust system, cooling system, control panel, auxiliary equipment, controls, and manufacturer's detailed specifications.

B. Submit seismic anchorage and bracing for equipment in compliance with pertinent provisions of Section 130541 – Seismic Restraint Requirements for Nonstructural Components.

C. Test Reports:

1. Submit certified test reports of prototype and production tests.
2. Submit field test reports on engine-generator start-up.

D. Submit operation and maintenance manual in compliance with pertinent provisions of Section 017700 - Closeout Procedures.

Commented [PUBS1]: Is this section to be included in spec package?

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70, National Electrical Code (NEC).
2. NFPA 110, Emergency and Standby Power Systems.
3. NFPA 30.
4. Local codes and ordinances.
5. Conduct factory prototype tests.
6. Conduct factory production tests simulating the field load conditions and verify proper operation of all components prior to shipping equipment.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

Commented [PUBS2]: Is this section to be included in spec package?

1.05 WARRANTY

A. The manufacturer shall warrant the materials and workmanship of the generator set for a minimum of 2 years from the registered commissioning and startup.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, and repair part costs during the warranty period.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide engine-generator set and factory authorized service and support from a manufacturer who shall warranty the complete engine-generator package with accessories as described herein.

1. Third party and/or individual warranties for components and accessories of the engine generator package do not meet this requirement of the specifications.

B. Seismic Requirements: The installed equipment shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) and the Site Seismic Criteria specified in Section 130541. The Contractor shall submit anchorage and bracing drawings and calculations as specified in Section 130541.

C. Acceptable Manufacturers:

1. Kohler
2. Cummins Power Generation
3. Caterpillar
4. Or equal.

2.02 ENGINE-GENERATOR RATINGS

A. Provide standby engine-generator set having the following minimum ratings:

1. Standby Rating: 125 kW; 156 kVA.
2. Power Factor: 0.8.
3. Frequency: 60 Hz.
4. Output Voltage: 208 Vac.
5. Three phase, 4-wire, wye connected.
6. Rating based upon operating conditions at 700-foot elevation and 38 degree C ambient temperature.

B. Provide regulator system suitably filtered and capable of regulating the generator output to permit the starting of and running of connected loads as shown on the Drawings, simultaneously with a maximum of 10 percent transient voltage dip for variable frequency drives and 25 percent transient voltage dip for all other loads, with return to steady state in less than 2 seconds. Steady state is

defined as operation with terminal voltage remaining constant within +1/2 of 1 percent of rated voltage.

2.03 ENGINE CONSTRUCTION

A. Provide heavy duty industrial type, water cooled, four stroke, diesel engine.

B. Operates on No. 2 diesel fuel. Engines requiring premium fuels will not be accepted.

2.04 ENGINE ACCESSORY EQUIPMENT

A. Provide the following engine accessories in addition to manufacturer's standard equipment for each system required:

1. Isochronous electronic governor: Control engine speed to maintain a frequency regulation not exceeding +0.25 percent from no load to full rated load.
2. Oil drain extension through side of skid base to outside of generator enclosure.
3. Heavy duty air cleaner.
4. Fuel priming pump or self-priming fuel pump per manufacturer's standard.
5. Fuel/water separator.
6. Lubricating oil cooler.
7. Overcrank cut-out.
8. Overspeed cut-out.
9. Low oil pressure cut-out.
10. High coolant temperature cut-out.
11. Battery charging alternator.
12. Flexible fuel connections.
13. Engine coolant heater with shut-off valves, watt, volt, single phase with adjustable thermostat.
14. Manufacturer's standard vibration isolators located between engine-generator and skid base.

2.05 STARTING BATTERIES AND CHARGER

A. Provide starting batteries:

1. Sufficient number of heavy duty 12 Vdc lead acid type batteries as recommended by the generator set manufacturer.
2. Stranded copper battery cables and clamps.
3. Acid resistant metal battery rack.
4. Locate batteries and rack near engine starter.

B. Provide automatic battery charger:

1. Transistor controlled battery charger for continuous taper charging.
2. Two charge ranges, float and equalize at manufacturer recommended voltage.
3. Automatic surge suppressors.
4. DC ammeter and voltmeter.
5. Fused ac input and dc output.

6. Housing: Manufacturer's standard enclosure for mounting on unit.
7. Operate on input voltage of 120 Vac.
8. Charger malfunction and low battery voltage alarms.

2.06 COOLING EQUIPMENT

A. Unit-Mounted Radiator:

1. Engine driven blower type fan sized to maintain safe operation at 105 degrees F maximum ambient temperature.
2. Duct adapter flange with ductwork and flexible connection section between radiator and discharge louver frame.
3. Total air flow restriction across the radiator not to exceed 0.5 inch W.C.
4. Sized for 50 percent ethylene-glycol solution at 40 degrees C ambient and 1,000 feet elevation.

B. Ethylene-glycol antifreeze with rust-inhibitor to minus 40 degrees C.

2.07 EXHAUST EQUIPMENT

A. Silencer:

1. Provide critical grade silencer (mounted inside the generator set enclosure).
2. Provide inlet and outlet flanges conforming to American Standard 125-150 pound drilling, along with gaskets for sizes 4-inch diameter and larger.
3. Mount so that weight is not supported by engine.
4. Provide with discharge elbow and rain cap.
5. See sound attenuation requirements in paragraph 2.11 A.1.

B. Piping:

1. Sized to ensure that exhaust backpressure does not exceed the maximum limitations specified by the generator set manufacturer.
2. Provide condensate drain tap, connecting nipple, and drain valve with operating handle.
3. Provide stainless steel flexible connector.
4. Provide suitable rain cap.

C. Insulation: Provide insulation for piping, fittings, and silencer, except expansion pieces, such that surface temperatures do not exceed 150 degrees F.

2.08 GENERATOR CONSTRUCTION

A. Provide three-phase, 60 Hz, single bearing, synchronous type generator of drip-proof construction with the following requirements:

1. Reconnectable broad range wiring.
2. Radio suppression meeting commercial standards.
3. Constructed to NEMA, IEEE, and ANSI standards.

4. Class H insulation for both stator and rotor.

    a. Protect both stator and rotor windings with 100 percent epoxy impregnation to reduce possible fungus and/or abrasion deterioration.

5. Voltage Regulation: Plus or minus 0.5 percent steady state within 40-degree ambient temperature change from no load to full load.
6. Provide readily accessible voltage droop, voltage level and voltage gain adjustments (minimum of plus 5 percent).
7. Provide short-circuit current sustaining device to enable the generator to sustain 300 percent of rated current for a period of up to 10 seconds.
8. Provide molded-case, 3-pole circuit breaker as follows:

    a. Rated amperes as shown on Drawings.
    b. Located on generator unit.
    c. Includes lugs for line and load sides.
    d. Includes an isolated neutral and a copper ground bus.
    e. Complies with Section 262800 – Low-Voltage Circuit Protective Devices.

2.09 ENGINE/GENERATOR CONTROLLER

A. General:

1. Digital, open protocol, microprocessor-based system.
2. True RMS sensing, 0.5 percent metering.
3. Programmable protective relaying with alarm set-points for under-voltage, over-voltage, under-frequency, over-frequency, over-current, and reverse power.
4. Programmable load demand relay.
5. User-friendly, quick access, keypad programming.

B. Construction:

1. IP22, dust proof cabinet designed to withstand 20 G shock (22 G at 18-500 Hz.).
2. Processor and associated alarm components sealed in die-cast aluminum housings.
3. Control panel and components to meet E.M.I. Immunity IEC 801-2, IEC 801-3, IEC 801-4, and EN 5082-2.
4. UL 508A listed.

C. Generator mounted electronic modular control panel to include:

1. Standard Generator Control and Monitoring:

    a. Digital ammeter, voltmeter, and frequency meter (0.5 percent accuracy).
    b. Ammeter/voltmeter phase selector switch.
    c. Voltage adjust rheostat.

2. Standard Engine Controls and Monitoring:

    a. Automatic/manual start-stop control.
    b. Engine control switch for off/reset, auto start, manual start.
    c. Cycle cranking.

d. Cool-down timer.
e. Emergency stop push button.

3. Safety Shutdown Protection and LED Indicators for:

a. Low oil pressure.
b. High coolant temperature.
c. Over-crank.
d. Over-speed.
e. Emergency stop push button.
f. Spare.

4. Digital Display for:

a. Coolant temperature.
b. Oil pressure.
c. Service hours.
d. Engine RPM.
e. System dc volts.
f. System diagnostic codes.

5. Five dry contact sets wired to terminal strip as follows:

a. One normally open set to indicate engine failure (closes when engine-generator fails to run).
b. One normally closed set for motorized damper (opens when engine-generator is running).
c. One normally open set for running status (closes when engine-generator is running).
d. One normally closed set for low fuel (opens when fuel tank level is low).
e. One normally open set for shutdown status (closes when engine-generator shuts down).

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2.10 FUEL SUPPLY EQUIPMENT

A. Provide a UL-listed dual wall subbase fuel tank assembly with closed top rupture basin located below engine-generator as follows:

1. Fuel Tank:

a. Fabricate to fit specified engine-generator.
b. Minimum Fuel Capacity: 24-hour engine running time when generator is running at maximum electrical kW rating.
c. Minimum of 12-gauge steel top, bottom, ends, and baffles.
d. Minimum of 7-gauge steel support channels.
e. Design load capacity to support engine-generator specified.
f. Structural angle supports at mounting holes for engine-generator.
g. Engine Fuel Supply and Return Openings with Tubes: 1/2-inch NPT minimum.
h. Manual Fill Tube with Lockable Cap: 2-inch.
i. Vent Opening: sized per NFPA requirements.
j. Fuel level gauge.
k. Low fuel detention system with red warning light on engine-generator control panel and dry contacts for remote indication, powered from engine starting batteries, and activated when fuel level is at 25 percent of tank capacity.
l. Comply with ANSI/NFPA 30.

2. Rupture Basin:

    a. Adequate capacity to contain fuel tank leakage.
    b. Minimum of 12-gauge steel bottom and ends.
    c. Structural steel floor channels with mounting holes for anchoring to concrete base.
    d. Fuel in rupture basin leak detection system complete with detector switch and red warning light on engine-generator control panel, powered from engine starting batteries.

3. Symmetrical to engine-generator footprint.
4. Includes conduit stub-up area with removable cover.

2.11 WEATHERPROOF, SOUND ATTENUATING, SKIN-TIGHT ENCLOSURE

A. Provide sound attenuating, weather protective engine-generator enclosure as follows:

1. Measured sound level with engine-generator running under full load not to exceed 75 dBa at 23 feet (7 meters) in any horizontal direction from center of unit in a free field condition.

    a. Compliance with this requirement to be verified during engine-generator start-up as indicated in Part 3 of this section.

2. Easy access to engine-generator, line circuit breaker, controller, and fuel fill tube by lockable, hinged doors on each side with stainless steel hardware and weather protective door seals.
3. Magnetic/limit switches on each access door prewired in series to terminal blocks in control panel. Switch contact to be closed when door is fully closed.
4. Adequate air flow for cooling and combustion.
5. Constructed of heavy-gauge reinforced aluminum or galvanneal sheet steel.
6. Oil and water-resistant sound absorption material.
7. All metal parts painted with prime coat and factory applied, baked enamel finish coat of color selected by Owner.

    a. No labels or decals except these required for warning purposes will be permitted on the exterior of the enclosure.

8. Factory installed, attached to engine-generator skid base.
9. Exhaust silencer mounted inside enclosure.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install engine-generator package on concrete pad in accordance with manufacturer's recommendations.

1. Anchor unit to concrete foundation with masonry anchors.
2. Provide diesel fuel required for start-up.
3. Provide full tank of diesel fuel upon satisfactory completion of start-up and testing.

B. Fill batteries and connect cables with suitable lugs.

3.02 ENGINE-GENERATOR START-UP

A. After all engine-generator equipment has been installed, provide a portable load bank test using the services of a manufacturer's representative to perform the following:

1. Connect the engine-generator set to the load bank and conduct a continuous 4-hour load test which varies the load on the generator from 10 percent to 100 percent to determine that the voltage, frequency, capacity, fuel, combustion air, cooling, and ventilation systems are adequate.

    a. Apply 10 percent load for 15 minutes, 25 percent load for 15 minutes, 50 percent load for 15 minutes, 75 percent load for 15 minutes, and 100 percent load for 3 hours.
    b. Apply each load increment in single steps.
    c. Observe and record the following parameters at 15-minute intervals throughout the test: voltage, frequency, amperes, oil pressure, coolant temperature, and battery charge rate (record battery charge rate at 5-minute intervals for the first 15 minutes, then at 15-minute intervals thereafter).

2. Perform an automatic transfer switch test in accordance with NFPA 110.

    a. Provide a comprehensive demonstration to Owner of the system maintenance and operation after the load bank test.

END OF SECTION 263213

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 263600 – TRANSFER SWITCHES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide transfer switches as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including electrical ratings, wiring schematics, single-line diagrams, NEMA rating, and manufacturer's detailed specifications.

B. Submit seismic anchorage and bracing for equipment in compliance with pertinent provisions of Section 130541 – Seismic Restraint Requirements for Nonstructural Components.

C. Submit operation and maintenance manuals in compliance with pertinent provisions of Section 017700 - Closeout Procedures.

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1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electric Code (NEC).
2. NFPA 110 Emergency and Standby Power Systems.
3. UL 1008.
4. NEMA ICS10-1993 Automatic Transfer Switches.
5. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

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PART 2 – PRODUCTS

2.01 GENERAL

A. Rating:

1. Service entrance rated, 208Y/120 V, 3-phase, 4-wire, 60 Hz.
2. Continuous current rating as shown on the Drawings.

3. Minimum 42,000 RMS symmetrical amperes short circuit current.

B. Seismic Requirements: The installed equipment shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) and the Site Seismic Criteria specified in Section 130541. The Contractor shall submit anchorage and bracing drawings and calculations as specified in Section 130541.

C. Provide automatic transfer switches with the following requirements:

1. Break before make, double throw contact configuration with mechanical and electrical interlocks to prevent load circuits from being connected to normal and emergency power sources simultaneously.
2. Industrial type pilot devices, relays, and time delays.
3. Front accessibility for ease of maintenance.
4. Programmable neutral switch position for motor load decay with the following requirements:

    a. Transfer time adjustable from 0 to 30 seconds.
    b. Time delay occurs for both transfer directions.
    c. Mechanical interlock to prevent both sets of contacts from being closed at the same time.

5. Undervoltage sensing (phase to ground) for each phase of normal source as follows:

    a. Pick-up voltage adjustable from 85 to 100 percent of nominal (set at 95 percent).
    b. Drop-out voltage adjustable from 75 to 98 percent of nominal (set at 85 percent).

6. Frequency and voltage sensing devices to prevent transfer to the emergency source until the engine-generator has reached its rated frequency and voltage as follows:

    a. Voltage adjustable from 85 to 100 percent of nominal (set at 90 percent).
    b. Frequency adjustable from 90 to 100 percent of nominal (set at 95 percent).

7. Time delay for override of normal source voltage sensing adjustable from 1 to 6 seconds (set at 1 second) to delay transfer and engine start signals.
8. Time delay for retransfer to normal source adjustable from 0 to 30 minutes (set at 10 minutes) beginning when normal source voltage has been restored to 95 percent of rated voltage on all three phases.
9. Test switch to simulate a normal source failure.
10. Position indicator lights to indicate which source is connected to the load.
11. Source available indicating lights controlled by normal and emergency source sensing circuits.

    a. Normal Source Available: Green light with engraved nameplate.
    b. Emergency Source Available: Red light with engraved nameplate.

12. Unassigned Auxiliary Switch Position Contacts: Normally open, single pole, double throw, rated 10 A at 240 Vac/32 Vdc.
13. Engine Start Contacts: One normally closed, one normally open rated 10 A at 32 Vdc.

14. Engine shutdown contacts time delay adjustable from 0 to 10 minutes (set at 5 minutes) after retransfer to normal source.
15. Engine Generator Exerciser: Solid state, programmable time switch as follows:

    a. Exercise cycle selectable for weekly, bi-weekly, or calendar schedule and time of day.
    b. Exercise period adjustable with automatic retransfer to normal source at end of period.
    c. Integral battery operation of exerciser when normal control power is not available.

D. Provide enclosure as follows:

1. Indoor: NEMA 1 rating.

2.02 CONTACTOR TYPE AUTOMATIC TRANSFER SWITCH

A. Provide a mechanically held, contactor type automatic transfer switch as follows:

1. Operated by momentarily energized mechanism.
2. Includes means for manual operation.

B. Acceptable Manufacturers:

1. ASCO Power Technologies.
2. Cummins.
3. Caterpillar.
4. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install transfer switches in accordance with manufacturer's recommendations.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a factory authorized service representative to inspect, test, and adjust the automatic transfer switches to verify proper operation.

3.03 DEMONSTRATION

A. Provide training on adjustment, operation, and maintenance of the automatic transfer switches.

B. Coordinate training with that for the engine generator equipment.

END OF SECTION 263600

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 264300 – SURGE PROTECTIVE DEVICES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide surge protection as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 SURGE PROTECTIVE DEVICE (SPD)

A. Design surge-protective device to protect ac secondary power line from line transients and other damaging voltage spikes.

B. Provide surge-protective device with the following requirements:

1. Meets or exceeds the following standards:

   a. ANSI/IEEE C62.41, C62.45, and C62.11.
   b. UL 1449.

2. Suitable for service entrance, Category C.
3. Suitable for operation on 208Y/120V, 3-phase, 4-wire system, at 60 Hz.
4. Capable of repeated operations.
5. Replaceable modular protection.

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6. Backup redundant protection.
7. 200,000 A per phase surge current capacity.
8. Monitoring of normal operation, protection event and protection reduced through indication lamps.
9. Suitable for mounting in service entrance equipment.

C. Acceptable Manufacturers:

1. Square D.
2. MCG Electronics, Inc.
3. LEA International.
4. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install surge-protective device in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 265000 - LIGHTING

PART 1 – GENERAL

1.1 SUMMARY

A. Bidding documents including Division 1 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

B. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, pole mounted lights, LED module, drivers, emergency lighting units, and accessories.

C. Provide the lighting system complete and operational. All light fixtures shall be provided complete with LED module, mounting hardware and accessories required for operation.

D. Provide lighting fixtures of types, sizes and finish as listed on the drawings. Light Fixtures shall be complete assemblies constructed to ensure full life of components and minimize amplification and transmission of component generated noise.

E. Contractor shall include in the bid all costs and documentation for lighting control commissioning required by the Washington State Non-Residential Energy Code (WSNREC). Contractor shall provide the owner a complete report of test procedures and results indicating all lighting controls have been tested, adjusted and operate in accordance with approved plans and specifications per the authority having jurisdiction.

F. Light fixture schedule series numbers are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of LED, driver, finish trim, ceiling type, mounting hardware, ceiling trim or special requirements as specified hereinafter or as required by the particular installation(s). Provide complete light fixtures and drivers to correspond with the number of LED's, wattage, switching and/or size specified. Refer to light fixture schedule, Architectural drawings, and schedules for additional requirements.

G. Light fixture voltage shall match voltage of circuit serving the light fixture. Contractor as part of the submittal process shall verify ceiling type compatibility of each light fixture and notify engineer in writing of any conflicts.

1.2 REFERENCES

A. Shall be as follows:
National Electrical Manufacturer's Association (NEMA):
LE 5-1993 Procedure for determining luminaire efficiency ratings.

1.3 QUALITY ASSURANCE

A. Listing and Labeling: Provide light fixtures, emergency lighting units, and accessories Listed

and Labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which installed.

B. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.4 SUBMITTALS

A. Submittals shall be neatly and clearly marked to indicate the light fixture(s), LED module and drivers fully comply with contract documents. When substitute light fixtures are submitted (if permitted) the data shall clearly cross reference (written and highlighted) the substitute light fixture complies with every detail of the specified light fixture. Light fixtures not fully complying with contract documents are not permitted.

B. Submittals shall have light fixture types and project name clearly indicated and shall be prepared by the authorized manufacturer's representative serving the project area. A list of manufacturer representatives (including address, telephone and fax numbers) identifying which light fixture types they represent shall be included with submittals. Submittals or requests for approval not meeting these requirements will be rejected.

C. For light fixtures mounted in continuous rows, submit scaled drawings prepared by the light fixture manufacturer showing all details of construction, lengths of runs, weight pendant and power feed locations, accessory pieces, finishes method of field assembly and list of materials.

Contractor to provide manufacturer with accurate field dimensions where required.

D. Product Data: For each type of lighting fixture indicated on the lighting fixture schedule, arranged in order of light fixture designation. Include data on features, accessories, and the following:

1. Dimensions of light fixtures.
2. Certified results of independent laboratory tests for light fixtures and LED module for electrical ratings and photometric data.
3. Emergency lighting unit battery and charger.
4. Types of LED's, color temperatures and (LPW) lumens per watt.

E. Wiring Diagrams: Detail wiring for light fixtures that clearly differentiates between manufacturer-installed and field-installed wiring.

F. Product Certificates: Signed by manufacturer(s) or their designated representatives stating lighting fixtures certifying that products comply with drawing and specification requirements.

G. Dimming Driver Compatibility Certificates: Signed by manufacturer of driver certifying drivers are compatible with dimming systems and equipment with which dimming drivers are to be used.

1.5 SUBSTITUTIONS

A. Lighting fixtures designated for this project are based on the light fixture types and manufacturers specified. If substitution of light fixtures other than those specified is proposed, Contractor shall submit highlighted product information for approval.

B. Substitution requests shall include all information required under 1.04 SUBMITTALS of this section.

1.6 COORDINATION

A. Lighting Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.7 WARRANTY

A. General Warranty: Special warranty specified in this section shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties under requirements of the Contract Documents.

B. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 10 years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for last nine years. Warranty shall include removal/installation labor and legal disposal by manufacturer.

C. Special Warranties for LED Drivers: Written warranty, executed by manufacturer agreeing to replace LED drivers, including removal/installation labor for driver failure in materials or workmanship within specified warranty period.

E. Light Fixtures Utilizing LED Lamp Technology: Provide manufacturer's warranty for a period of not less than 5 years including parts and labor for full replacement of defective product.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below to match product installed and packaged with protective covering for storage and identified with labels describing contents.

1. Drivers: Provide 10% (minimum 1) of each type LED light fixture driver. Label each driver with fixture type as identified in O & M manual and on record drawings. Turn over to Owner at completion of project and obtain signed receipt.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES AND LIGHTING FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during re-lamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

2.2 LED MODULES AND LED DRIVERS

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:

a. Minimum efficiency: 85% at full load.
b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
d. Integral short circuit, open circuit, and overload protection.
e. Power Factor: ≥ 0.95.
f. Total Harmonic Distortion: ≤ 20%.
g. Comply with FCC 47 CFR Part 15.

4. LED modules shall include the following features unless otherwise indicated:

a. Comply with IES LM-79 and LM-80 requirements.
b. Minimum CRI 80 and color temperature 3500˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
c. Minimum Rated Life: 50,000 hours per IES L70.
d. Light output lumens as indicated in specified fixture literature.

B. LED Fixtures:

1. Housing, LED driver, and LED module shall be products of the same manufacturer.

2. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2.3 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with Authorities Having Jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
4. Self-diagnostic type with test switches and indicator lights.

2.4 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. LED module automatically disconnects from battery when voltage approaches deep-discharge level.
   When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
4. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.
5. Self-diagnostic type with test switches and indicator lights.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Contractor shall provide “Seismic Controls for Electrical Work” such as channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as light fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single light fixture. Finish same as light fixture.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to light fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by light fixture manufacturer.

2.6 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each light fixture.

B. Verify mounting provisions prior to the ordering of fixtures. Fixtures shall be UL listed for the location, and application in which they are installed.

C. Install lighting fixture diffusers only after construction work, painting and clean up are completed. Prior to final acceptance, remove all, reflectors and diffusers, wash, rinse and reinstall.

3.2 SUPPORT OF LED FIXTURES

A. Recessed Downlight Type: Mount in frames suitable for the ceiling, with the recessed portion of the light fixture securely supported from the ceiling framing. For light fixtures supported by a ceiling suspension system, provide as a minimum or as required by ARJ, two safety chains secured to structural members above suspended ceiling.

B. Surface and Pendant Mounted Type:

1. Where mounted on accessible ceilings, hang from structural members by means of hanger rods through ceiling or as approved.
2. Continuous Runs of Light Fixtures: Straight when sighting from end to end, regardless of irregularities in the ceiling. Where light fixtures are so installed, omit ornamental ends between sections. For surface pendant mounted fixtures of three or more provide a

unistrut channel for mounting fixtures. Provide 3/8-inch thread rod secured to structural members for support of unistrut channel.

3. Provide surface mounted fluorescent light fixtures with UL approval for direct mounting on the various ceilings used. Spacers will not be approved where mounted on lay-in ceilings, support light fixtures by at least two positive devices which surround the ceiling runner, and which are supported from the structure above by a No. 12 gauge wire. Spring clips or clamps that connect only to the runner are not acceptable.

3.3 CONNECTIONS

A. Ground equipment

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed light fixture for damage. Replace damaged light fixtures and components. Verify color temperature.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Test as follows:

1. Verify proper operation, switching and phasing of each light fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation. Verify normal transfer to battery source and retransfer to normal.
3. Report results in writing.

E. Malfunctioning Light Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.5 CLEANING AND ADJUSTING

A. Clean light fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

3.6 FIRE-RATED ENCLOSURES

A. The contractor shall provide 5/8" plasterboard minimum, taped box enclosures for all recessed light fixtures in 1 or 2-hour fire-rated ceilings, as required by local building or fire codes. Enclosure to provide minimum 3" air space around light fixture Contractor prior to bid shall verify Architectural drawings and specifications for areas where this provision is applicable.

3.7 CEILING TYPES

A. Refer to Architecture drawings. Provide flange trim where light fixtures are installed in GWB ceilings.

B. The Contractor prior to submitting shop drawings to the Engineer for review shall review the Architectural drawings to verify and coordinate the ceiling systems and lighting fixture frame requirements as well as proper ballast voltage. Contractor shall provide a written statement with the shop drawing submittal stating this has been completed.

3.8 CONCRETE FOUNDATIONS

A. Install at locations shown taking care to provide soil compaction the same as required under paving to avoid settling and tilting of pole. Provide for all steel, concrete or aluminum poles shown. Concrete foundations shall have a minimum raceway sweep(s) of 90 degrees and anchor bolts shall be accurately set in foundations using a template supplied by the pole manufacturer. When concrete work has cured, base plates shall be leveled and grouted in place. Pole anchor bases shall then be set on base plates, leveled plumb on foundations, and secured with holding nuts.

END OF SECTION

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 265629 – SITE LIGHTING (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide site lighting as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings for each type of pole, mast arm, and fixture required, including:

1. Manufacturer's printed data, including photometric data on lighting fixtures.
2. Manufacturer's printed data on pole, base, anchor bolts, and bolt pattern.
3. Fixture shop drawings in booklet form with index and a separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with specified fixture, pole, and accessories clearly indicated on each sheet.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electric Code (NEC).
2. Local codes and ordinances.

B. Fixtures and poles as specified in lighting fixture schedule establish standard of quality for project as determined by Engineer.

C. Equivalency of fixtures will be determined by Engineer based upon the following criteria:

1. Efficiency.
2. Photometric data (Efficacy, Distribution).
3. Appearance.
4. Construction.
5. Design compatibility.
6. Manufacturer reliability based upon past performances.

D. Equivalency of poles will be determined by Engineer based upon the following criteria:

1. Appearance.
2. Construction.
3. Design compatibility.
4. Manufacturer reliability based upon past performances.

E. Provide fixtures that bear UL label and manufacturer's name.

PART 2 – PRODUCTS

2.01 SITE LIGHTING

A. Provide lighting fixtures of type, size, and rating shown in lighting fixture schedule at locations shown on the Drawings, complete with, but not necessarily limited to, lamps, lamp holders, ballast, reflectors, starters, wiring, and any other details required for a complete working installation.

B. Provide pole-mounted fixtures designed for pole top tenon mounting with adjustable adapter designed for easy mounting and maintenance.

2.02 POLES

A. Comply with pole requirements contained in description on lighting fixture schedule and notes on the Drawings.

2.03 PHOTOELECTRIC CONTROLS

A. Provide photoelectric controls where indicated on the Drawings.

B. Provide control unit as recommended by lighting manufacturer for fixture and lamp type.

C. Construct in accordance with NEMA specifications.

D. Turn-on, turn-off ratio to meet NEMA specifications.

E. Design to inhibit actuation by transient light sources such as lightning or vehicle headlights.

F. Operate over a temperature range of -30 to 70 degrees C.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which fixtures and lighting poles are to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Poles:

1. Provide pole foundations in the location shown on the Drawings.
2. Provide concrete foundations as detailed on the Drawings and as recommended by manufacturer.
3. Anchor pole to concrete foundation as recommended by manufacturer.
4. Ground metal poles as specified in Section 260526.
5. Paint metal poles, if required, as specified in Section 099000.

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B. Fixtures:

1. Install and wire fixture heads as recommended by manufacturer.
2. Verify placement of surface-mounted fixtures to maintain alignment, spacing, layout, and general arrangement as shown on the Drawings.
3. Provide fuses within transformer base to individually protect/disconnect each pole mounted fixture.

C. Photo Electric Controls: Install control unit as recommended by manufacturer.

3.03 ADJUSTMENT AND CLEANING

A. Adjust angle of light fixture head, if adjustable, to provide illumination over area intended and thoroughly clean refractor.

B. Adjust photoelectric controls, if any, to provide correct response to changing light levels.

C. Align adjustable fixtures after daylight to satisfaction of the Engineer.

3.04 FIELD QUALITY CONTROL

A. At time of Substantial Completion, replace lamps in lighting fixtures observed to be noticeably dimmed after Contractor's use and testing, as judged by the Engineer.

END OF SECTION 265629

SECTION 266020 – ELECTRICAL SERVICE (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide electrical service as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.
3. Utility Company providing service.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 ELECTRIC POWER SERVICE

A. Electrical Service for the Site: 800 A, 208Y/120 V, 3-phase, 4-wire, provided by Ohop Mutual Light Co. (Utility Company).

2.02 MATERIALS

A. Comply with applicable sections of these Specifications and Utility Company requirements for all Contractor-furnished conduit, fittings, wire, metering equipment, etc.

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate installation of electrical service to site with Utility Company and Owner/Engineer.

3.02 INSTALLATION

A. The Utility Company will provide the following:

1. Compartmental transformer mounted on concrete pad.
2. Transformer primary connections, protection, and grounding.
3. Transformer secondary connections.
4. Meter.
5. Current transformers for services having current ratings higher than 200 A.

B. Provide the following and all other related electrical work and miscellaneous materials for a complete installation:

1. Conduit and conductors, etc. for secondary service from Utility Company transformer to metering equipment.

    a. Slack length of service conductors at transformer per Utility Company requirements.

2. Metering equipment and termination of service conductors in metering equipment.
3. Conductor, ground rods, fittings, etc., for grounding.

3.03 OWNER RESPONSIBILITY

A. Owner will apply for and obtain Utility Company's Service Agreement for electrical service.

B. Owner will pay directly to Utility Company all installation and/or excess facilities charges, if any, and monthly service charges.

END OF SECTION

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 269592 – RELAYS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. This section specifies general purpose relays and time delay relays.

B. Provide relays as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 REFERENCE STANDARDS

A. The relays shall be designed, manufactured and tested in accordance with the latest applicable following standards:

1. UL Listed.
2. UL Standard 508, Industrial Control Equipment.
3. UL Standard 916, Energy Management Equipment.
4. UL Standard 864, Control Units and Accessories for Fire Alarm Systems.

1.03 SUBMITTALS

A. Procedures: Section 260511 – Basic Electrical Methods and Materials, and Section 013300 – Submittal Procedures.

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B. Submit shop drawings including but not limited to:

1. Catalog cuts for all materials.
2. Product Data:

    a. General features and dimensions of relays.

3. Test results for all specified testing.
4. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

C. Provide one spare relay for each type of relay installed. Package all spare parts and label all packages with quantity, item description, and part number.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.

B. Contractor shall store relays in dry, temperature-controlled location and provide protection from dust, debris, and moisture while electrical equipment is stored before installation.

C. Comply with pertinent provisions of Section 016000 – Product Requirements.

1.05 SPARE MATERIALS

A. Provide one spare relay for each type of relay installed. Package all spare parts and label all packages with quantity, item description, and part number.

1.06 WARRANTY

A. In addition to the warranty specified in Division 1, the manufacturer's warranty to Owner shall in no event be for a period of less than 2 years starting from when the equipment and installation are substantially complete.

B. Warranty shall include repair parts, labor, and travel expenses.

PART 2 – PRODUCTS

2.01 GENERAL PURPOSE RELAYS

A. Design general purpose relays to operate as follows:

1. On application of control power to relay coil, contacts reverse state.
2. Contacts return to de-energized state on removal of control power.

B. Provide general purpose relays with the following requirements:

1. Plug-in blade type.
2. Contacts:

    a. Material: Silver cadmium oxide.
    b. Rating: Minimum of 10 A at 120 Vac.
    c. Two Form C, minimum. Provide number of contacts for each relay as required for application.

3. Duty Cycle: Continuous.
4. Relay sockets with barrier-type screw terminal connections for external wiring:

    a. Surface or DIN rail mount.
    b. Relay hold-down clips.

5. Lamp indication when relay is energized.
6. Acceptable Manufacturers:

a. IDEC, RH Series.
b. Or approved equal.

2.02 DELAY-ON-MAKE (ON-DELAY) TIME DELAY RELAYS

A. Design delay-on-make time delay relays to operate as follows: On application of voltage to the coil, the relay contacts remain in the "off state" and timing cycle begins. When the set time has elapsed, the relay contacts transfer to the "on state." The contacts remain in the "on state" until the timer is reset. The timer is reset upon removing the coil voltage. Timer is then ready for the next operation.

B. Provide delay-on-make time delay relays with the following requirements:

1. Plug-in blade type.
2. Repeat Timing Accuracy: Plus or minus 1.5 percent.
3. Minimum Setting: 10 percent of full range.
4. Duty Cycle: Continuous.
5. Timing Range: 0.1 seconds–10 minutes.
6. Contacts:

   a. Material: Silver cadmium oxide.
   b. Rating: 10 A at 120 Vac.
   c. Two Form C.

7. Relay sockets with barrier-type screw terminal connections for external wiring:

   a. Surface or DIN rail mount.
   b. Relay hold-down clips.

8. Acceptable Manufacturers:

   a. IDEC, RTE Series.
   b. Or approved equal.

2.03 DELAY-ON-BREAK (OFF-DELAY) TIME DELAY RELAYS

A. Design delay-on-break time delay relays to operate as follows: Voltage is applied to the coil at all times. When a momentary or maintained start signal is supplied the contacts immediately transfer to "on state." The set time begins when the start signal is removed. When the set time has elapsed, the contacts transfer to the "off state." The contacts remain in the "off state" until the next start signal is supplied. The timer can be reset by application of a reset input or by removing coil voltage.

B. Provide delay-on-energize time delay relays with the following requirements:

1. Plug-in blade type.
2. Repeat Timing Accuracy: Plus or minus 1.5 percent.
3. Minimum Setting: 10 percent of full range.

4. Duty Cycle: Continuous.
5. Timing Range: 0.1 seconds–10 minutes.
6. Contacts:

    a. Material: Silver cadmium oxide.
    b. Rating: 10 A at 120 Vac.
    c. Two Form C.

7. Relay sockets with barrier-type screw terminal connections for external wiring.

    a. Surface or DIN rail mount.
    b. Relay hold-down clips.

8. Acceptable Manufacturers:

    a. IDEC, RTE Series.
    b. Or approved equal.

2.04 POWER CONTROL RELAYS

A. Design power control relays to operate as follows:

1. On application of control power to relay coil, contacts reverse state.
2. Contacts return to de-energized state on removal of control power.

B. Provide power control relay for heavy-duty switching operation with the following requirements:

1. Screw-mounted type with screw type terminals.
2. Contacts:

    a. Material: Silver cadmium oxide.
    b. Rating: 25 A at 277 Vac, 1 hp per movable arm at 120 Vac.
    c. Two Form C, minimum.

3. Duty Cycle: Continuous.
4. Coil Operating Voltage: 120 Vac.
5. Acceptable Manufacturers:

    a. Potter and Brumfield.
    b. Or approved equal.

2.05 THERMOSTAT CONTROL RELAYS

A. The thermostat control relay shall have dual thermostat function to control both the heater unit and the air conditioner. The heater is used to minimize enclosure condensation when the air conditioner is OFF. The air conditioner is used to keep the equipment temperature below maximum operating temperature and is only ON when the heater is OFF:

1. The dual thermostat shall have two separate adjustable temperature controls, one to OPEN as temperatures rise (i.e., heater) and the other to CLOSE as temperature continues to rise (i.e., air conditioner).
2. Dual thermostat shall have adjustable range from 32 degrees F to 120 degrees F.
3. Thermostat shall have bimetallic sensor element.
4. Electrical connection shall be 4-pole terminal.

    a. Switching capacity (NC) 10 A resistive/2 A inductive at 250 Vac.
    b. Switch capacity (NO) 5 A resistive/2 A inductive at 250 Vac.

5. Thermostat shall be capable of DIN rail mounting.

B. Acceptable manufacturers:

1. nVent/Hoffman Catalog No. ADLTEMP.
2. Or approved equal.

C. Contractor shall confirm performance of dual thermostat with supplier of heater and air conditioner.

2.06 INTERPOSING RELAY

A. Relay used to isolate two different systems or devices from one another.

1. The main function of an interposing relay is to separate two circuits, provide isolation between them, put a barrier between them, and to operate the one circuit with the help of another circuit.
2. Interposing relays can be used to connect an NPN and PNP sensors into the PLC.
3. Interposing relays are used between mismatched sensors, controllers, and/or control devices.

B. Acceptable manufacturers:

1. Allen Bradley
2. Phoenix Contact
3. Schneider Electric
4. IDEC
5. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install relays in accordance with manufacturer's recommendations.

3.02 CALIBRATION

A. Calibrate and program equipment to meet system requirements.

3.03 START-UP AND TESTING

A. Comply with the manufacturer's recommended testing procedures.

B. Contractor shall demonstrate to Owner the performance of dual thermostat operation with heater and air conditioner.

END OF SECTION

SECTION 271000 - TELECOMMUNICATIONS CABLING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Bidding documents including Division 00 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

1.2 DESCRIPTION

A. Definition

1. "Telecommunications Cabling" as used in this Section refer to a unified cable plant primarily designed for carrying signals associated with telephone, telecommunications common carrier, data, and communications within the building or between buildings. At places, interfaces occur between the telecommunications cabling system and other signal cable systems, and telecommunications systems may share tray and rack spaces with other systems. However, for construction purposes the "Telecommunications Cabling" system is separate and may have different specification provisions from other systems.

B. Station Cable

1. Provide a complete cable system tested for continuity and performance to each outlet, including:

    a. Category 6 station cables for voice/data interconnections
    b. Multi-Mode and single mode fiber connections for multi use applications
    c. Multi-purpose outlet plates
    d. RJ-45 jacks and terminations
    e. Rack mounted RJ-45 patch panels
    f. Rack mounted fiber patch panels
    g. Equipment Racks
    h. 110 blocks and terminations

C. Copper Backbone Cable: Provide a backbone cable system tested for continuity and performance, consisting of category 3 UTP telephone riser cable.

D. Fiber Optic Backbone Cable: Provide a complete tested, and documented backbone data cabling system consisting of multimode and single mode fiber outside plant optic cable, including termination shelves, connector termination and testing.

E. Telecommunications Rooms: Provide telecommunications room equipment racks, overhead ladder rack, wire management, and terminating hardware as specified.

F. Identification and Labeling: Labeling is to be functional and permanent, in strict compliance with Owner/Engineer direction.

G. Detailed Documentation:

1. Provide detailed documentation of as-built conditions required for this section to complete shop drawings for telephone and data cabling system administration. Labeled cables connected at each outlet location must be those shown in "as-built" documentation.

H. Work Furnished By Others:

1. Telephone switching equipment, telephone instruments, computing equipment, and data switches will be furnished by others.
2. ANY connections to active equipment in a telecommunications room will be performed by Owner IT staff only.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Early in the construction time line, and before any shop drawings are provided, a representative of the low voltage communications installer, who shall serve as supervisor to the installation crew throughout construction, shall attend a pre-construction meeting with General Contractor, Electrical Contractor, owner, Architect and Electrical Engineer where installation details, including labeling and wire management will be discussed.

1.4 SYSTEM DESIGN OBJECTIVES

All recommended revision, Value Engineering suggestions, or installer options during the construction phase should consider the following design objectives:

A. System Description: The cabling system is designed to support a universal cabling system for both voice and data. Most information outlets will consist of outlet boxes with uniform Category 6 jacks for voice and data. The size of outlet boxes and conduit at each location are indicated on the electrical drawings and in the electrical specifications.

B. Telecommunication Room Support Fixtures:

1. The telecommunications room(s) shall be equipped with equipment racks, ladder rack, patch panels, termination panels, power outlets, power strips, and other furnishings required to facilitate an installation that is neat, functional, flexible, and earthquake resistant to local code.
2. All telecommunications room fixtures must be installed as shown in the drawings, or alternate plans must be expressed in approved shop drawings before materials are ordered or work begins. The contractor shall be responsible for any work or re-work required due to improper approval and/or acceptance of work performed which differs from the construction documents at no cost to the Owner.

1.5 REGULATORY REQUIREMENTS

A. All work shall be performed in accordance with the latest revisions of the Washington Department of Labor and Industries and the following industry standards and codes:

FCC Part 68	Connection of terminal Equipment to Telephone Network.
Uniform Building Code	International Conference of Building Officials (ICBO; Regional Office: 12605 Bellevue-Redmond Road, Bellevue, WA 98005
WAC-296-46	Laws, Rules, and Regulations for installing Electric Wires & Equipment
NFPA 70 (NEC)	1999 National Electrical Code
NFPA 75	Protection of Electronic Computer and Data Processing Equipment
NFPA 78	Lightning Protection Code
NFPA 101	Life Safety Code
OSHA 29 CFR Part 1910	Occupational Safety and Health Standards
FCC Part 76.611	CFR Title 47 Radiation Leakage Standards

B. Other References:

ANSI/TIA/EIA-526-14A	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
ANSI/TIA/EIA-569-A	Commercial Building Standard for Telecommunication Pathways and Spaces
ANSI/TIA/EIA-568-B	Commercial Building Telecommunications Cabling Standard (Includes B.1, B.2 & B.3 including addenda)
ANSI/TIA/EIA-606-A	The Administration Standard for the Telecommunication Infrastructure of Commercial Buildings
ANSI/TIA/EIA-607	Commercial Building Grounding and Bonding Requirements for Telecommunications
ANSI/TIA/EIA-758-A	Customer-Owned Outside Plant Telecommunications Standard

C. Governing codes and Conflicts: If the requirements of this section of the project drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.6 COORDINATION

A. The necessity to coordinate this work with the Serving Utility (Rainier Connect), Owner (Washington State Parks) and the other on site Contractors is emphasized. The Contractor shall be responsible for any omissions, delays and additional cost due to lack of coordination or approval from the same.

B. Coordinate work with other contractors and trades. The layout and installation of the systems shown on the drawings and specified herein shall be coordinated such that all special requirements for the telecommunications systems shall be provided and incorporated into the project. The systems to be coordinated shall include (but are not limited to) electrical raceway, grounding, fire rated assembly, lighting, power distribution, control and labeling of cables, termination, outlets, jacks, etc. Report all conflicts to the Architect/Engineer.

1.7 INSTALLER QUALIFICATIONS AND QUALITY ASSURANCE

A. The Low Voltage cable system installer shall at a minimum be firm normally employed in the low voltage cabling industry with reference list of at least (5) five projects with contact names to confirm the successful completion of Category 6 UTP and fiber optic cable plant projects within the last (12) twelve months prior to the bid opening date of this project. In addition, the Contractor must submit proof of category 6 UTP and fiber optic cable test equipment training and certification for the technicians that will be testing the installation. The Contractor shall discuss Category 6 testing procedures with the Owner and Engineer prior to beginning testing.

B. Documentation demonstrating that the Contractor employs a minimum of one registered communications distribution designer (RCDD) certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the contractor is not acceptable. The document shall also declare that the Contractor will continue to employ a minimum of one RCDD throughout the duration of project.

1. During the course of construction, the Contractor's RCDD shall periodically (once per two-week period) review (on-site) the construction in progress for conformance to ANSI/TIA/EIA and BICSI installation standards. The written report to the Owner/Engineer on company letterhead, which details the work, reviewed and states the work conforms to ANSI/TIA/EIA and BICSI installation standards.
2. After substantial completion and prior to Owner acceptance, the contractor's RCDD shall certify in writing on company letterhead the completed installation meets or exceeds ANSI/TIA/EIA and BICSI installation standards. The written certification shall be complete with RCDD's stamp and certification number and shall bear the RCDD's signature across the face of the stamp.

C. The Owner/Architect/Engineer reserves the right to exercise it's discretion to require the Contractor to remove from the project any such employee of the Contractor deemed by the Owner to be incompetent, careless, or insubordinate.

D. Personnel whom the Contractor intends to use as supervisors or testers, and at least (50%) half of the installation technicians at large, must have been employed by the Contractor for at least (6) six months as of the date of the bid opening. Proof of AMP and AMP/Mohawk certification for each technician is required showing they have been trained and are familiar with the products they will be installing. Technicians shall have been trained on the Contractor's company policies with respect to personnel safety, telecommunications industry cabling quality and neatness standards, and use of CSI-standard specifications and drawings.

E. A (25) twenty-five year AMP or Mohawk performance and installation warranty shall be provided by the selected Low Voltage installer. The contractor must be certified by AMP and

Mohawk if Mohawk cable is used at the time of bid. This warranty shall include defects in workmanship and/or material. The warranty period shall begin at the date of the Owner's acceptance of the work. Quality and workmanship evaluation shall be made solely by the Engineer.

F. The selected Low voltage installer must be licensed, bonded, and insured in the State of Washington.

1.8 UNIT PRICES

A. Unit prices must be submitted for addition or deletion of telecommunications wiring devices during the period of this contract. The pricing shall include all costs associated for addition and the credit for deletion of outlets ad locations. In addition unit pricing shall be submitted for addition or deletion of patch panels, wire managers, racks, cable, etc.

1.9 SUBMITTALS

A. The Contractor shall finish the following in a single consolidated submittal with an approval copy to the Owner:

1. Contractors license number and proof of qualifications required in paragraph 1.6 above.
2. Contractor's certification certificate from AMP.
3. The name of the person who will act as the Contractor's official contact with the Contractor/Owner/Engineer.
4. The name of every certified Category 6 and fiber optic cable installation technician who may be used in the conduct of the project, and evidence of certification of each.
5. To qualify, under the preceding paragraph, courses attended must include hands-on access to cable and terminating tools and materials, and test equipment required to perform the installation functions required in the work of this contract.
6. Complete manufacturer's product literature for all products to be used in the installation except for the Owner furnished materials. In addition, whenever Owner/Engineer pre-approved substitutions are recommended products are made, samples (when requested by the Owner/Engineer) and the manufacturer's supporting documentation demonstrating compatibility with related products shall be included. Product submittals must be keyed to the specification or drawing references.
7. Shop Drawings.

    a. Proposed cable routing shall be submitted and approved prior to installation of any cables.
    b. The contractor shall submit scaled drawings of all proposed changes in communications room installation detail (see paragraph 1.3.B.2).

8. Proposed Contractor category 6 UTP and fiber optic cable test result forms. Backbone UTP cables shall be tested as provided herein. Contractor shall provide test documentation and forms.
9. Examples of the cable labeling materials and proposed arrangement. Submittal must include actual samples of each type of proposed connecting fixture, with realistic labels attached.

B. A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution systems described for this project. At a minimum, this Construction schedule shall include the following milestones:

1. start and completion of Comm room installation
2. start and completion of backbone cable installation
3. phasing of station cable installation
4. testing dates
5. cable label documentation delivery
6. final inspection

C. Project Completion

As a condition for project acceptance, the contractor shall submit to the Owner/Engineer the following for review and approval:

1. Complete manufacturer's product literature and samples (if requested) for all approved substitutions to the recommended products made during the course of the project.
2. An Exceptions List of deviations (in materials, construction, and workmanship) from the specified in this section and shown on the Project Drawings. The Owner will review this list and declare each item as either an approved exception, or as one the Contractor must correct.
3. Filed Drawings. Through out the course of the project, details concerning the exact physical layout or arrangement of the backboards as shown on the Construction Drawings and details shall be marked on the field set 9with dimensions and inches) reserved for this purpose. The field drawings shall be available through out the project for inspection and shall be submitted to the Consultant/Engineer at Project Completion with changes "as-builts" in CADD format and submitted on CD. The Field Drawings shall be clear and accurate so the original Construction drawings can be brought up-to-date by the Contractor.
4. Inspection and test Reports: During the course of the Project the Contractor shall maintain the adequate inspection system and shall perform such inspections to insure that the materials supplied and the work performed conform to Contract requirements. The Contractor shall provide written documentation, which indicates that all cable termination testing was completed and all irregularities were corrected prior to job completion.

1.10 PROJECT OBSERVATION AND FINAL ACCEPTANCE

A. The Contractor shall request interim observations by the Owner/Engineer throughout the course of the project to avoiding costly corrections at the end of the project.

B. The Contractor shall incorporate in the construction schedule a minimum 2-week period for the final review and project observation process. During this period, the Owner/Engineer will review the project completion submittals and conduct on-site observation.

C. The Field Drawings will be checked for completion and accuracy to be compared to engineer provided construction documented and details from the start of the project.

D. The Owner/Engineer will generate a list of materials and workmanship that are not acceptable (in a project observation report/punchlist). Any part of the system, materials or workmanship, not meeting the requirements of this section, and not otherwise accepted by the Owner/Engineers, shell be corrected by the Contractor at no additional cost to the Owner prior to final acceptance.

E. A follow-up observation shall be made after the Contractor has made all corrections necessitated by earlier project observation reports. This review and observation process will be repeated as required until final acceptance is granted.

F. If completed test results for copper and fiber cables are questionable in regard to failures, an independent spot test on cables with problems may be done by a different independent contractor, with the cost of such spot-checks to be retained from Contractor's payments.

1.11 CABLE LABELING AND PLACEMENT

A. Cable terminations shall be labeled according to Owner/Engineer instructions onsite.

B. Cables will be assigned specific termination locations. Such assignment may be made or changed by the Owner/Engineer at any time prior to the installation phase at no additional cost to the owner or contract.

PART2-PRODUCTS

2.1 GENERAL

A. All material required for a complete installation shall be furnished by the Contractor.

B. All materials must be new, free from defects and not less than the quality herein specified. They shall be designed to insure satisfactory operation and operation life in the environmental conditions which will prevail where they are being installed.

C. Each type of materials bid and furnished shall be of the same make and shall be of the standard products or manufacturers regularly engaged in the production of such materials and shall be the manufacturer's latest standard design.

D. Materials shall be as listed or shall be equivalent products of other manufacturers meeting the intent and quality level of the specifications. Any approved equivalent products will be published by addendum prior to bid.

E. Security: Contractor shall furnish and maintain suitable lockable storage locations for on-site secure storage of materials. Any lost, stolen, damaged, or cut materials shall be replaced by the Contractor.

F. No custom items shall be used except as specified on the Construction Drawings or as reviewed and approved by both the Owner and Engineer as required to meet unusual physical requirements *of* the installation site.

2.2 WIRE PLANT MATERIALS

A. Materials shall be as listed or shall be equivalent products *of* other manufacturers meeting the intent and quality level *of* the EIA/fIA-568-B specifications. All approved equivalent products will be published by addendum prior to bid.

B. All products shall be new and brought to the job site in original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label and/or the CSA equivalent. All communications cable shall bear flammability testing ratings as follows:

CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-rated Communications Cable
All voice and data station cables specified herein shall be CMP plenum as required by code.

C. Initial Cable inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is *of* proper gauge, containing correct number of pairs, etc. Note any buckling *of* the jacket which would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

2.3 SUBSTITUTION OF MATERIALS

A. Listing of materials is not intended to prevent listing *of* other material.

1. No requests for variance prior to bid will be approved unless it is stated a pre-approved product may be submitted for review and listing.
2. After Award of Contract, only as follows:
   The reason for the unavailability is beyond the Contractor's control, i.e., due to strikes, bankruptcy, discontinuance of manufacture, etc. Requests for substitutions shall be made in writing and shall be accompanied by complete description *of* the substitute material or equipment.

B. In all cases, should a substituted material result in requiring system or building modifications, or additional labor on the part *of* the installation contractor(s), the Contractor shall be liable for all costs to provide these modifications including all costs to the Engineer for redesign time required to accommodate the required modifications. Liquidated damages provisions of the Contract may also apply.

2.4 BACKBONE CABLES

A. Telephone Multi-conductor Riser Cables: The multi-conductor telephone cables shall be 24 A WG with electrical specifications as follows:

1. Typical Parameters:

   a. EWTIA Specification Category 3
   b. Mutual Capacitance: 20 pF/ft, 66 pF/m

c. Char. Impedance: 100 +\- 20
d. Attenuation:
   1) 7.7 dB/1000 ft, 2.5 dB/lOOm @ 1 MHz
   2) 18 dB/1000 ft, 5.9 dB/100m @ 4 MHz
   3) 30 dB/1000 ft, 9.8 dB/100m @ 10 MHz
   4) 38 dB/1000 ft, 12 dB/100m @ 16 MHz

Acceptable Products: (See Below)
Campus Connection: Essex 300 pair PE-39, or pre-approved equal
Voice Extensions: Mohawk# M56126 (50 pair Cat 3)

B. Optical Fiber Cable:

1. Outside Plant

   a. 50/125 urn -12 strand Multi-Mode and 48 strand Single Mode optical fiber cables for backbone.
   Single Mode Acceptable Products:
   AMP# 048SCSILAFERJA Mohawk #M93814
   Multi-mode Acceptable Products:
   AMP# 012MBSILABNRJB Mohawk #M9 A811

2. Inside Plant

   a. 50/125 urn -12 strand Multi-Mode and 12 strand Single Mode optical fiber cable for backbone.
   Single Mode Acceptable Products:
   AMP# 012SEHNTATJPNY Mohawk #M93048
   Multi-mode Acceptable Products:
   AMP# 012MBHNTATJPNN Mohawk #M9A048
   Contractor shall supply required length for planned route plus 25 foot maintenance service loops at each end.

2.5 STATION CABLING

A. Voice/Data Station Cable: Provide Category 6 cable (as identified by TIA/EIA-568-B) for all voice/data station cables: Each cable reel shall be tested for Category 6 performance at the factory. All cable shall be plenum rated.

Acceptable Products:
AMP# 219667-X (White for Campus Network) 219567-X (Violet for CIT)
Mohawk# M56905 (White for Campus Network) M57201 (Violet for CIT)
NOTE: Floor box locations to have 10' of cable coiled under floor so that floor box locations have the ability to be relocated within a 10' radius.

2.6 STATION HARDWARE

A. Jacks: Flush mount voice and data jacks shall be high quality tested Category 6 8-pin (RJ45)

modular jacks with IDC style terminations. All jacks shall use the T568B pin configuration. Jacks shall exceed the TIA/EIA-568-B recommendations for Category 6 connecting hardware. Confirm campus network wall and floor box outlet colors with Owner/engineer.

Acceptable Products: (See Below)
Wall and Floor Box Locations:
AMP # l375055-X
AMP# 1-1375055-0 (Violet for CIT)

B. Icons and Labels: Icons shall have voice or data symbols as appropriate

Acceptable Products: AMP icons

C. Faceplates: Faceplate color shall be determined by the Owner/Engineer.

Acceptable Products:
AMP Faceplate# 1139l18-X
AMP Module# lll6409-X AMP Blank# 1116410-X
Floor Box Faceplate: Spider Mfg AMP Faceplates

D. Consolidation Points/MUTOAS: Consolidation points are to be installed under the floor with transition cables routed to furniture and installed in standard faceplates

Acceptable Product:
AMP # 406771-1
Cat 6 6-Pack Inserts: 1375367-1
Transition Cables: 219599-1

E. Cable labels.

1. All cables shall be labeled at the TR termination and at the user terminal connection with the same identifying code.
2. TR-end labels shall be mechanically printed on strips designed for use with the prescribed terminating hardware.
3. Jack-end labels must be mechanically created, have letters that are at least 3/16 inches high, and have a high contrast with the label background.
4. Label adhesive must be shown to be permanent and not removable without use of heat or solvents, when applied to each of the types of outlet cover plates to be used in the project.

2.7 VOICE/DATA TERMINATION HARDWARE

A. Backbone Voice Hardware.

Acceptable 110 Products (for walls):
AMP 300 pair blocks without legs
Mounting Frame: Homaco Part# 110D-1800W
Acceptable Voice patch Panels
AMP 48-Port Cat 6 #1375015-1
Category 3 50-pair cable will terminate from voice patch panels to wall mounted 110 blocks. One pair to each port on the patch panels - pins 4 and 5. Cross-connects will be preformed at

the 110 wall field by the ***Owner*** IT Staff.

B. Termination clips: Equip termination frames with C4 and C5 type clips for riser cabling.

C. Termination Block Label Strips: Standard colored designation label strips that match the colors indicated for voice and data icons shall be affixed to each row of the 110-type wiring termination. For PBX-feed cables, labels shall be white.

D. Horizontal Voice/Data Cabling Patch Panels. 1. 48 port Category 6 patch panel.
Acceptable products: AMP Part# 1375015-1

E. Horizontal Wire Managers. There shall be horizontal wire managers between each patch panel as shown in drawings.

Acceptable product: AMP Part# 1375159-1

F. Equipment Racks. Provide 7'x19" racks per Telecommunications Room details. Equipment racks must be base mounted, grounded with a #6 ground wire and secured to structure and overhead tray.

Acceptable product: Ortronics part# OR-60400169 with OR-60400433 wire mangers between racks and at the end of the rows
4-PostRacks: SWDP: SWE310BLK

2.8 FILLER OPTIC CABLE TERMINATIONS

A. The contractor is to provide complete enclosures. The enclosures used in the Communications Rooms for the optical fiber risers shall be of sufficient size and capacity to terminate all of the combined fiber count of the vertical riser fiber optic cables. The contractor shall provide complete fiber optic patch panels and all required materials, i.e. coupler panels, blank panels and connectors, as shown on plans for multi- mode fiber termination panels with SC connectors for single mode and MTRJ connectors for multi-mode.

Acceptable Products: (See Below)
Campus Fiber Enclosure: AMP# 559552-2
MDF/Server Room Enclosures: AMP# 559542-2
Single Mode Adapter Plate: AMP# 559558-2
Multi-mode Adapter Plate: AMP# 1278328-3
Blank Plates: AMP# 559523-1
Single Mode Connectors: AMP# 504655-4 (SC)
Multi-mode Connectors: AMP# 1588880-1 (MTRJ)

2.9 MDF/SERVER ROOM CABLE TRAY

A. Size: 12 inch wide x 4 inch deep as shown on the drawings with all necessary support hardware and seismic bracing. Provide all accessories required for a complete installation as required.

B. Cable tray shall be continuous, rigid, welded steel wire mesh cable management system.

Material shall be stainless steel wire, AISI 316L, 2B, finished cold drawn wire.

C. Cable tray sections shall be mechanically and electrically continuous at all splices, changes in elevation, etc. Connections between sections shall attach using hardware and accessories of the same manufacture as the cable tray and shall be installed per manufacturer's recommendations. Connections shall be listed by a Nationally Recognized Testing Laboratory as electrically continuous for purposes of grounding continuity, or supplemental bonding jumpers shall be provided at connections.

D. Support system shall be Cablofil FAS system. Provide brackets as required for ceiling or wall installation as indicated on drawings. Install per manufacturer's recommendations.

E. Provide Cablofil FAS Rollers for cable pulling at all angles, bends, and level changes in the tray.

F. Compression-type, copper alloy connector lugs shall be provided for bonding and grounding conductor connections to cable tray. Grounding and bonding connection hardware shall be of the same manufacture as the cable tray.

G. Provide manufacturer's cable drop out accessory where cables exit tray. Part #DROPOUT.

H. Acceptable Product: Cablofil EZ Tray, part # CF *105/300* EZ or pre-approved equal

2.10 BUILDING ENTRANCE TERMINALS AND PROTECTORS

A. Building entrance terminals with connector blocks consisting of flame-retardant molded plastic fastened to a metal mounting bar shall be provided to terminate the outside plant cable as shown. The connector blocks shall be of 100-pair block size and equipped with protection modules as shown on drawings. The connector blocks shall be 110 in and 110 out. All terminals are to be provided with a ground lug and grounded.
Acceptable Product: Circa# 1880ECAI-I00G

B. The protector modules shall be 5 pin solid state type modules with PTC's to protect against "sneak currents."
Acceptable Product: Circa# C4BIS (PTC)

2.11 SEISMIC BRACING

A. Ladder racks and free-standing equipment racks shall be seismically braced in accordance with requirements for seismic Zone 4. Seismic bracing shall consist of rigid supports. Cables, wires, chains or other non-rigid materials shall not be used for seismic support. Provide approved fixed equipment anchorage assemblies as published by the manufacturer. In lieu of manufacturer's published seismic bracing assemblies, the Contractor shall provide seismic installations approved by a licensed structural engineer.

B. Approved drawings of seismic assemblies shall be made available for review by the Contracting Agency or the inspecting Authority Having Jurisdiction upon request.

2.12 MDF/SERVERROOMS

A. Termination Backboards

1. Material: Type CDX plywood. Label fire treated. Do not paint.
2. Size: 3/4 inch thick x 8 feet high to cover walls as shown on drawings.
3. Finish: White flat latex paint. Paint plywood on all sides and edges prior to mounting on walls.

B. Grounding

1. Per ANSI/TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications, and National Electrical Code, provide and install in MDF and Server Room copper ground bars which are connected to building ground system via minimum #6 A WG green insulated copper grounding conductor.
2. Copper ground bars shall be CPI #10622

PART 3-EXECUTION

3.1 FIRE STOPPING

A. Any penetration through fire rated walls, and both ends of all vertical conduit chases (including those in sleeves) will be sealed with specified fire stopping sealant.

B. Contractor shall also seal all floor, ceiling, and wall penetrations in fire or smoke barriers and in the telecommunications rooms.

3.2 CABLE HANDLING

A. All cable, especially Category 6, is subject to subtle damage that may degrade future performance, if abused during installation. In all cable installation, set reels and use sufficient pulleys and manpower so that cables are not pulled around blunt corners or against material that might cause chafing. For the purpose of this paragraph, any edge with a radius of less than 5 inches is considered "blunt". Any non-rotational surface that has sufficient friction to cause shavings or particles to be pulled off of cable jackets is unacceptable.

OBSERVATION OF IMPROPER CABLING HANDLING TECHNIQUES ON THE JOB MAY CAUSE THE CONSULTANT/ENGINEER AND/OR OWNER TO REQUIRE THE CONTRACTOR TO DISCARD OBSERVED CABLES, INCLUDING ANY OTHERS ALREADY INSTALLED BY THE PERSONNEL FOUND USING IMPROPER TECHNIQUES.

B. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. The following tables provide typical minimum pulling bend radii and maximum pull tensions for twisted-pair and fiber optic cables in conduit.

Refer to manufacturer's recommendations for the limitations on the installed cables.

MINIMUM PULLING BEND RADIUS and MAXIMUM PULL TENSION FOR TWISTED-PAIR CABLE in CONDUIT

PAIRS	MINIMUM PULLING BEND RADIUS	MAXIMUM PULL TENSION
4	5 inches	25 lbs.
100	17 inches	500 lbs.
200	22 inches	1000 lbs.
900	44 inches	5000 lbs.

MINIMUM PULLING BEND RADIUS and MAXIMUM PULL TENSION FOR OPTICAL FIBER CABLE in CONDUIT

PAIRS	MINIMUM PULLING BEND RADIUS	MAXIMUM PULL TENSION
Riser	5 inches	275 lbs.

1. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

2. Recommended Products:
   Twisted-pair Cable: Dyna-Blue, American Polywater Optical Fiber Cable: Optic-Lube, Ideal

D. Pull Cords: Provide pull cords in all sections of conduit. Tapes shall be marked in feet and secured at each end of the conduit.

   Recommended Product: Greenlee

E. Replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over twisted pairs at terminals, and re-terminate cables with sheath removed over 2 inches

3.3 FIBER OPTIC BACKBONE CABLE INSTALLATION

A. Install multimode optical fiber in innerduct between telecommunications rooms as shown on prints. Provide 10-foot service loops at both ends coiled neatly above, but not on, the rack.

B. Terminations shall be performed by a manufacturer certified technician for SC and MTRJ connections.

C. Terminations shall be made in a controlled environment. The Contractor may choose to have the cable assembled off-site, although testing must be completed with the cable in its final installed condition.

3.4 LABELS

A. The Contractor will label all outlets and cables using permanent, legible typed or machine engraved labels pre-approved by the Owner. Submit proposed labels to Engineer/Consultant for approval.

B. Terminals in the telecommunications rooms shall be labeled by the Contractor using designation strips designed for the patch panels or terminal hardware.

3.5 STATION CABLING INSTALLATION

A. Certified Installers: The Contractor shall supervise the installation of all communications cable. All Category 6 cable shall be installed by individuals trained and certified in low voltage data cable system installation. All Category 6 cable must be handled with care during installation so as not to change performance specifications. The Contractor shall not over tighten wraps or over bend cables.

B. Station cables shall be typically installed in under floor spaces. Any cable placed in ceiling areas shall be supported with Erico]-hooks attached appropriately to walls or support wires and spaced a maximum of four feet apart. Cables shall not come in contact with HV AC or mechanical system components or run within (8) eight inches of any electrical component. Provide straight routes, parallel with floors and corridor walls, between the outlet box locations and the telecommunications room.

C. Coordination: All cabling and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All cable and associated hardware shall be placed so as to not impair the use or capacity of other building systems, equipment or hardware placed by others (or existing). All cable, associated support structures and hardware shall be placed so as to not impair the Owner's efficient use of their full capacity.

D. Installation: Pull all cables carefully, adhering to standards of care and manufacturer's recommendations for installation of cabling. Where cables emerge from raceways or drop out of cable racks, maintain a supported bundle with at least a (5) five-inch bend radius. Use special care not to pull cables around comers unless a large-radius pulley or careful manual handling is employed. Assure that when cables are left on the floor, signs or other procedures are used to assure that no one steps on the cables. (In the event an observing Owner's representative, Consultant/Engineer, or Architect observes installation practices in which cables are subject to crushing or tight-bend abuse, the Contractor may be required to remove and discard from the site all cables which may have been subjected to the observed abusive action. No additional charges will be allowed in the event of such replacement action.)

NOTE: Cabling installation shall not precede floor installation

3.6 TELECOMMUNICATION ROOM DETAILS

A. Mount termination equipment per drawing details. Leave clear routes for riser and station cable bundles as indicated.

B. Support ladder racks on walls using manufacturer supplied triangular support brackets and wall angles. Attach ladder rack to equipment rack where ladder rack passes over equipment rack. Support free spans greater than (6) six feet using a trapeze style support consisting of (2) two sections of all-thread and a section of C-channel supporting the ladder rack.

C. Mount power strips on the back side of the vertical wire management using manufacturer supplied offset brackets.

D. Install 110 termination blocks for copper backbone cable.

E. Install fiber optic termination shelf for fiber optic backbone cable.

F. Coordinate with other work of Division 26 to assure installation of power outlets, sleeves, ground bus bar, and backboard in each location shown on the drawings. Keep telecommunications cabling clear of spaces designed for power outlets. Telecommunications cable jackets shall not come in contact with electrical outlet boxes or conduit at any point in the system.

3.7 STATION HARDWARE

A. UTP cables shall be terminated in high-quality Category 6 RJ-45 jacks meeting EIA/TIA-568-B specifications, using wiring format T568B (TIA), which is both 100baseT and ISDN compatible.

3.8 BACKBOARD CABLING/EQUIPMENT RACK CONFIGURATION

A. Cabling shall be routed to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, network equipment, mounting access hatches to air filters, switches or electrical outlets, electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any conduit opening. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

B. Cable shall be routed as close as possible and parallel to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not come in contact with, electrical conduit or other equipment.

C. Cable bundles passing from a wall to a rack or other free-standing object shall not bridge a gap of greater than (4) four inches without the use of a uni-strut or other bridging structural piece. All cables to a rack shall be cabled out to the top. On backboards, lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block.

D. Lace or bundle all similarly routed cables together, and attach by means of D-rings screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" comers over a path that will offer minimum obstruction to future installations of equipment, backboards, or other cables.

E. Do not allow binding on cable. Do not use tie-wraps. Velcro-style straps are recommended for

cable bundling, where required. Observe Category 6 cable bend radius standards for all cables.

3.9 COPPER CABLE INSTALLATION TESTING

A. The Owner/Engineer shall be notified one week prior to any testing so that the initial testing may be witnessed. Contractor shall not replace or correct any cable deficiencies found through testing prior to the notified date. (The initial test results are an effective indication of the overall quality of an installation. "Rehearsal" tests by the Contractor deprive the test observer of the opportunity to detect general quality conditions that may detected at the time of the first test performed.)

B. Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms, and timetable for all copper plant wing.

C. Acceptance of the simple test procedures discussed below is predicated on the Contractor's use of the recommended products (including but not limited to twisted-pair cable, cross-connect blocks, and outlet devices specified in the Products paragraph), and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.

D. At a minimum, the Contractor shall test:

1. All copper backbone cable pairs for continuity from source to destination.
2. All station drop cable pairs from telecommunications rooms to outlet device RJ45 jacks.

E. Each Category 6 wire/pair shall be tested per TWEIA-568-B, including addenda, at a minimum for the following:

1. Wire map
2. Length
3. Insertion loss
4. Near-end crosstalk (NEXT) loss
5. Power sum near-end crosstalk (PSNEXT) loss
6. Equal-level far-end crosstalk (ELFEXT)
7. Power sum equal-level far-end crosstalk (pSELFEXT)
8. Return loss
9. Propagation delay 10. Delay skew

F. hese test procedures shall be based on EIA/TIA-568-B utilizing a commercial Level III UTP cable tester that will test at or above the Category 6 parameters. Acceptable test equipment includes Fluke DSP-4XXX, Aglient Scope 350 or other approved tester. Testers shall have the latest software update. Testers shall be set for Category 6 cable tests. Each tester shall be certified as calibrated within (3) three months of testing.

G. UTP Category 6 cables shall be tested from the telecommunications room to RJ45 outlets in small groups. After a small group of station cables are installed, they must be tested. Test groups shall consist of no more than (40) forty cables.

H. The Category 6 testing will show numerous problems which go undetected with lower frequency testing including the following:

1. Stretched cables.
2. Kinked cables.
3. Short bend radius.
4. Tight bindings.
5. Loose twists and tight twists at terminals.
6. Cable sheath removed too far.

I. When errors are found, the source of each error shall be determined, corrected, and the cable re-tested. All defective components shall be replaced and retested. Defective components not corrected shall be reported to the Owner/Engineer with explanations of the corrective actions attempted.

J. Test rcords shall be maintained using the test equipment manufacturer's electronic form. The form shall record cable identification number, outcome of test, indication of errors found, cable length, re-test results after problem resolution, and signature of the technician completing the tests. Test results shall be submitted in electronic spreadsheet format (Excel or Word compatible) on disk with a printed copy. Test results for each test group shall be submitted within two days of tests for immediate review.

3.10 FIBER OPTIC Cable INSTALLATION TESTING

A. All testing shall be performed by trained, certified personnel.

B. A calibrated OTDR is required to test all the bare fiber optic cables on the reels prior to installation. This includes testing on the 850 nm and 1300 nm range for multi-mode and 1310 nm and 1550 nm range for single mode fiber optic cable. Recorded printouts are to be submitted.

C. Installed fiber must be tested in accordance with TIA/EIA-568-B, including addenda and ANSI/TIA/EIA-526-14A, Method Band ANSI/TIA/EIA-526- 7, Method A.l in both directions.

D. Fiber optic cable and connector loss shall not exceed 0.5 dB max. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer' specifications.

3.11 GROUNDING

A. Grounding shall conform to ANSI/TIA/EIA-607, National Electrical Code and manufacturer's grounding requirements at a minimum.

B. Ground equipment racks, housing, and raceways individually.

END OF SECTION

SECTION 283100 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SCOPE

A. Bidding documents including Division 00 General Conditions, Published Addenda and related work in other Divisions form an integral part of these Specifications and shall be binding on the Division 26 Contractor for all work performed under Division 26, Electrical.

B. This specification document provides the requirements for the installation, programming and configuration of a complete Honeywell Silent Knight #6808 digital protocol analog addressable fire alarm system. This system shall include, but not be limited to, system cabinet, power supply, built in Signaling Line Circuit (SLC), 80 character LCD annunciator, two programmable notification circuits, built in dual line, IP and cellular Digital Communicator, associated peripheral devices, batteries, wiring, conduit and other relevant components and accessories required to furnish a complete and operational Life Safety System.

1.2 WORK INCLUDED

A. General Requirements

1. The contractor shall furnish and install a complete 24 VDC, electrically supervised, analog addressable fire alarm system as specified herein and indicated on the drawings. The system shall include but not be limited to all control panels, power supplies, initiating devices, audible and visual notification appliances, alarm devices, and all accessories required to provide a complete operating fire alarm system.

B. Listings

1. All fire alarm system equipment shall be listed for it’s intended purpose and be compatibility listed to assure the integrity of the complete system.

1.3 STANDARDS

A. The fire alarm equipment and installation shall comply with the current provisions of the following standards and shall be listed for it’s intended purpose and be compatibility listed to insure integrity of the complete system.

1. National Electric Code, Article 760
2. National Fire Protection Association Standards:
   NFPA 70 National Electrical Code
   NFPA 72 National Fire Alarm Code

NFPA 101 Life Safety Code

3. Local and State Building Codes
   BOCA, National Building Code, Mechanical Code, Fire Prevention Code
4. Local Authorities Having Jurisdiction
5. Underwriters Laboratories Inc.
6. All equipment shall be approved by Underwriters Laboratories, Inc. for it's intended purpose, listed as power limited by Underwriters Laboratories, Inc., for the following standards as applicable:
   UL 864 UOJZ Control units for Fire Protective Signaling Systems
   Local Signaling Unit
   Central Station Signaling Protected Premises Unit
   Remote Signaling Protected Premises Unit.
   UL 2075 CO Detectors Connected to FACP
   UL 864 Releasing Device Control Unit (Water Release Only)
   UL 268 Smoke Detectors for Fire Protective Signaling systems.
   UL 268A Smoke Detectors for duct applications
   UL 217 Smoke Detectors for Single Stations
   UL 521 Heat Detectors for Fire Protective Signaling systems.
   UL 228 Door Holders for Fire Protective Signaling systems.
   UL 464 Audible Signaling appliances
   UL 1638 Visual Signaling appliances
   UL 38 Manually Activated Signaling Boxes
   UL 346 Waterflow indicators for Fire Protective Signaling systems.
   UL 1481 Power Supplies for Fire Protective Signaling systems.
7. Americans with Disabilities Act (ADA) of 1990.
8. All visual Notification appliances and manual pull stations shall comply with the requirements of the Americans with Disabilities Act.

1.4 GENERAL REQUIREMENTS

A. Manufacturers/Distributors Services:

1. The following supervision shall be provided by a factory trained service technician from the distributor of the fire alarm equipment. The technician shall be trained and shall have a minimum of two (2) years of service experience in the fire alarm industry. The technicians name shall appear on equipment submittals and a copy of his manufactures trained shall be sent to the project engineer. The technician shall be responsible for the following items:

   a. Approved Venders:
      1. E-Squared Systems, Lakewood, WA (253) 284-3707

   b. A pre installation visit to the job site to review equipment submittals and to verify the method by which the system is to be wired.
   c. During the installation the certified technician shall be on site or make periodic visits to verify installation and wiring of the system. He shall also supervise the completion of conduit rough, wires pulled into conduit and wiring rough, and ready for trim.
   d. Upon completion of wiring, final checkout and certification of the system shall

be made under the supervision of this technician.

e. At the time of the formal checkout, technician shall give operational instructions to the owner and or his representative on the system.

B. Submittals

1. The contractor shall submit a single electronic PDF copy of documentation within thirty (30) calendar days after award of the purchase order. Indicated in the document will be the type, size, rating, style, catalog number, manufacturers names, photos, and /or catalog data sheets for all items proposed to meet these specifications. The proposed equipment shall be subject to the approval of the Architect/Engineer and no equipment shall be ordered or installed on the premises without that approval.
2. Supplier qualifications shall be submitted indicating years in business, service policies, warranty definitions, NICET certification, and completion of factory training program and a list of similar installations.
3. Contractor qualifications shall be supplied indicating years in business and prior experience with installations that include the type of equipment that is to be supplied.

C. Contract close-out Submittals

1. Deliver an electronic PDF of the following to the owner's representative within Thirty (30) days of system acceptance. The closeout submittals shall include:

   a. Installation and Programming manuals for the installed Life Safety System.
   b. Point to point diagrams of the entire Life Safety System as installed. This shall include all connected Smoke Detectors and addressable field modules.
   c. All drawings must reflect device address as verified in the presence of the engineer and/or end user.

D. Warranty

1. Warranty all materials, installation and workmanship for a one (1) year period, unless otherwise specified. A copy of the manufacturer warranty shall be provided with the close out documentation.

E. Products

1. This Life Safety System Specification must be conformed to in its entirety to ensure that the installed and programmed Life Safety System will accommodate all of the requirements and operations required by the building owner. Any specified item or operational feature not specifically addressed prior to the bid date will be required to be met without exception.
2. Submission of product purported to be equal to those specified herein will be considered as possible substitutes only when all of the following requirements have been met:

   a. The fire alarm system has been designed around Silent Knight. Any substitutions must be presented to owner. If substitution, contractor shall provide written approval to Engineer signed by owner with substitution request.

b. Any deviation from the equipment, operations, methods, design or other criteria specified herein must be submitted in detail to the contractor prior to the scheduled submission of bids.

3. General Equipment and Materials Requirements

a. All equipment furnished for this project shall be new and unused. All components shall be designed for uninterrupted duty. All equipment, materials, accessories, devices and other facilities covered by this specification or noted on the contract drawings and installation specification shall be best suited for the intended use and shall be provided by a single manufacturer. If any of the equipment provided under this specification is provided by different manufacturers, then that equipment shall be "Listed" as to its compatibility by Underwriters Laboratories (UL), if such compatibility is required by UL standards.

F. Satisfying the Entire Intent of these Specifications

1. It is the contractor's responsibility to meet the entire intent of these specifications.
2. Deviations from the specified items shall be at the risk of the contractor until the date of final acceptance by the architect, engineer, and owner's representative.
3. All costs for removal, relocation, or replacement of a substituted item shall be at the risk of the electrical contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. Control Panel

1. The fire alarm control panel (FACP) shall be the Silent Knight #6808 analog addressable control panel. The FACP must have a 6 amp power supply and be capable of expansion to a maximum of 51 total amps via bus connected expander modules that supervise low battery, loss off AC and loss of communication.
2. The FACP must have drift compensation sensitivity capabilities on detectors and be capable of supporting 99 detectors and 99 analog addressable points. The communication protocol on the SLC loop must be digital.
3. The FACP must support a minimum of four programmable notification circuits. The panel must have a built in 80 character LCD annunciator with the capability of having an additional eight supervised remote annunciators connected in the field.
4. The FACP must have a built in UL approved IP digital communicator with cellular module for communication. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data.
5. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.

6. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. The FACP must have maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode (Jumpstart) and the ability to upgrade the core operating software on site through USB or ethernet cable.
7. The FACP shall have a Jumpstart feature that can automatically enroll all properly connected accessories into a functional system within 60 seconds of powering up the panel. Panels that do not have these capabilities will not be accepted.
8. The main communication bus (SBUS RS485) shall be capable of class A or class B configuration with a total Bus length of 6,000 feet.

B. System Wiring

1. The Signaling Line Circuit (SLC) and Data Communication Bus (S-BUS) shall be wired with standard NEC 760 compliant wiring, no twisted, shielded or mid capacitance wiring is required for standard installations. All FACP screw terminals shall be capable of accepting 14-18 AWG wire. All system wiring shall be in accordance with the requirements of NFPA 70, the National Electrical Code (NEC) and also comply with article 760 of the NEC.

C. Signaling Line Circuits

1. Each SLC shall be capable of a wiring distance of 12,500 feet from the SLC driver module and be capable of supporting 99 detectors and 99 modules. The communication protocol to SLC devices must be digital. Any SLC loop device, which goes into alarm, must interrupt the polling cycle for priority response from the FACP. The FACP must respond consistently to a device that goes into alarm on an SLC in under 3 seconds. The SLC shall be capable of functioning in a class A or class B configuration.

D. SLC loop devices

1. Devices supported must include photoelectric, ionization smoke detectors, heat detectors, contact monitoring modules and relay output modules. There is to be no limit to the number of any particular device type up to the maximum of 99 detectors and 99 modules, that can be connected to the SLC.

E. Addressable detector functions

1. The products of combustion detectors must communicate analog values using a digital protocol to the control panel for the following functions:

    a. Automatic compliance with NFPA 72 standards for detector sensitivity testing
    b. Drift compensation to assure detector is operating correctly
    c. Maintenance alert when a detector nears the trouble condition
    d. Trouble alert when a detector is out of tolerance.

F. Programmable FlexPuts

1. The FACP shall support four programmable notification circuits that are capable of

being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, reset able or door holder power. The circuits shall also be programmable as input circuits in class A or B configurations to support dry contact or compatible two wire smoke detectors.

G. Addressable Notification Module

1. The contractor shall furnish and install where indicated on the plans, addressable notification modules. The modules shall be U.L. listed compatible with Silent Knight's fire alarm control panel. The notification module must provide one class A (Style Z) or class B (Style Y) notification output with one auxiliary power input. The notification module must be suitable for mounting in a standard 4 square electrical box and must include a plastic cover plate. The notification module must provide an LED that is visible from the outside of the cover plate. The notification module must be fully programmable for such applications as required by the installation. The IDP-control shall reside on the SLC loop and can be placed up to 12,500ft. from the FACP.

H. Annunciators

1. The main control must have a built in annunciator with an 80-character LCD display and feature LED's for General alarm, Supervisory, System trouble, System Silence and Power. When in the normal condition the LCD shall display time and date based on a 200 year clock which is capable of automatic daylight savings time adjustments. All controls and programming keys are silicone mechanical type with tactile and audible feedback. Keys have a travel of .040 in. No membrane style buttons will be permissible. The annunciator must be able to silence and reset alarms through the use of a keypad entered code, or by using a fire fighters key. The annunciators must have twenty levels of user codes that will allow the limitation of operating system programming to authorized individuals.

I. Remote Annunciators

1. The fire system shall be capable of supporting up to three remote annunciators. LCD Remote annunciator shall have the same control and display layout matching the built in annunciator. Remote annunciators shall be available in two colors, red and light gray. Remote annunciators shall have the same functionality and operation as the built in annunciator. All annunciators must have 80-character LCD displays and must feature five LED's for general alarm, supervisory, system trouble, system silence, and system power. All controls and programming keys are silicone mechanical type with tactical and audible feedback. Keys shall have a travel of .040 inches. No membrane style buttons will be permitted.
2. The annunciator must be able to silence and reset alarms through the use of a code entered on the annunciator keypad or by using a firefighter key. The annunciator must have twenty levels of user codes that will limit the operating system programming to authorized individuals. The control panel must allow all annunciators to accommodate multiple users input simultaneously. Remote annunciators shall be capable of operating at a distance of 6000 feet from the main control panel on unshielded non-twisted cable.

J. The fire system shall be able to support up to eight I/O modules that shall be used to drive remote LED graphic style displays and accommodate up to eight dry contact type switch inputs. The I/O modules shall each drive up to 40 LEDs without requiring external power connections. The I/O module inputs shall be supervised and be suitable for alarm and trouble circuits as well as reset and silence switches. The system shall also support up to 40 LED drivers that reside on the two-wire SLC loop. These driver boards shall contain 80 LED outputs that are powered by an external power source.

K. Serial/Parallel interface

1. The fire system shall be capable of supporting up to two serial / parallel interfaces that are capable of driving standard computer style printers. The interface shall be programmable as to what information is sent to it and shall include the ability to print out Detector Status by point, Event History by point and System Programming.

L. Distributed Power Module

1. The contractor shall supply a power module #5496 and 5895XL compatible with the Model # 6808 fire alarm control panel. The power module must have 6 amps of output power, six flexput circuits rated at 3amps each, and two form C relay circuits rated at 2.5 amps at 24 volts DC. The six flexput circuits shall have the same functionality as the flexput circuits on the main panel. The Distributed Power Supply shall be capable of being connected via an RS-485 system bus (SBUS) at a maximum distance of 6000ft. from the main control panel. The power module shall contain an additional RS-485 bus that is completely compatible with all Model #6808 add on modules. The power module will also act as a bus repeater so that additional RS-485 (modules) devices can be connected at a maximum distance of 6000ft. from the power module.
2. The power module's RS-485 bus shall be electrically isolated providing ground loop isolation and transient protection.

M. Digital Communicator

1. The IP digital communicator must be an integral part of the control panel and be capable of reporting all zones or points of alarm, supervisory, and trouble as well as all system status information such as loss of AC, low battery, ground fault, loss of supervision to any remote devices with individual and distinct messages to a central station or remote station. The communicator must also be capable of up/downloading of all system programming options, Event history and Sensitivity compliance information to a PC on site through a USB or ethernet cable. It shall transmit the information by one or more of the following means of communication, internet, cellular or phone line.

N. Dry Contacts

1. The FACP will have three form "C" dry contacts, one will be dedicated to trouble conditions, the other two will be programmable for alarm, trouble, sprinkler supervisory, notification, pre-alarm, waterflow, manual pull, aux. 1 or aux. 2. The trouble contact shall be normal in an electrically energized state so that any total power loss (AC and Backup) will cause a trouble condition. In the event that the

Microprocessor on the FACP fails the trouble contacts shall also indicate a trouble condition.

O. Ground Fault Detection

1. A ground fault detection circuit shall be used to detect positive and negative grounds on all field wiring. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground faults will not interfere with normal operation, such as alarm, or other trouble conditions.

P. Over Current Protection

1. All low voltage circuits will be protected by microprocessor controlled power limiting or have a self-restoring poly switches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.

Q. Test Functions

1. A “Lamp Test” mode shall be a standard feature of the fire alarm control panel and shall test all LED’s and the LCD display on the main panel and remote annunciators.
2. A “Walk Test” mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for two seconds. The FACP will then automatically perform a reset and confirm normal device operation. The event memory shall contain the information on the point tested. the zone tripped, the zone restore and the individual points return to normal.
3. A “Fire Drill” mode shall allow the manual testing of the fire alarm system notification circuits. The “Fire Drill” shall be capable of being controlled at the main annunciator, remote annunciators and via a remote contact input.
4. A “Bypass Mode” shall allow for any point or nac circuit to be bypassed without effecting the operation of the total fire system.

R. Remote Input Capabilities

1. The control panel shall have provisions for supervised switch inputs for the purpose of Alarm reset and Alarm and trouble restore.

S. Notification Appliance Mapping Structure

1. All notification circuits and modules shall be programmable via a mapping structure that allows for a maximum of 125 output groups. Each of these groups shall have the ability to be triggered by any of the panels 125 Zones. A zone may trigger from groups individually or may contain a global trigger for manual pull stations, fire drills and two different system alarms. Additionally, each Zone will individually control the cadence pattern of each of the Groups that it is “Mapped” to so that sounders can indicate a variety of conditions. The Zone shall be capable of issuing a different cadence pattern for each of the Groups under its control. The mapping structure must also allow a group to be designated to “ignore cadence” for use with strobes and other continuous input devices. Zones shall have eight different output categories;

Detector alarm, Trouble, Supervisory, Pre-alarm, Waterflow, Manual pull, Zone auxiliary one and Zone Auxiliary two. Each of the categories shall have the ability to control from 1 to 8 output groups with a cadence pattern. The patterns are; March code, ANSI 3.41, Single Stroke Bell Temporal, Zone 1 coded, Zone 2 coded, Zone 3 coded, Zone 4 coded, Zone 5 coded, Zone 6 coded, Zone 7 coded, Zone 8 coded, Custom output pattern 1, Custom output pattern 2, Custom output pattern 3, Custom output pattern 4, and Constant. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules.

T. On board programmer

1. The FACP shall have an on board programmer which will allow for all system functions and options to be programmed via the on board annunciator keypad. Any panel that does not have this capability will not be accepted.

U. Downloading Software

1. The fire alarm control panel must support up/downloading of system programming from a PC under Windows 7 or newer. The FACP must also be able to download the detector sensitivity test results and a 1000 event system event buffer to the PC. Communication shall take place over a direct connection to the PC and/or via the same telephone lines as the built in digital communicator and shall not require an external modem to be connected to the panel. The downloading software shall contain a code that will block unauthorized persons from accessing the panel via direct connection or ethernet.

V. Facility Management Software

1. The FACP must support a facility management software capable of providing off site access to FACP data that is necessary to manage fire system operation. A software package capable of uploading the detector sensitivity test results and the 1000 event system event buffer to the PC shall be required as part of the bid package. Communication shall take place over a direct connection to the PC and/or via the same communication protocol as the built in digital communicator. The facility management package must be separate from the downloader package and must not be capable of affecting programmed system options.

W. Service reminder

1. The FACP shall be capable of automatically generating textual service reminder and the main and remote annunciator LCD's to inform the user of required testing or service. The service reminder shall not interfere with the normal operation of the FACP.

X. English language descriptions

1. The FACP shall provide the ability to have a text description of each system device, input zone and output group on the system. The use of individual lights to provide descriptions will not be acceptable.

2.2 SYSTEM OPERATION

A. Alarm

1. When a device indicates any alarm condition the control panel must respond within 3 seconds. All programmed audio and visual devices will activate at this time. The General Alarm or Supervisory Alarm LED on the annunciator(s) should light and the LCD should prompt the user as to the number of current events. The alarm information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.
2. When the alarmed device is restored to normal, the control panel shall be required to be manually reset to clear the alarm condition, except that the alarms may be silenced as programmed.
3. An alarm shall be silenced by pressing silence at the main panel or a code or Firefighter key at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur (subsequent alarm feature). When alarms are silenced the silenced LED on the control panel, and on any remote annunciators shall remain lit, until the alarmed device is returned to normal

B. Troubles

1. When a device indicates a trouble condition, the control panel System Trouble LED should light and the LCD should prompt the user as to the number of current events. The trouble information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.
2. When the device in trouble is restored to normal, the control panel shall be automatically reset, The trouble restore information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators. A trouble shall be silenced by a code or Firefighter key at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur.

C. Supervision methods

1. Each SLC loop shall be electrically supervised for opens and ground faults in the circuit wiring, and shall be so arranged that a fault condition on any loop will not cause an alarm to sound. Additionally, every addressable device connected to the SLC will be supervised and individually identified if in a fault condition. The occurrence of any fault will light a trouble LED and sound the system trouble sounder but will not interfere with the proper operation of any circuit which does not have a fault condition.
2. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder but will not interfere with the proper operation of any circuit which does not have a fault condition.

2.3 CONTROL UNIT

A. System Cabinet

1. Mounting

a. The system cabinets shall be red and can be either surface or flush mounted. The cabinet door shall be easily removable to facilitate installation and service.
b. Audible System Trouble Sounder
c. An audible system trouble sounder shall be an integral part of the control unit. Provisions shall also be provided for an optional supervised remote trouble signal.

B. Power Supply and Charger:

1. The entire system shall operate on 24 VDC, filtered switch mode power supply with the rated current available of 6 Amps. The FACP must have a battery charging circuit capable of complying with the following requirements:
2. Sixty (60) hours of battery standby with five (5) minutes of alarm signaling at the end of this sixty (60) hour period (as required per NFPA 72 remote station signaling requirements) using rechargeable batteries with automatic charger to maintain standby gel-cell batteries in a fully charged condition.
3. Twenty-four (24) hours of battery standby with five (5) minutes of alarm signaling at the end of this twenty-four (24) hour period (as required per NFPA 72 central station signaling requirements) using rechargeable batteries with automatic charger to maintain gel-cell batteries in a fully charged condition.
4. The power supply shall comply with U.L. Standard 864 for power limiting.
5. The FACP will indicate a trouble condition if there is a loss of AC power or if the batteries are missing or of insufficient capacity to support proper system operation in the event of AC failure. A “Battery Test” will be performed automatically every minute to check the integrity of the batteries. The test must disconnect the batteries from the charging circuit and place a load on the battery to verify the battery condition.
6. In the event that it is necessary to provide additional power one or more of the model 5496 or 5895XL Distributed Power Modules shall be used to accomplish this purpose.

C. Connections and Circuits

1. Connections to the light and power service shall be on a dedicated branch circuit in accordance with the National Fire Alarm Code NFPA 72, National Electrical Code (NEC) NFPA 70, and the local authority having jurisdiction (AHJ).
2. The circuit and connections shall be mechanically protected. A circuit disconnecting means shall be accessible only to authorized personnel and shall be clearly marked “FIRE ALARM CIRCUIT CONTROL”.

2.4 THE FACP SHALL SUPPORT THE FOLLOWING DEVICES ON THE RS-485 DATA BUS:

SK-NIC	Interface Network Card
SK-NIC-KIT	Installation Access Kit
SK-FML	Splitter Fiber Module, Multi-Mode
SK-FSL	Fiber Module, Single Mode
5824	Printer Interface Module
6860	LCD Remote Annunciator
5865-3	LED Remote Annunciator
5865-4	LED Remote Annunciator with reset and silence switches
5880	LED I/O module
5895XL	Intelligent Distributed Power Module
5496	Remote Power Supply 6.0 Amp
5883	Relay Interface Board

2.5 The FACP shall support the operation of 99 detectors and 99 addressable module total devices per SLC loop without regard to device type. The following devices shall be supported:

SK-Photo	Addressable Photoelectric Smoke detector
SK-Photo-T	Addressable Photoelectric Smoke detector with Thermal
SK-FIRE-CO	Combination Photoelectric and CO Detector
SK-Heat	Addressable Heat Sensor
SK-Heat-ROR	Addressable Heat with Rate of Rise
SK-Heat-Ht	Addressable Heat High temp 190°
SK-Acclimate	Addressable Multi Criteria Smoke detector with thermal
SK-6AB	6” detector base
SK-Duct	Addressable Duct Detector Housing
SK-Pduct-R	Addressable Duct Detector with Relay
SK-Relay	Addressable Relay Module
SK-Relay-6	Addressable Multi Relay Module
SK-Monitor	Addressable Input Module (Class A or B)
SK-Minimon	Mini Input Module
SK-Monitor-2	Addressable Dual Input Module
SK-Monitor-10	Addressable Multi Input Module (10)
SK-Control	Addressable Notification Module
SK-Control-6	Addressable Notification Multi Module (6)
SK-Zone	Two Wire Smoke Detector Module
SK-Zone-6	6 Multi Smoke Detector Module
SK-Iso	Isolation Module
SK-Beam	Addressable Beam Detector
SK-Beam-T	Addressable Beam Detector with Test feature
B224RB	Detector Relay Base
B200SR	Detector Sounder Base
RT S151KEY	Remote Test Switch For Photoelectric Duct Detector
SK-Pull-SA	Addressable Single Action Pull Station
SK-Pull-DA	Addressable Dual Action Pull Station

The FACP shall support these other Silent Knight devises via addressable input, addressable Notification, or Addressable Output Modules.

PS-SATK	Single Action Manual Pull Station – Key Reset

PS-DATK Dual action Manual Pull Station – Key Reset

2.6 FURNISH AND INSTALL THE FOLLOWING DEVICES

A. Manual Fire Alarm Stations

1. Manual Fire Alarm Stations shall be non-coded, break glass, Single or double action type, with a key operated test-reset lock in order that they may be tested, and so designed that after actual Emergency Operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset Manual station and open FACP without use of another key.
2. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of fifty feet, front or side. Manual Stations shall be constructed of die cast metal with clearly visible operating instructions on the front of the stations in raised letters.
3. Stations shall be suitable for surface mounting on matching backbox, or semi-flush mounting on a standard single-gang box and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on Manual Station accessibility or per local requirements. Manual Stations shall be installed in conjunction with an Addressable Input Module IDP Minimon Input Module IDP Minimon. Manual Stations shall be Silent Knight Model PS-DATK or PS-SATK and Underwriters Laboratories listed.

B. Remote Power Supplies

1. The Remote Power Supplies for Notification appliances shall be the Silent Knight 5496 and/or 5895XL. The Power Supply shall hang on the main S-Bus and be programmed through the 6808 control. The 5496 or 5895XL will support 5amps of 24 volt DC power, with 6 Flexput circuits, rated at 3amps each. The power supply will also regenerate the S-Bus for an additional 6000’.
2. The remote power supply model 5499 or 5495 may also be used on the system. These power supplies are activated by the SK-Control module and support 6amps of 24VDC power, with 4 notification circuits, rated at 3amps each. These power boosters may also be activated from another notification circuit from either the fire alarm control, a distributed power supply 5895XL.

2.7 NOTIFICATION DEVICES

A. The visible and audible/visible signal shall be compatible with 6808, 5495, 5496, 5499 or 5895XL and be listed by Underwriters Laboratories Inc. per UL 1971 and/or 1638 for the ST and also UL464 for the HS.

B. The notification appliance (combination audible/visible units only) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber. The signaling appliance shall also have the capability to silence the audible signal while leaving the visible signal energized with the use of a single par of wires Additionally, the user shall be able to select either continuous or temporal tone output with the temporal signal having the ability to be synchronized.

C. The visible signaling appliance shall maintain a minimum flash rate of 1Hz or greater regardless or power input voltage. The appliance shall also be capable of meeting the candela requirements of the blueprints presented by the Engineer and ADA. The appliance shall have an operation current of 57ma or less at 24VDC for the 15/75Cd.

D. The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount to a single gang or double gang box or double workbox with the use of an adapter plate. The unit shall have an input voltage range of 19-30 volts with either direct current or full wave rectified power.

2.8 SMOKE DETECTORS

A. Smoke detectors shall be Silent Knight model SK-Photo ceiling mounted, Analog/Addressable photoelectric smoke detectors. The combination detector head and twist lock base shall be U.L. listed compatible with the Silent Knight 6808 fire alarm control panel.

B. The base shall permit direct interchange with Silent Knight's SK-ACCLIMATE and SK-Heat detectors. The base shall be the appropriate twist lock base B210LP.

C. The smoke detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for external test equipment.

D. The vandal security-locking feature shall be used in those areas as indicated on the drawing. The locking feature shall be field selectable when required. It shall be possible to perform a sensitivity test of the detector without the need of generating smoke. The test method shall simulate the effects of products of combustion in the chamber to ensure testing of the detector circuits.

E. Detectors shall have completely closed back to restrict entry of dust and air turbulence and have a 30 mesh insect screen. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

2.9 HEAT DETECTORS

A. Furnish and install analog/addressable heat detectors, Silent Knight model SK-Heat. The combination heat detector and twist lock base shall be U.L. listed compatible with the Silent Knight 6808 fire alarm control panel.

B. The base shall permit direct interchange with the Silent Knight SK-Photo and SK-ACCLIMATE detectors. The base shall be appropriate twist lock base B210LP.

C. The heat detector shall have a flashing status LED for visual supervision. When the

detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The vandal security-locking feature shall be used in those areas as indicated on the drawings. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

2.10 DUCT DETECTORS

A. Duct Detector shall be Silent Knight Model DNR Duct Detector Housing with the SK-Photo.

PART 3 - EXECUTION

3.1 INSTALLER'S RESPONSIBILITIES

A. The installer shall coordinate the installation of the fire alarm equipment. All conductors and wiring shall be installed according to the manufacturer's recommendations.

B. It shall be the installer's responsibility to coordinate with the supplier, regarding the correct wiring procedures before installing any conduits or conductors.

3.2 INSTALLATION OF SYSTEM COMPONENTS

A. System components shall be installed in accordance with the latest revisions of the appropriate NFPA pamphlets, the requirements contained herein, National Electrical Code, local and state regulations, the requirements of the fire department and other applicable authorities having jurisdiction (AHJ).

B. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protection signaling circuit cable per National Electrical Code, Articles 760.

3.3 WARRANTY

A. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for one year (365 days) from the date of final acceptance.

3.4 FINAL TEST

A. Before the installation shall be considered completed and acceptable by the awarding authority, a test of the system shall be performed as follows:

B. The contractor's job foreman, a representative of the owner, and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.

C. At least one half of all tests shall be performed on battery standby power.

D. Where application of heat would destroy any detector, it may be manually activated.

E. The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per circuit to check for the presence of correct supervision circuitry.

F. When the testing has been completed to the satisfaction of both the contractor's job foreman and owner, a notarized letter cosigned by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the fire department.

G. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the awarding authority.

H. Prior to final test the fire department must be notified in accordance with local requirements.

3.5 RECORD DRAWINGS, TESTING, AND MAINTENANCE INSTRUCTIONS

A. Record Drawings

1. A complete set of reproducible "Record" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system.

B. Operating and Instruction Manuals

1. Operating and instruction manuals shall be submitted prior to testing of the system. Electronic PDF copy of operating and instruction manuals shall be delivered to the owner upon completion. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

END OF SECTION

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 283100.1 – FIRE ALARM SYSTEM **(FOR SCHEDULE B ONLY)**

PART 1 – GENERAL

1.01 SUMMARY

A. Provide a complete, proper, and functional fire alarm system as specified in this section and on the Drawings.

B. Work Included:

1. Design and provide a Fire Detection and Alarm (FA) System for the following locations:

a. Operations Building.

2. The fire alarm control panel, sensing and actuating devices at the new construction shall be fully addressable and expendable.
3. The fire alarm system monitoring service installer shall be Western States Fire Protection Company.
4. Contractor shall be responsible for a successfully operating fire alarm system and is responsible to ensure the subcontractors support design, installation, proper operation, and approval by the fire marshal.

1.02 REFERENCE STANDARDS

A. Referenced Standards: This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of a listed document, the requirements of this section shall prevail.

1. NFPA 72 – National Fire Alarm Code.
2. NFPA 70 – National Electrical Code.
3. UL 268 – Smoke Detectors for Fire Protective Signaling Systems.
4. UL 864 – Control Units for Fire Protective Signaling Units.
5. UL 268A – Smoke Detectors for Duct Applications.
6. UL 521 – Heat Detectors for Fire Protective Signaling Systems.
7. UL 464 – Audible Signal Appliances.
8. UL 38 – Manually Actuated Signaling Boxes.
9. UL 1971 – Visual Notification Appliances.

B. Local and State Building Codes.

C. Requirements of the Authority having Jurisdiction (AHJ).

1.03 SUBMITTALS

A. Design Drawings: Submit in accordance with the project submittal requirements in Section 260511 – Basic Electrical Methods and Materials, and Section 013300, "Submittal Procedures."

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1. A wiring diagram, complete description, and an elementary control diagram of components.
2. An overall inter-connection diagram of devices and the fire alarm control panel.
3. A dimensioned plan drawing to scale, showing zones, conduit routing, device locations, mounting heights, and device connections.

    a. Submitted plan drawings shall show location of fire alarm equipment and wiring not to interfere with the process equipment along with the maintenance and servicing of the process equipment.

4. A Fire Alarm System Bill of Materials (BOM) including item number, item description, manufacturer, model number, catalog number, and number of units required. The BOM shall include provided spare parts.
5. An Electrical Components BOM including item number, item description, manufacturer, model number, catalog number, and number of units required.
6. A complete component riser diagram.
7. Submit design drawings no later than 45 days after Notice to Proceed.
8. Approved design drawings shall be required prior to installation of any fire alarm system components or associated electrical equipment.
9. An affidavit demonstrating coordination with and conformance with the requirements of the AHJ.
10. Submit Fire Alarm Test Plan for new fire alarm detection system and its integration into existing system.

B. As-Built Diagrams and Manuals: Upon completion of work and prior to final testing and inspection, furnish as-built drawings showing the exact sequence of initiating devices as they were installed in the circuits.

1. Contractor shall integrate the new drawings into the existing drawing set.
2. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Plans and specifications shall be prepared by the manufacturer of the fire alarm system or by a fire alarm installation service which is regularly engaged in fire alarm design.
2. Fire alarm plans and specifications to be stamped and signed by a fire alarm engineer registered in the State of Washington.
3. The installing company shall provide a minimum Level II fire alarm technology technician on-site for installation and final checkout to ensure the integrity of the system.

B. Certification:

1. Fire alarm plans and specifications shall be stamped by a fire alarm engineer registered in the State of Washington.
2. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001.

1.05 WARRANTY

A. Work shall be warranted for a period of not less than 1 year from the date of Substantial Completion against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

PART 2 – PRODUCTS

2.01 GENERAL

A. Equipment shall be listed by the State Fire Marshal, UL listed, FM listed, and tested by a nationally recognized fire test laboratory.

B. Electrical installation to be in compliance with Division 26 of these specifications.

C. Linear Heat Detection (LHD) shall be the detection used for the automatic detection system.

D. As minimum hand pull stations shall be provided at each exterior door.

E. Horn strobe annunciators shall be provided in each room.

F. The fire alarm equipment and wiring shall not interfere with the process equipment along with the maintenance and servicing of the process equipment.

2.02 COMPONENTS

A. The detection system use shall be linear heat detection cable shall be configured so that each room is its own fire detection zone. A fire monitor module shall be used for all four zones.

B. Provide any additional components as required for a complete and operational fire detection and alarm system.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation shall not begin until the State Fire Marshal Listing for equipment and plans and specifications have been approved by the Fire Marshal.

B. Installation of wiring and equipment shall conform to Article 760 of NFPA Standard No. 70 and NFPA Standard No. 72.

C. Minimum conductor size shall be No. 16 AWG for the alarm-initiating circuits and No. 14 AWG for output circuits to audio/visual annunciators.

D. Wiring shall be in galvanized rigid steel conduit per the requirements in Section 260533 and other Division 26 specifications. Provide red powder-coat on exterior of junction boxes and covers used for the fire alarm and detection system.

1. Linear heat detection cable is not required to be in conduit.
2. Linear heat detection cable shall be supported as instructed by the manufacturer.
3. All conduits and cables shall not interfere with overhead cranes, monorails, access to the process equipment (along with maintenance of process equipment), equipment and personnel doors.

E. Terminations in control panels shall be made on terminal strips with a separate point for each conductor.

F. Install no automatic detection equipment on its ceiling mounting plate until the associated room has been painted and cleaned.

G. Coordinate dial out to monitoring station with the Owner.

3.02 TESTING

A. A factory-trained representative of the manufacturer shall supervise final testing of the complete system.

B. The test of each component of the total system shall be made in the presence of the Owner and in the presence of the enforcing fire agency. Upon completion, the Owner's maintenance staff shall be instructed in the testing and operation of the system by the Manufacturer's representative.

3.03 TRAINING

A. Factory-trained representative shall demonstrate operation of new fire alarm system to the Owner. The demonstration shall include the signaling and notification at the main fire alarm control panel.

1. Demonstrate the notification of the responding fire crew to the location specified in this section.

2. Training shall include educating the Owner of all fire alarm system equipment locations and operations in the buildings/structures listed in this section.

END OF SECTION

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 310000 – EARTHWORK

PART 1 – GENERAL

1.01 WORK IN THIS SECTION

A. This work shall generally consist of, but not be limited to:

1. Utility trench excavation, bedding, and backfill.
2. Excavation and backfill for new septic tanks.
3. Cutting, filling, and grading.
4. Foundation excavation.
5. Subgrade preparation for roadways, tanks, and manholes.
6. Excavating and transporting cut material to other areas within the project site to be used as fill material. Includes placing and grading at the new locations.
7. Excavating, salvaging, and stockpiling, existing HMA road base material for use by the Contractor as sub-base fill material as required under new 4-inch layer of CSTC for new HMA.
8. Importing, placing, compacting structural fill material.

1.02 REFERENCES

A. This paragraph references the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

References	**Title**
ASTM D1557	Laboratory Compaction Characteristics of Soil Using Modified Effort
ASTM D4254	Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D1556	Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D6938	In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
WSDOT	Washington State Standard Specification for Road, Bridge and Municipal Construction (Current Edition)

1.03 SPECIFIC STANDARDS

A. The specific reference standard for this work will be Washington State Department of Transportation (WSDOT)/American Public Works Association (APWA) Standard Specifications for Road, Bridge, and Municipal Construction (Latest Edition).

1.04 QUALITY ASSURANCE

A. Codes, Definitions and Standards: Section 014000 – Quality Requirements. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Quality Control: Section 014000 – Quality Requirements.

1.05 SUBMITTALS

A. Prior to trucking to the site, perform and submit sample analysis for each type of import material to demonstrate specification compliance. All soil analyses shall be at the Contractor's expense. No import material will be accepted or approved without above submittals.

B. Submit one (1) copy of load receipt for each load of import material to the Engineer.

1.06 JOB CONDITIONS

A. Verification: Visit the site. Examine and note all conditions pertaining to the work involved so that earthwork may be executed in an orderly and careful manner with due consideration for surrounding areas which are to remain undisturbed.

B. Site Information: Test borings and other exploratory operations may be made by Contractor at no cost to Owner.

C. Existing Utilities:

1. Existing utilities of record are shown in the Plans. These are shown for convenience only and the Engineer assumes no responsibility for improper locations or failure to show utility locations on the Plans.
2. Locate existing overhead and underground utilities in areas of work. When utility services occupy the same space as the new sewer infrastructure, the Contractor shall complete necessary excavation to fully expose such services a minimum of ten (10) working days ahead of construction and report inconsistencies to the Engineer. Coordinate with utility companies for shut-off of services if lines are active. The Contractor shall protect said services and work around them during construction activities including pipe-laying, shoring and manhole installation.
3. Any damage to services resulting from the Contractor's operations shall be immediately reported to the affected utility owner/utility company and the Engineer. Such damage shall be repaired at the Contractor's expense to the satisfaction of utility owner. Any damage to unmarked services that result from the Contractor's operations shall be repaired at the Owner's expense.

Commented [YM1]: ??

D. Use of Explosives: The use of explosives is not permitted.

E. Protection of Persons and Property:

1. Barricade open excavations and post with warning lights operated as recommended by authorities having jurisdiction.
2. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

F. Protection of Tree Roots: Perform hand excavation within dripline of large trees and plants that are to remain, unless approved otherwise by the Engineer. Protect the root system of trees from damage or dryout. Maintain moist condition for root system and cover exposed roots with burlap. Notify the Engineer if any tree roots that are larger than 1-1/2 inch in diameter need to be cut before cutting them. Paint approved root cuts of 1-1/2-inch diameter and larger with emulsified asphalt tree paint.

1.07 UNANTICIPATED DISCOVERY OF CULTURAL RESOURCES

A. See Section 013501 – Inadvertent Discovery of Cultural Resources and Skeletal Remains.

PART 2 – PROJECT ENGINEERS, CONTRACTORS, PRODUCTS

2.01 IMPORTED AGGREGATE AND SOIL MATERIALS

A. Crushed Surfacing Top Course for the following shall conform to WSDOT Section 9-03.9(3).

1. Leveling course under HMA roadway and parking areas.

B. Crushed Surfacing Base Course (CSBC) for the following shall conform to WSDOT Section 9-03.9(3).

1. Base rock under CSBC gravel surfacing.

C. Select structural fill under manhole structures and tank structures shall be “Gravel Borrow” conforming to WSDOT Section 9-03.14(1).

D. Topsoil shall be considered existing surface duff (mixture of vegetative material and topsoil) stripped from areas of excavation until all materials on site have been used. Imported topsoil shall be a high quality screened three-way mix of sandy loam, composted manure, and sawdust. Topsoil shall only be imported to the jobsite after all surface duff has been used. No topsoil shall be imported to the jobsite until after submittal approval.

E. Trench backfill within the roadway prism shall be “Bank Run Gravel for Trench Backfill” conforming to WSDOT Section 9-03.19.

F. Trench backfill outside of the roadway prism may be native material excavated from the trench, free of debris and rock 4 inches and larger with the appropriate moisture content.

G. Pipe zone bedding shall be “Gravel Backfill for Pipe Zone Bedding” conforming to WSDOT Section 9-03.12(3).

PART 3 – EXECUTION

3.01 EXCAVATION: GENERAL

A. Classifications: Excavation is unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

B. Stripping Duff: The Contractor shall strip off all surface duff from all areas where new pipelines, pavement, sidewalks and structures are to be placed. This material shall be reused as topsoil as designated on the Contract Drawings.

C. Unauthorized Excavation: Unauthorized excavation is defined as the removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavations, as well as remedial work directed by Engineer shall be at Contractor's expense.

1. Under footings or foundation bases, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

D. Additional Excavation: When excavation has reached the required subgrade elevations, notify Engineer who will make an inspection of conditions.

1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material only as directed by Engineer.
2. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

E. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

1. Maintain sides of slopes of excavations in safe condition until completion of backfilling.

F. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

1. Contractor is responsible for design of shoring and bracing as required to establish requirements to comply with local codes and authorities having jurisdiction.
2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (1 degree C).

H. Material Storage: Stockpile excavated materials for reuse where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Protect all stockpiled soil materials from erosion through the use of Visqueen sheeting or similar temporary measures.

1. Locate and retain soil materials away from edge of excavations and drip lines of trees to remain.

I. Utilization of Excavated Materials: All old road base and general excavated material shall be used as detailed in the Contract Drawings.

3.02 EXCAVATION

A. Excavation work will require the Contractor to provide survey work, excavation work, and disposal of excavated material as detailed in the Contract Drawings regardless of its nature.

B. Excavation for Structures: Conform to elevations and dimensions shown on the Contract Drawings. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

C. Excavation for Pavements: Once the old roadway base material has been stockpiled for re-use, (under the demo work), cut the subgrade under the "to be paved" areas to comply with the roadway/parking/trail design detailed in the Contract Drawings.

D. Excavation for Trenches:

1. Trenching and backfilling of trenches shall conform to the requirements of this section.

    a. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide clearance on both sides of pipe or conduit as shown on the plans.
    b. Excavate trenches to the depths indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze -ups.
    c. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.
    d. For pipes or conduit 5 inches or less in nominal size and for flat-bottomed multiple -duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on specified compacted bedding material.
    e. For pipes or conduit 6-inch or larger in nominal size, tanks and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6 inches below bottom of work to be supported.
    f. Except as otherwise indicated, excavate for exterior water-bearing piping (water, sewer, drainage) so top of piping is not less than 3 feet-0 inch below finished grade. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe. Support piping or conduit with a 6-inch layer of the specified compacted bedding material.
    g. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

E. Excavation for Trails and Utility Trenches Through Wooded Areas: All excavations for trails and utility trenches through wooded areas shall be with motorized equipment small enough to ensure no disturbance occurs to the natural vegetation outside of the staked utility corridor.

3.03 COMPACTION

A. Control soil compaction during construction providing the minimum percentage of density specified for each area classification.

B. Percentage of Maximum Density Requirements:

1. Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D1557; and not less than the following percentages of relative density, determined in accordance with ASTM D4254, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

    a. Structures, and Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relative density for cohesionless material.
    b. Lawn, Landscaped, or Unpaved Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material at 85% maximum density for cohesive soils and 90% relative density for cohesionless soils.
    c. Walkways: Compact top 6-inches subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% relative density for cohesionless material.

C. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

    a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

D. Compaction Equipment:

1. Compaction equipment shall be capable of obtaining compaction requirements without detrimentally affecting the compacted material. The compacting units may be of any type, provided they are capable of compacting each lift of material as specified and meet the minimum requirements contained herein. Minimum requirements for rollers are as follows:

    a. Sheepsfoot, tamping, or grid rollers shall be capable of exerting a force of 250 pounds per inch of width of roller drum.
    b. Steel-wheel rollers other than vibratory shall be capable of exerting a force of not less than 250 pounds per inch of width of the compression roll or rolls.
    c. Vibratory steel-wheel rollers shall have a minimum weight of 6 tons. The compactor shall be equipped with amplitude and frequency controls and specifically designed to compact the material on which it is used.
    d. Pneumatic-tire rollers shall have smooth tread tires of equal size that will provide a uniform compacting pressure for the full width of the roller and capable of exerting to compact the material on which it is used.
    e. Heavier compacting units may be required to achieve the specified density of the compacted area.

E. Compaction Testing:

1. In-place compaction testing shall conform to ASTM D1556 or ASTM D6938. Contractor shall arrange and pay for compaction testing by any independent laboratory. Compaction testing will be required for each lift of fill under pavement and concrete. A sufficient number of compaction test shall be made on the subgrade to give a true representation of overall compaction conditions. The number of compaction tests required to represent the overall compaction conditions shall be determined by the Engineer. The Owner shall have the right to approve the Contractor's selection of a testing firm engaged to perform the work. Engineer shall inspect and approve the final subgrade prior to placement of base course.
2. Engineer reserves the right to specify where compaction density tests are taken by the testing service. Additional tests may also be called for by the Engineer in the event any areas are in question, at no additional cost to the Owner.

3.04 BACKFILL AND FILL

A. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below. Reference Subsection 2.01 of this section.

1. Excavations: Satisfactory excavated or imported borrow material.
2. Trench Excavations: Satisfactory backfill and fill material
3. Grassed and Landscaped Areas: Satisfactory excavated or imported borrow material and/or topsoil.
4. Walks and Pavements: Subbase material
5. Piping and Conduit: Bedding material where bedding is indicated under piping or conduit. Shape to fit bottom half of cylinder.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval, and recording locations of underground utilities.
2. Removal of trash and debris.

C. Ground Surface Preparation:

1. Remove vegetation, debris, duff, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 3 horizontal so that fill material will bond with existing surface.
2. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

D. Placement and Compaction:

1. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
2. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift.

3.05 GRADING

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Provide a smooth finished surface within specified areas. Grade the finished surface smoothly to within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Around Tanks and Structures: Grade areas adjacent to tanks and structures to drain way from structures and to prevent ponding.

C. Finish all surfaces to be free from irregular surface changes, and as follows:

1. Lawn, landscaped, or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

D. Grading of Trails Through Wooded Areas: All grading for trails and utility trenches through wooded areas shall be performed by hand or with motorized equipment small enough to ensure no disturbance occurs to the natural vegetation outside the specified clearing limits.

E. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density or relative density for each area classification and provide compaction testing as specified.

3.06 PAVEMENT SUBBASE COURSE

A. General: Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

D. When a compacted subbase course is shown to be 8 inches thick or less, place material in a single layer. When shown to be more than 8 inches thick, place material in equal layers, except no single layer more than 8 inches or less than 3 inches in thickness when compacted.

3.07 MAINTENANCE OF GRADED AREAS

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

1. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.08 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including excess soil, trash, debris, and other specified material and properly dispose of it off Owner's property in accordance with local codes and ordinances. Contractor is responsible for payment of loading, shipping, and disposal fees for waste materials.

END OF SECTION

SECTION 310513 – AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes aggregates used as base for gravel pathways, and as subbase for asphalt pavement.

1.2 STANDARD SPECIFICATIONS

A. All work to be performed and materials to be used shall be in accordance with the current edition of the Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.

B. The Contractor shall have one copy of the Standard Specifications and all amendments therein, and applicable WSDOT Standard Plans at the job site.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 01 Specification Sections apply to this Section.

1.4 SUBMITTALS

A. Product Data: Submit gradation summary and source approval for the following:

1. Crushed Surfacing Base Course (CSBC).
2. Crushed Surfacing Top Course (CSTC).
3. Gravel backfill for pipe zone bedding.

PART 2 - PRODUCTS

2.1 CRUSHED SURFACING BASE COURSE (CSBC)

A. The crushed surfacing base course (CSBC) shall conform as specified in Section 9.03.9(3) of the WSDOT Standard Specifications.

2.2 CRUSHED SURFACING TOP COURSE (CSTC)

A. The crushed surfacing top course (CSTC) shall conform as specified in Section 9-03.9(3) of the WSDOT Standard Specifications.

2.3 GRAVEL BACKFILL FOR PIPE ZONE BEDDING

B. Gravel backfill for pipe zone bedding shall conform as specified in Section 9.03.12(3) of the WSDOT Standard Specifications.

2.4 GRAVEL BORROW

C. Gravel Borrow shall conform as specified in Section 9-03.14(1) of the WSDOT Standard Specifications

PART 3 - EXECUTION

3.1 CRUSHED SURFACING BASE COURSE (CSBC)

A. Crushed surfacing base course (CSBC) shall be placed and compacted in conformance with Section 4-04.3 of the WSDOT Standard Specifications.

3.2 CRUSHED SURFACING TOP COURSE (CSTC)

A. The crushed surfacing top course (CSTC) shall be placed and compacted in conformance with Section 4-04.3 of the WSDOT Standard Specifications.

3.3 GRAVEL BACKFILL FOR PIPE ZONE BEDDING

B. Gravel backfill for pipe zone bedding shall be placed per Section 7-09.3(9) of the WSDOT Standard Specifications.

3.4 GRAVEL BORROW

C. Gravel Borrow shall be placed and compacted per the Geotechnical Report provided as Appendix A.

3.5 AGGREGATE TESTING

A. Aggregates shall be tested per WSDOT Standard Specification Section 9-03.20 of the WSDOT Standard Specifications.

END OF SECTION

SECTION 311100 – CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes the following but is not limited to the following: protection of existing trees, shrubs and other vegetation identified to be saved, removal of trees and other vegetation as specified, Selective Clearing, stripping topsoil, clearing and grubbing, removing above-grade improvements, removing below-grade improvements, salvaging surface boulders, and protection of all other existing improvements to remain. Work shall be in compliance with WSDOTSS 2-01 Clearing, Grubbing, and Roadside Cleanup unless otherwise modified in the section.

B. “Clearing" means removing and disposing of all unwanted material from the surface such as trees, brush, downed timber, or other natural materials.

C. “Grubbing” means removing and disposing of all vegetative matter from the existing surface and underground such as sod, stumps, roots, buried logs or other debris.

D. “Salvage and Reuse existing crushed rock surfacing” means removing and disposing of all organic matter from the surface of the existing Maintenance Building Crushed Rock Surfacing intended to receive new paved surfacing. This definition applies only to the existing Crushed Rock Surfacing that is around the existing maintenance building.

E. "Debris" means all non-usable natural material produced by clearing and grubbing.

F. “Selective Clearing” means the cutting of trees by the Contractor as selected by Owner.

G. “Chipped” means trees shall be chipped in compliance with WSDOTSS 2-01.2(3).

1.2 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Section 015713 – Temporary Erosion and Sedimentation Control
2. Section 312000 – Earth Moving
3. Section 329113 – Bark Mulch & Wood Chips
4. Appendix A – Geotechnical Reports

1.3 PROJECT CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Removal of Improvements: Remove existing above grade and below grade improvements as indicated and as necessary to facilitate new construction.

C. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

D. Protect improvements on adjoining properties and on Owner's property.

E. Restore damaged improvements to their original condition, as acceptable to property owners.

F. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles by implementing the tree protection plan.

G. Provide additional protection measures throughout the life of the Contract as follows:

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
2. Vegetation Damage Control:

    a. Protect all existing trees and vegetation to remain from foliage, trunk, and root damage.
    b. Provide tree protection fencing and maintain existing conditions around trees, shrubs or other vegetation, and where shown on Plans to protect such areas from damage of any nature caused by construction operations.
    c. Prior to beginning work, submit a tree protection plan prepared by a certified arborist for the existing trees to remain on site.

H. Contractor can anticipate encountering large quantities of cobbles and boulders through-out the work zone. Contractor can observe cobbles and boulders removed from the Phase 1 and 2 sitework at the borrow pit as examples of the type and size of cobbles and boulders that may be encountered.

1.4 SUBMITTALS

A. Prior to beginning work submit a tree protection plan indicating work areas, haul routes, and the existing trees and vegetation designated on Plans to remain on site.

PART 2 - PRODUCTS – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEARING

A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Remove as specified herein and on Plans.

B. Fell trees only within the area to be cleared and verify all trees to be cleared with Owner's Representative.

C. Leave standing any trees or native growth indicated by the Owner's Representative.

D. Protect by fencing where indicated on Plans and where directed by the Owner's Representative, all trees or native growth from any damage caused by construction operations.

E. Sawcut minor roots and branches of trees within 1/2" of rootwad/trunk indicated to remain where such roots and branches obstruct installation of new construction.

F. No logs, stumps, rocks, spoil stockpiles, etc., shall be left lying in or adjacent to the work area without specified written approval by the Engineer.

G. Only those trees greater than 8-inch caliper, identified "To Be Removed" on the Drawings shall be removed. (SCHEDULE B ONLY)

H. Contractor shall carefully remove sword ferns and heal roots into nearby soils, out of clearing limits, until all pipeline construction is complete. Ferns shall then be re-planted along disturbed area as re-vegetation.

3.2 SELECTIVE CLEARING

A. This work includes the trees to be selectively cleared that are located outside of the Work Area/Clearing Limits. These trees identified by Owner to be selectively cleared will be marked with Orange spray paint during the Bidding period and Post Notice-to-Proceed on the tree trunk approximately 5 to 7 feet above the existing grade. These Trees are not shown on the Plans but shall be assessed by the Contractor. Tree size, condition, species, quantities, orientation, and all Tree characteristics shall be assessed by the Contractor prior to Bid Submission.

B. Trees identified by Owner to be selectively cleared shall be safely cut at the top of the root flare or one foot above the existing grade whichever is lower. Trees shall be fell in a direction that does not impact existing and contract improvements. Trees to be selectively cleared shall be fell in a position so the fallen Tree is in full contact with the existing grade and not in a hazardous position as determined by the Owner. Selectively cleared trees that have been felled in a hazardous position shall be further cut in place into tree segments so the felled tree is no longer hazardous as determined by the Owner. Selectively cleared trees are not required to be removed from the site. No part of a fallen tree shall be located within the project work zone.

3.3 GRUBBING

A. Grub to six inches (6") minimum, or to mineral soil sub base per Geotechnical Report to remove all sod and grass / vegetative layer, organic soils/material and all stumps, root wads, large roots (larger than 1" diameter), buried logs and other vegetative material under proposed aggregates and structures and dispose offsite in a legal manner.

B. Grub deep enough to remove all stumps, root wads, large roots (larger than 1" diameter), buried logs, and other vegetative material in landscape areas.

C. Grub all areas:

1. As shown on Plans and where indicated by the Owner's Representative.
2. To be excavated.
3. Where unsuitable material is removed, or structures built.
4. Upon which embankments will be placed.

3.4 Salvage and Reuse Existing Crushed Rock Surfacing for Pavement Base

A. Salvage and Reuse Existing Crushed Rock Surfacing for Pavement Base applies to all existing crushed rock surfacing around the existing Maintenance Building.

B. The intent is to remove grass, leaves, branches, and all vegetative matter within the salvage and reuse zone resulting in a clean crushed rock surfacing base course suitable for paving.

3.5 SALVAGING BOULDERS

A. Project Site has Boulders scattered throughout the project limits to be cleared and grubbed. Contractor shall salvage Boulders found during Grubbing operations. Contractor shall salvage Boulders that are One Man Rock Size and larger as defined in WSDOTSS 9-03.11(3). Salvaged Boulders shall be stored on-site in location defined by Owner. Boulders in excess of the quantity required to fulfill the projects needs shall be stockpiled at the Borrow Pit as directed by the Owner.

3.6 BACKFILL DEPRESSIONS

A. Fill depressions caused by Clearing and Grubbing operations with Crushed Surfacing Top Course unless further excavation or earthwork is indicated.

B. Place backfill material (Gravel Borrow) in horizontal layers not exceeding 10 inches loose depth, and thoroughly compact to 95 percent density.

C. Backfill void depressions caused by Salvaging Boulders/Cobbles in the Grubbing Zone with Gravel Borrow.

3.7 CHIPPING OF CLEARING AND GRUBBING MATERIALS

A. Contractor shall take possession of all cleared and grubbed organic material and process this organic material into Wood Chips meeting WSDOT section 2-01.2(3) Disposal Method No. 3 - Chipping. Wood Chips shall be Hog Fuel as processed by Tub Grinder or similar on-site processing equipment and range in size from 6 inches to 1/2 inch with a thickness no greater than 1/2".

B. Contractor shall coordinate the timing and location of the Chipping operation with Owner as well as the storage location of Wood Chips.

3.8 DISPOSAL OF GRUBBING MATERIALS

A. Contractor shall take possession of all Grubbed Materials. Grubbed materials shall be disposed of off site legally.

3.9 DISPOSAL OF COBBLES/BOULDERS

A. Contractor shall dispose of Cobbles/Boulders in the Owner provided Borrow Pit. Cobbles/Boulders disposed of in the Owner provided Borrow Pit shall be placed in a manner to facilitate future simple and easy construction equipment access to permit loading onto truck access to used elsewhere within Nisqually State Park. Placement of Cobbles/Boulders shall be accomplished in a safe and non-hazardous manner as determined by the Owner. Coordinate Cobble/Boulder location/placement with Owner.

B. Access to the Owner provided Borrow Pit for disposal of boulders will not be provided until October 1st 2025.

END OF SECTION

SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work for this Section includes, but is not necessarily limited to the following: Excavating, cutting, filling, backfilling, rough and finish grading, and compaction required to attain indicated grades.

B. Excavation and removal of existing topsoil and subgrade soils to lines and grades as shown on the Plans and as directed by Owner.

C. Compaction of subgrade soils for structures, asphalt, concrete, and crushed rock paved areas.

D. Backfill and compaction of boulder voids and grubbed tree rootballs.

E. Remove all materials from the site which are in excess of that required.

F. Import all materials required to complete the work.

G. Coordinate earthwork operations with other work of the project.

H. Process Boulders as defined herein.

1.2 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Section 015713 – Temporary Erosion and Sedimentation Control
2. Section 220510 - Excavation & Backfill
3. Section 311100 – Clearing and Grubbing
4. Section 323253 – Landscape Boulders
5. Section 331300 – Water Distribution
6. Section 333300 – Sanitary Sewers
7. Section 334000 - Stormwater Utilities
8. Appendix A - Geotechnical Report

1.3 REFERENCES

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 Kg) Rammer and 12-inch (304.8 mm) Drop.

D. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

E. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

F. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

G. ASTM D2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

H. ASTM D2434 - Test Method for Permeability of Granular Soils (Constant Head).

I. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

J. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

K. All Work shall comply with Washington State Department of Transportation Standard Specifications (WSDOTSS), most recent published edition at time of Bid applies.

1.4 QUALITY ASSURANCE

A. Site Examination:

B. Visit site prior to bidding to determine nature of existing site materials and other conditions affecting work.

C. Geotechnical Report:

1. Review the Geotechnical Report and determine the nature of existing soil and subsurface conditions of the work.

D. Tolerances:

1. Contractor is required to measure all subgrades and finish grades to laser level or GPS accuracy and shall provide a laser level or GPS unit on site for the Owner to use to check grades. Conduct Field Meeting with Owner prior to verify subgrade compliance prior to backfilling any subgrades.
2. Subgrades: plus or minus 0.05 foot in twenty (20) linear feet of adjusted Design elevations.
3. Surfaced paving; plus or minus 0.05 foot of elevation shown on the Plans. No deviation of .05 in twenty (20) lineal feet will be accepted.
4. Gravel Borrow subgrade; plus or minus 0.05 foot in twenty (20) linear feet.
5. Crushed Surfacing; plus or minus 0.05 foot in twenty (20) linear feet.
6. Non-paved and non-crushed surfacing subgrades; plus or minus 0.10 foot in twenty (20) linear feet.

E. Compaction:

1. Compact fills, exposed subgrades, and all imported aggregates to the following percentages of maximum dry density (MDD) as determined by ASTM: D 1557 or as otherwise noted:
2. Backfills beneath all buildings and structures shall be compacted to 95 percent of maximum density.
3. Backfills beneath crushed surfacing, concrete surfaces, and asphalt paving, is specified shall be compacted to 95 percent of maximum density.
4. Embankments and Fill Slopes: 95 percent (unless otherwise noted).
5. Boulder Walls: Machine compact to 85 percent of maximum density.
6. Landscape areas: 85 percent of maximum density.

F. Compaction Tests:

1. The Owner will pay for compaction tests by an independent testing laboratory.
2. Compaction tests will be performed on the subgrade of structural fills beneath structures, crushed surfacing, and paved areas as directed by Owner.
3. All test results must indicate conformance to this specification before proceeding with related work. If, in the opinion of the Owner, subgrade or fills which have been placed are below specified density, the Contractor shall provide additional compaction and testing at his expense. The Contractor shall provide three (3) days advance notice to the Owner when tests are required to be performed.

1.5 SUBMITTALS

A. Contractor shall provide testing and certification from a testing agency that Products described in Part 2, Products, comply with WSDOTSS and/or submit Qualified Products List per WSDOTSS 1-06.1(1) to the Owner. Submit 5-gallon sample of all Products required herein to Owner to remain on site as examples of the approved materials.

1.6 PROJECT CONDITIONS

A. Site Information: Data in the Geotechnical Report was used for the basis of the design and are included in the Appendix. Conditions are not intended as representations or warranties of accuracy or continuity between soil explorations. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

B. Additional geotechnical test exploratory and other exploratory operations may be performed at the Contractor’s option; however, no change in the Contract Sum will be authorized for such additional exploration.

C. Carefully maintain benchmarks, monuments and other reference points. If disturbed or destroyed, replace as directed at the Contractor's expense.

D. In subgrade cut situations where soil is encountered that cannot be proof rolled to a firm and unyielding condition, the Contractor shall inform the Owner immediately. Contractor shall take no further action until directed by Owner in writing.

E. The Contractor is advised that underground utilities exist in the construction area. The general locations of these are shown on the Plans. Prior to beginning construction, the Contractor shall check and verify the location and elevation of all known lines. Any damage to existing utilities as a result of construction operation shall be promptly repaired by the Contractor at no expense to the Owner.

F. Coordinate all traffic control with the Owner to maintain vehicular and pedestrian traffic along the frontage of Mashel Prairie Road, during construction operations. Use flagmen, barricades, warning signs, and other approved devices to maintain safety and cause the least disruption to traffic.

G. Provide excavation plan and list of proposed equipment and methods at Pre-Construction Conference, including a schedule of earthwork activities and phasing of earthwork. The Contractor shall prepare a simple diagrammatic plan showing the proposed distribution of fill material subject to Owner approval.

H. The Contractor may encounter a large quantity of Boulders during the earth moving work on the Phase 3 Project. The Boulders encountered during the one-acre sitework of Phase 1, and the sitework of Phase 2 have been placed along the edge of the Borrow Pit. The Owner will select Boulders to be installed around the Host Campsite from the Boulders from the Phase 3 earthwork. Boulders encountered during the Phase 3 sitework are anticipated to be of similar character and quantity as encountered in Phase 1 & 2 sitework. Boulders that are encountered and not selected to be used for installation in the Host Campsite shall be removed, hauled, and placed at the Owner Furnished Borrow Pit in a location determined by the Owner, after 10/2/2025. The cost of excavating, loading, and hauling of all Boulders shall be considered to be incidental work to execute the earth moving.

1.7 BARRIERS, SAFETY GUARDS AND WARNING LIGHTS

A. Provide for public, visitors', workers' protection, as required by the Washington State Department of Labor and Industries.

PART 2 - PRODUCTS

2.1 CRUSHED SURFACING BASE AND TOP COURSE

A. Crushed Surfacing Base Course and Top Course per WSDOTSS 9-03.9(3). Mineral aggregate shall be composed of clean, uniform particulate size groups essentially free from wood waste and other deleterious materials obtained from approved material extraction quarries.

2.2 CRUSHED ROCK SURFACING TYPE A

A. Crushed Rock Surfacing Type A shall comply with WSDOTSS 9-03.9(3) except it shall meet the following sieve requirements.

Sieve Size	Percent Passing

3/4”	100
3/8”	80-100
No. 4	46-66
No. 40	8-24
No. 200	10.0 max.
% Fracture	75 Min.
Sand Equivalent	40 Min.

2.3 QUARRY SPALLS

A. Shall be fractured quarry rock. Spalls shall be hard, sound, and unweathered, and shall comply with WSDOTSS 9-13.

2.4 GEOTEXTILE FABRIC

A. Geotextile Fabric shall comply with WSDOTSS 9-33.2(1) Table 3, nonwoven Geotextile for Separation.

2.5 GRAVEL BORROW

A. Gravel Borrow shall comply with WSDOTSS 9-03.14(1)

2.6 SALVAGED BOULDERS

A. Salvaged Boulders shall range in size from One Man to Four Man Rock sizes as defined in WSDOTSS 9-13.7(1) and shall be salvaged and stockpiled for use as shown in the Plans. Boulders in excess of the Boulders required in the Plans shall be hauled and placed in the Borrow Pit in a safe manner as determined by the Owner.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to all Work in this Section, the Contractor shall become thoroughly familiar with the site conditions. Prior to site grading, any site surface water and groundwater shall be collected and routed away to a proper drainage away from the work areas in order to facilitate work and subgrade construction. Control drainage during construction to avoid getting materials excessively wet and prevent areas which hold water. Eliminate areas that hold water as required, within 48 hours of notification from the Owner.

B. The Contractor shall be aware that on-site soils may be moisture sensitive and weather dependent. Contractor is fully responsible for scheduling and controlling earthwork operations.

C. Perform work in such a manner as to prevent overworking and over-saturation of on-site soils. This shall include any/all precautions necessary throughout the entire work area (including access drives/haul roads/staging areas) to control surface and groundwater, to protect soils and subgrades from heavy vehicle loads, and to achieve soil moisture levels capable of achieving specified compaction. No extra compensation will be paid to the Contractor due to work performed at non-optimum times or under non-optimum conditions resulting in unsatisfactory soil conditions. The Contractor shall correct unsatisfactory conditions at no additional cost to the Owner. Contractor is responsible for managing the soil moisture conditions to maintain the constructability of soil in order to meet the construction contract schedule. No extra compensation will be paid to the Contractor for watering or aerating the subgrade, excavated areas, or fills to achieve specified compaction.

D. Delays may occur due to inclement weather. It shall be the Contractor's responsibility to immediately notify the Owner and request an extension of completion time for justified reasons.

E. Do not allow or cause any of the Work performed or installed to be covered up or enclosed prior to all of the required reviews, tests and approvals.

F. Should any of the Work be so enclosed or covered up before it has been approved, the Contractor shall uncover all such Work, at no additional cost to the Owner.

G. After the Work has been completely tested, inspected, and approved, make all repairs and replacements necessary to restore the Work to the condition in which it was found at the time of uncovering, all at no additional cost to the Owner.

3.2 STABILIZED CONSTRUCTION ENTRANCE ACCESS

A. The Contractor shall clear vegetation down to existing grade prior to placement of Geotextile Fabric and Quarry Spalls to construct the Stabilized Construction Entrance. Comply with Pierce County and jurisdictional agencies' requirements.

3.3 FINISH ELEVATIONS AND LINES

A. Grades shown on the Plans are finish grades. Contractor shall derive subgrade elevations founded on Plans' finished grades; Contractor shall consult with Owner on any and all subgrade elevations unclear to Contractor.

3.4 EXCAVATION

A. Excavate, as necessary, for Work shown on the Plans or specified herein. Remove roots, rocks, boulders, concrete and other obstructions. Allow a minimum of twelve inches of clear space

between any obstruction and formwork. Leave bearing surfaces undisturbed, level and true. Obtain Owner's acceptance of subgrade prior to commence of next phase of work.

B. Post Grubbing Boulders. Subsequent to grubbing operations, subsurface Boulders may be exposed in a manner unacceptable to the Owner. Owner will identify those Post Grubbing Boulders to be removed in their entirety by the Contractor. Remnant void edges will be graded smooth and the voids will be backfilled with Gravel Borrow and compacted as specified herein.

C. Where depressions result from, or have resulted from, the removal of surface or subsurface obstructions, open the depression to equipment working width and remove all debris and soft material, as directed by the Owner.

D. Provide trench boxes, temporary shoring and supports appropriate to the specific conditions at all trenches, cuts, and excavations. Remove prior to backfilling and in such a manner as not to endanger structures. Design system for loading required and to prevent seepage of fines from cut slope. When excavating near footings, pavement, catch basins, utility poles or structures, provide lateral support to said features.

E. All Excavation is unclassified and includes excavation to subgrade elevations indicated on the Plans, or as required to construct the work, regardless of character or materials and obstructions encountered, except as allowed in the provisions for Unsuitable Material; see subsection 3.06 herein.

F. Grade top perimeter of excavation and all work areas to prevent surface water from draining into excavation. All work required to maintain positive drainage is incidental to the work.

G. Notify Owner immediately of subsurface conditions that are not as noted in the Geotechnical Report and discontinue affected work in area until notified to resume work in writing by the Owner.

H. Unauthorized excavations consist of removal of materials beyond indicated subgrade elevations or dimensions without specific written direction from the Owner. Backfill areas where unauthorized over-excavation has taken place with material specified by the Owner, and compact to specified density per subsection 1.03.D. Unauthorized excavation, as well as remedial work required, shall be at Contractor expense.

3.5 PREPARATION OF SUBGRADE – GENERAL

A. Remove all ruts, hummocks, and other uneven surfaces by surface grading prior to placement of fill.

B. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collecting in depressions.

C. Where soil has been softened or eroded by flooding or placement during unfavorable weather, remove all damaged areas and re-compact per 1.3.D herein per Owner's written direction.

D. Final subgrades shall be crowned/sloped to establish positive drainage and shall conform to all design grades and details.

3.6 PREPARATION OF SUBGRADE - UNSUITABLE MATERIAL

A. In subgrade situations where soil is encountered that cannot be proof rolled to a firm and unyielding condition as determined by the Owner, the unsuitable material shall be removed to depths determined by the Owner and disposed off-site. Contractor shall backfill unsuitable material void with Gravel Borrow and compact to specified density per subsection 1.03.C to attain subgrade elevations.

B. Should the subgrade soil be rendered unsuitable material as a result of the Contractor's negligence as determined by Owner, the Contractor will be required to excavate the unsuitable material to depths determined by Owner and disposed off-site. Contractor shall backfill unsuitable material void with Gravel Borrow, and compact to specified density per referenced section 1.3.D at no cost to the Owner.

C. “Contractor negligence” is defined as Contractor failing to deploy measures to protect the site from weather conditions, overworking of moisture sensitive soils, and directing drainage to moisture sensitive soils.

3.7 DEWATERING

A. Provide and maintain at all times during construction, ample means and devices which promptly remove and dispose of all water from every source entering the excavations or other parts of the Work.

B. Dewater by means which will ensure dry excavations and the preservation of the final lines and grades of bottoms of excavations.

3.8 FILL AND COMPACTION – GENERAL

A. After subgrade compaction has been approved, spread approved fill material in loose lifts not exceeding ten (10) inches in thickness. Each lift shall be conditioned to the optimum moisture content and compacted to the specified minimum density prior to placing the next lift. Earthwork shall be performed under the observation of the Owner to ensure contract compliance.

B. Water or aerate the fill material as necessary, and thoroughly mix to obtain a moisture content which will permit proper compaction. No extra compensation will be paid to the Contractor for watering or aerating the fill material to achieve specified compaction.

C. Do not place, spread, or compact any fill material during unfavorable weather conditions. Do not resume operations until moisture content and fill density will conform to specification requirements.

D. Compact each soil layer to at least the minimum density specified. Repeat compaction process until plan grade and specified compaction density is attained.

E. Compact areas not accessible to rollers or compactors with pneumatic hand tampers or other approved means. Use hand vibrators within 5'-0" of foundations and walls. No heavy compaction equipment shall be allowed adjacent to walls and foundations.

F. During Warranty period, replace work damaged by settlement and replace slabs and pavement which develop settlement cracks, all at no additional cost to the Owner.

G. In fill areas where grade slopes more steeply than 5H: IV (horizontal: vertical) the base of any embankment shall be tied to the firm stable subsoil by appropriate keying and benching.

3.9 BUILDINGS, PAVEMENTS, AND STRUCTURAL FOUNDATIONS:

A. General:

Includes all building and structural foundations, hot-mixed asphalt, cement concrete pavements, and trail surfaces.

B. Cut:

Compact the top twelve (12) inches of the subgrade to a firm and unyielding condition meeting the minimum tolerances specified herein.

C. Fill:

1. Place Gravel Borrow over compacted subgrade in loose lifts no greater than ten (10) inches in loose thickness and compact each lift to the minimum density specified herein.
2. Compact the Crushed Surfacing beneath the pavement sections and structures to the minimum density specified herein.
3. Place clean Crushed Aggregate beneath building slabs and compact to the minimum density specified herein.

3.10 GRADING

A. Except as otherwise directed by the Owner, perform all rough and finish grading required to attain the elevations shown on the Plans. Provide the subgrade grading to an elevation to allow for finish materials and to achieve a smooth transition to undisturbed grades at project perimeter.

3.11 TREATMENT AFTER COMPLETION OF GRADING

A. Protect all areas from oversaturation and excessive vehicle loads. Perform work in such a manner as to minimize vehicle crossings.

B. Use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

C. Repair at Contractor's expense, all damage and unsatisfactory conditions including wheel ruts and vehicle/equipment tracks, humps, low spots/depressions, footprints, rills, erosion, washes, debris drift piles, which may develop for any reason between the time finish grading is accepted and permanent stabilization measures have completely stabilized the graded area.

3.12 SALVAGED BOULDERS

A. Boulders meeting the definitions in Part 2 herein shall be salvaged and stored for use as indicated in the Drawings. Boulders that do not meet the size limits and are in excess of the Salvaged Boulders to be used in the Plans as defined herein shall be hauled and placed at the Borrow Pit, as directed by Owner.

3.13 WET WEATHER PROVISIONS

A. The subsurface conditions may vary throughout the site; refer to the Geotechnical Report.

B. Existing soils on site are likely to be susceptible to changes in water content and tend to become muddy, unstable and difficult to proof roll and compact if moisture content significantly exceeds the optimum.

C. Performing earthwork during dry weather would reduce these problems associated with rainwater, trafficability, and handling of wet soils. Wet and potentially muddy conditions should be anticipated during subsurface excavations.

3.14 DISPOSAL OF UNACCEPTABLE MATERIALS

A. Unacceptable excavated material including, but not limited to trash, rebar, asphalt, and concrete, and miscellaneous construction debris shall be hauled off-site and disposed of in a legal manner.

END OF SECTION

SECTION 312000.1 – EARTH MOVING (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes the following in support of utilities, installation, and new building construction:

1. Excavation and embankment.
2. Preparing subgrades.
3. Trench excavation and backfill.
4. Base course for asphalt paving.

1.02 SPECIFIC STANDARDS

A. The specific reference standard for this work will be Washington State Department of Transportation (WSDOT)/American Public Works Association (APWA) 2010 *Standard Specifications for Road, Bridge, and Municipal Construction*.

B. Additional standards may also apply.

1.03 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

B. Base Course: Layer placed between the subgrade and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by the Owner. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by the Owner, shall be without additional compensation.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other manmade stationary features constructed above or below the ground surface.

G. Top Course: Layer placed between the base course and asphalt paving, or shoulder or walk surfacing as identified by the Plans.

H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base course, drainage fill, or topsoil materials.

1.04 SUBMITTALS

A. General: Follow the procedures specified in Section 013300 – Submittal Procedures.

B. Submit one copy of load delivery ticket for each load of imported material paid by tonnage delivered to the jobsite. Ticket shall identify tonnage.

C. Perform and submit sample analysis for each type of import material to demonstrate proper specification compliance. No import material will be accepted or approved by the Owner without above submittals prior to delivery to jobsite.

D. Submit one copy of each/all soil materials and compaction density testing reports to the Owner immediately following completion of each test.

E. Certificates: WSDOT pit certification for each pit.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stockpiling: Stockpile materials on-site within grading area, staging area, designated fill sites, and at locations approved by the Owner.

B. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

C. Comply with WSDOT Section 3-02.2(6) – Construction of Stockpiles.

D. Maintain toe of material at least 6 feet from edges of trenches and excavations. Pile so surface water is prevented from flowing into excavations. Provide free access to fire hydrants and access roadways.

1.06 PROJECT CONDITIONS

A. Verification of Site Conditions: Both prior to bidding and before commencing site work, the Contractor will be expected to visit and inspect all areas of the project site. Examine and note all conditions pertaining to the work involved so that earthwork may be executed in an orderly and careful manner with due consideration for surrounding areas, structures, vegetation, soil conditions, and all other site conditions which will directly impact the work.

B. Soil/Site Information: Limited subsurface conditions have been explored and are documented in the available geotechnical reports located in Appendix A. However, the Contractor shall be satisfied as to the quality of the material required to be moved during this work.

C. Protection of Persons and Property: Barricade and cover all open excavations and post with warning lights, signs, barrier tape or a combination of such measures to warn workers and park patrons of unsafe conditions and protect them from harm. Open trenches shall, in all cases, be marked by a sufficient number of flashing lights and barriers during hours of darkness. Ensure that all open trenches are properly barricaded, covered, and flagged at the end of each working day before vacating the jobsite.

1.07 SITE SAFETY

A. All trenching, excavations, shoring, etc., shall be performed in compliance with Chapter 49.17 RCW and Chapter 296-155 WAC, as well as other applicable local, State and/or Federal regulations. All work shall also comply with the requirements contained in these Specifications.

B. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movements, undermining, washout, and other hazards created by earthwork operations.

1.08 EROSION CONTROL

A. See Section 312500 – Erosion and Sedimentation Controls.

B. Comply with the specific requirements of Jefferson County codes and ordinances pertaining to construction practices and temporary erosion control and sedimentation control measures and methods as they apply to work performed under this contract.

C. Comply with all temporary erosion control procedures and requirements outlined and/or specified on the county-approved Plans, Specifications, and final construction permit(s).

D. Best Management Practices (BMPs) shall be in accordance with the *Stormwater Management Manual for Western Washington*, Washington State Department of Ecology, and the *Surface Water Design Manual*, King County Department of Public Works, and/or as specified by the Owner or County Engineer.

1.09 LAYOUT OF WORK AND SURVEYING

A. Construction staking shall be per Section 017123 – Field Engineering.

1.10 SEQUENCING AND SCHEDULING

A. Sequence work to minimize disruption of existing vegetation beyond the limits of fill work. Wide-track construction equipment shall be used in lieu of pneumatic-tire equipment, where possible.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Excavated Soil Materials (General):

1. Selected soils excavated from the site may be utilized as backfill material for nonstructural embankments, structural fill, and general backfill areas with the approval of the Owner on a case-by-case basis.
2. All materials deemed unsatisfactory for embankments or backfills will be disposed of off-site by the Contractor.
3. The Owner retains the right to reject and have removed, at no additional cost, any/all excavated soil material placed as backfill material without the prior approval and/or direction of the Owner for use of said soil in any particular application.
4. All materials considered to be excavation debris shall be loaded and hauled from the site to a Contractor provided disposal site at no additional cost. Such debris shall include all roots, buried logs, and all other nonsoil type debris exposed during earthwork operations.

C. Structural Fill: Imported soil consisting of clean, free-draining sand, and gravel containing less than 7 percent fines (silt and clay sized particles) based on the fraction passing the 3/4-inch sieve and meeting the requirements of Gravel Borrow below.

D. Gravel Borrow shall meet the requirements of WSDOT 9-03.14(1). Gravel Borrow is excavated material from a site outside the project site. Borrow site(s) shall be arranged and paid for by the Contractor and be approved by the Owner prior to delivery to the grade or project site.

E. Aggregate for Crushed Surfacing Base Course for road construction and for shoulder gravel shall meet the requirements of WSDOT 9-03.9(3).

F. Aggregate for Crushed Surfacing Top Course, shall meet the requirements of WSDOT 9-03.9(3).

G. Pipe zone bedding material for all utilities shall meet the requirements of WSDOT 9-03.12(3).

H. Gravel Backfill for Drains shall meet the requirements of WSDOT 9-03.12(4).

I. Pea Gravel for the rapid infiltration basins shall meet the following requirements:

Aggregate Type	Infiltration Rate (in./hr)	Percent Passing and Sieve Sizes						
		200	100	50	8	4	3/8	1/2
Pea Gravel	5,000	0-1		0-5	0-10		80-100	100

J. Filter Sand for the rapid infiltration basins shall meet the following requirements:

		Percent Passing and Sieve Sizes

Aggregate Type	Infiltration Rate (in./hr)	200	100	50	8	4	3/8	1/2
Filter Sand	50	0-2	0-7	0-18	70-90	90-100	100	100

K. Foundation material to replace unsuitable material excavated from the bottom of trenches shall meet the requirements of WSDOT 9-03.17.

L. Aggregate for trench backfill shall meet the requirements of WSDOT 9-03.19 (Bank Run Gravel for Trench Backfill) or meet the requirements of select soils per Paragraph 2.1.B of this section.

M. Drain Rock for Dry Wells shall meet the requirements of WSDOT 9.03.12(5).

N. Controlled Density Fill shall meet the requirements of WSDOT 2-09.3(1)E.

O. Geotextile shall meet the requirements of WSDOT 9-33 “High Survivability” “Drainage Class C.”

2.02 UTILITY WARNING TAPE

A. Shall be APWA color-coded detectable underground marking tape. Tape shall be 6-inch-wide plastic-encased aluminum foil tape capable of being located by a metal detector. Message and coding shall be per APWA Standards and shall be as follows:

Message	Color Coding
CAUTION: ELECTRIC LINE BURIED BELOW	Red
CAUTION: WATER LINE BURIED BELOW	Blue
CAUTION: SEWER LINE BURIED BELOW	Green
CAUTION: TELEPHONE LINE BURIED BELOW	Orange
CAUTION: CATV LINE BURIED BELOW	Orange

B. Provide new continuous warning tape for each type of utility installed. Also provide new replacement warning tape for utilities encountered and replace any/all damaged sections of existing warning tape for those utilities. Should no warning tape exist on encountered utilities, provide a section of new tape at the crossing.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, freezing temperatures or frost, and other hazards created by earthwork operations. Provide protective insulating materials as necessary.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding area.

D. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

3.02 EROSION CONTROL

A. Erosion control measures shall be installed and maintained by the Contractor per Section 312500 – Erosion and Sedimentation Controls.

3.03 GENERAL PLANNING AND COMPLIANCE

A. Plan and coordinate all construction to reduce sediment and subsequent pollution. The Contractor shall employ all means as may be required to ensure that silts and construction debris do not migrate from the construction site limits. Failure to halt the migration of construction debris, mud, silts, and related pollutants to outside of the construction limits, shall be cause for suspension of work until pollution control devices are remade, repaired, lengthened or strengthened as required to properly manage the site discharge.

3.04 EARTHWORK

A. Control excavation for site work operations. Stockpile the material removed from the excavation in areas where a minimum of sediment will be generated and where other damage will not result from the piled earth. Stockpile topsoil and forest duff material separately. Protect and maintain drainage ways at all times. Do not pile soil in drainage ways.

B. Protect all stockpiled soil materials from erosion through the use of Visqueen sheeting or similar temporary measures.

C. Any area stripped of vegetation, where no further work is anticipated for a period of 14 calendar days, shall be immediately stabilized with an approved erosion control method such as seeding, mulching, netting, erosion control blankets, etc.

D. All disturbed areas shall be promptly and thoroughly stabilized against erosion during periods of wet weather, particularly when work is not being performed at the site.

3.05 STABILIZATION

A. Stabilize all slopes, channels, ditches or any disturbed area as soon as possible after the final grade or final earthmoving has been completed. Upon completion of the project, stabilize all areas that were disturbed by the project to prevent accelerated erosion. Maintain any erosion and sedimentation control facility required or necessary to protect areas from erosion during the

stabilization period. Provide Visqueen sheeting and/or erosion control matting, properly anchored, to control erosion of cut or fill slopes and related construction.

3.06 MAINTENANCE

A. Maintain the erosion control measures and facilities in proper condition such that they will individually and collectively perform the functions for which they were designed. In order to insure the effectiveness and proper maintenance of the measures and facilities, the Contractor shall make periodic inspections at sufficiently frequent intervals to detect any impairment of the structural stability, adequate capacity, or requisites of the herein approved measures and facilities that might impair their effectiveness. The Owner will inspect all erosion control measures on each site inspection visit to verify that all facilities are being properly maintained and are functioning as intended. The Contractor shall take immediate steps to correct any deficiencies found to exist.

3.07 EXCAVATION

A. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Excavate for structures, pavements, and walks to the indicated elevations and dimensions. Extend excavations for placing and removing concrete formwork, for installing services and other construction, and for inspections. Trim bottoms to required lines and grades to leave solid base to receive other work.

C. Excavate utility trenches to indicated gradients, lines, depths, and invert elevations of uniform widths as shown on the Drawings to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit.

1. During trench excavation, continuously separate satisfactory excavated material from unsuitable material and debris. Material which is deemed satisfactory for trench backfill shall be stockpiled in a neat and orderly fashion set back from the top of trench sufficiently to avoid overloading of trench sidewalls and to prevent caving in of sidewalls. Only stockpile excavated materials inside of established and staked trenching corridor/clearing limits so as to avoid unnecessary damage to adjacent vegetation outside the limits.
2. Excavate utility trenches to the widths and depths necessary to accommodate specified numbers and types of utilities and specific utility burial depths for each utility. See the Plans for appropriate utility trench details for each specific location, utility type, and/or combination thereof.

D. Proof roll subgrades, before filling or placing aggregate courses, with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades or the rapid infiltration basin areas.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

F. Stockpile borrow materials and satisfactory soil materials, without intermixing, in shaped, graded, drained, and covered stockpiles. Stockpile soil materials away from edge of excavations and outside drip line of remaining trees, when possible.

G. The Pea Gravel and Filter Sand shall be stored in a manner to prevent contamination by native soil (e.g., aggregate may be stored in containers or on an asphalt pad prior to placement within the rapid infiltration basins.

H. Stability of Excavations:

1. Comply with all applicable local, state, and federal excavation safety laws; codes; regulations; and/or ordinances at all times.
2. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
3. Maintain sides of slopes of excavations in safe condition until completion of backfilling.

I. Shoring and Bracing:

1. Provide materials for shoring and bracing of trenches and excavations as required for safe completion of the work and to comply with applicable safety laws such as trench boxes, sheet piling, uprights, stringers, and cross braces, in good serviceable condition.
2. Contractor is solely responsible for proper design of shoring and bracing as required to comply with all laws, codes and authorities having jurisdiction. As a minimum, the following requirements shall be met:

    a. RCW Chapter 49.17 WISHA.
    b. WAC 296-155 Safety Standards for Construction Work.
    c. WAC 296-155-650.
    d. RCW Chapter 39.04.180 Public Works/Trench Excavations-Safety Systems Required.
    e. OSHA Technical Manual – Section V: Chapter 2.

3. Protect all utility trench and structural excavation in excess of 4 feet in depth with a safety system conforming to the referenced requirements.
4. Maintain shoring and bracing in excavation regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

3.08 CONTROL OF WATER

A. Keep excavation free of water. Dewater as necessary.

B. Direct drainage away from excavation.

C. Grade top perimeter of excavation to prevent surface water from draining into the excavation.

D. Direct runoff and water from dewatering into temporary erosion and sedimentation control facilities. Provide additional filtration necessary to prevent silt-laden water from leaving the site.

3.09 BACKFILLS AND FILLS

A. Utility Trench Backfill: Place, compact, and shape bedding course to provide continuous support for pipes and conduits over rock and other unyielding bearing surfaces and to fill unauthorized excavations.

B. Fill: Place and compact fill material in layers to required elevations.

C. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

D. Compaction: Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

E. Compaction Levels:

1. Subgrade to 90 percent per ASTM D1557 to a depth of 1 foot below subgrade level.
2. Fills under pavement, structures, and sidewalks:

    a. Within 3 feet of finish grade – 95 percent per ASTM D1557.
    b. Below 3 feet of finish grade – 90 percent per ASTM D1557.

3. Fills in landscaped areas: 90 percent per ASTM D1557.

F. Grading: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated. Grade lawns, walks, and unpaved subgrades to tolerances of plus or minus 1 inch and pavements, and areas within building lines to plus or minus 1/2 inch.

G. Base Courses: Under pavements and walks, place base course on prepared subgrade. Compact to required grades, lines, cross sections, and thickness.

H. Rapid Infiltration Basin Subgrade and Backfill: Care shall be taken to avoid compaction of the subgrade within the rapid infiltration basins and prevent migration of fine grained material into the rapid infiltration basins. Specifically, no equipment shall be driven through the bottom of the rapid infiltration basins and no stormwater may be allowed to discharge into the rapid infiltration basins.

3.10 UTILITY BEDDING

A. Bed all utilities (i.e., water, sewer, electrical cables and conduit, telephone cables) in specified compacted pipe zone bedding over their entire lengths as indicated in the Plans. Minimum bedding thickness and limits shall be as specified in the Plans.

B. Bed all culverts and storm drainage piping in specified compacted gravel backfill bedding as indicated in the Plans. Minimum bedding thickness and limits shall be as specified in the Plans.

C. Bed all tanks, vaults, catch basins, and similar utility structures on a layer of specified compacted foundation gravel as indicated in the Plans. Minimum bedding thickness and limits shall be as specified in the Plans.

D. Shape initial layer of compacted bedding to snugly fit pipe joints and to firmly and uniformly support pipe and joints as well as hold and maintain entire runs of pipe at appropriate slopes and grades. Place remaining bedding in equal lifts along each side of the utility/piping and compact into place. Avoid distortion of the pipe/utility section due to improper compaction methods or lack of proper bedding and compaction. Carry compacted bedding material to specified cover depth over each utility.

E. Completed utility piping found to be out of grade or alignment because of poor and/or improper bedding, compaction, and backfilling methods will be required to be removed and completely redone at no additional cost.

F. Compact all bedding to maximum possible relative density for the particular bedding material in use. Use hand operated mechanical vibrators or tampers for compaction of all utility bedding material. Lack of appropriate compaction for bedding will be cause for rejection of the work.

G. Leave all joints of waterlines exposed for inspection purposes during the required system pressure testing specified elsewhere. Do not cover any joints or valves with bedding or backfill until all pressure testing has been completed and accepted.

H. Leave all electrical work uncovered as required for inspection purposes by the local electrical inspector. Also, do not cover electrical work until the Owner has inspected and approved all work.

I. Leave all sewer and drainage utilities uncovered for inspection purposes by the Owner and also the county public works inspector should he require it. These utilities may be partially bedded prior to such inspections, but the piping shall be left visible for inspection purposes. Bedding and compaction of these items may be completed once all inspections and pressure tests have been satisfactorily completed and approved by the Owner.

J. The Owner may require the Contractor to excavate and expose any or all utilities, portions of utilities, pipe joints, valves, etc., which may have been covered prior to proper testing, inspections and approvals, at no additional cost. The Contractor shall properly rebed and re-backfill all such items at no additional cost.

3.11 UTILITY BACKFILLING

A. After bedding and placement of utilities, and the Owner has inspected and approved of all installations, carefully place specified final backfill materials in trenches in uniform lifts and compact each lift into place using mechanical tampers or vibrators. Each backfill lift shall be uniform in depth and not more than 6 inches in loose thickness. Simply dozing the backfill into and over the trenches and then track, wheel, or bucket compacting into place will NOT be accepted. Any/all backfill material either observed or suspected of being placed and compacted in this, or any other, inappropriate fashion will be rejected and be required to be completely redone at no cost to the State.

B. When placing backfill material at road or parking lot crossings, compact all lifts of backfill aggregate to not less than 95% of maximum density using mechanical tampers. Carry the final lift

of backfill to subgrade elevation and then roller compact the final lift to 95 pecent of maximum density. Use only the specified crushed aggregate as trench backfill at all road and parking lot crossings.

C. Provide any/all water necessary for achieving proper compaction of trench backfill. Add water uniformly and only in proper amounts necessary to achieve optimum moisture content for proper compaction. Flooding of trench backfill to promote settlement and compaction will NOT be accepted and work performed in this fashion will be rejected and be required to be redone.

D. During placement of trench backfill, install specified utility marking/warning tape(s) and toning wire directly over each utility and at the depths indicated on the Plans. Marking tape(s) and toning wire shall run continuously from end to end of each utility.

E. Trench backfill shall only be of the material(s) specified. Do not bury or hide sod, rocks, waste, pavement chunks, woody debris, or any other unsuitable materials in trench backfills. Any/all such materials observed, or suspected, of being used as trench backfill will be required to be removed and disposed of properly and then replaced with appropriate material. Should the Owner observe any such materials buried in any trench backfill or portions thereof, it will be cause for complete rejection of all completed backfill.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner shall engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Allow testing agency to test and inspect subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.13 PROTECTION AND DISPOSAL

A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction.

C. Where settling occurs before project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

D. Disposal of Excess Suitable Material: Shall be hauled and deposited in areas as shown on the Plans.

E. Disposal of Excess Unsuitable Material and Debris: Remove all unsuitable material, debris, trash and waste, and dispose of it outside the park at a Contractor provided disposal site in strict accordance with all local codes, ordinances and regulations.

END OF SECTION

SECTION 312100 – BORROW PIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the work necessary to excavate and grade Common Borrow A for Phase 3A Improvements from the Owner furnished Borrow Pit.

B. Testing for Metals and cPAHs during the Common Borrow A excavation process.

1.2 RELATED SECTIONS

A. Section 311100 – Clearing and Grubbing

B. Section 312000 – Earth Moving

1.3 QUALITY ASSURANCE

A. Owner may conduct Gradation testing of the Borrow Pit's Working Face at Owner's discretion and may direct Contractor to modify excavation operations to a different Working Face within the Borrow Pit.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor is responsible for assessing Haul Road and Borrow Pit site conditions prior to bidding.

3.2 PREPARATION

A. Clearing and Grubbing shall be implemented for the Borrow Pit. Rootwads shall be processed into Wood Chips and not remain on the surface and/or buried in the Borrow Pit. Any Boulders encountered shall be safely and securely stored in the Borrow Pit in a location defined by the Owner. "Securely stored" means the Boulders shall be placed in a manner where all the Boulders shall exhibit zero movement under human pressure.

B. The Haul Route to the borrow pit will be used by contractors not working on Phase 3A. To accommodate truck traffic and limit conflict, the phase 3A contractor shall construct pull outs

along a segment of the Haul Route as directed within the projects drawings. Locations shall be staked by the contractor and approved by the project Landscape Architect prior to any clearing, grubbing, excavation or Grading. The construction of these pull outs shall be coordinated with the Landfill Cleanup contractor, to limit conflict and impact of their work. Contact information of the Landfill Cleanup contractor will be shared with the selected phase 3A contractor at the preconstruction conference.

C. All Phase 3A Traffic from the borrow pit traveling west on the Haul Route shall yield to traffic traveling east on the Haul Route by utilizing the constructed Haul Route Pull Outs.

3.3 EXCAVATION & GRADING

A. Contractor shall excavate the Borrow Pit's Working Face in the area shown on the Plans only unless notified otherwise by the Owner.

B. Contractor shall take professional care to monitor the consistency of Common Borrow A. Contractor shall visually assure the material excavated meets Gravel with sand (GP) gradation (Common Borrow A). Contractor Shall notify Owner should Working Face material change consistency.

C. At the end of every working day and at Final Completion, Contractor shall grade the Working Face so all slopes are at the angle of response and safe.

3.4 METALS AND CARCINOGENIC AROMATIC HYDROCARBONS (cPAHs) TESTING

A. The Owner has found the Borrow Pit contains various levels of lead (historical recreational shooting w/clay pigeons) and has conducted a preliminary testing assessment which can be found in the Appendix. Owner will provide lead testing per Environmental Protection Agency Method 6020B and carcinogenic aromatic hydrocarbons (cPAHs) per Environmental Protection Agency Method 8270 in the frequency shown in the table below. Owner will take a minimum of two four-ounce samples to the testing lab for each testing occurrence. Lead and cPAHs samples selected for testing shall be taken from the processed Common Borrow A material and submitted under chain of custody to an accredited laboratory for analysis. Testing/analytical results shall be copied from the selected laboratory to Contractor and Owner simultaneously. Detected Lead Concentrations range shall be categorized as follows: <50 mg/kg (suitable for commercial fill above water table); >50-220 mg/kg (suitable for reuse as paving base material and road construction); and >220 (not suitable for reuse within the Park). The detected cPAHs concentrations range shall be categorized as follows: 0.05 - 0.1 mg/kg (suitable for commercial fill above water table); >0.1 - 2 (suitable for reuse as paving base material and road construction); and >2 (not suitable for reuse as fill within the Park). Use/reuse of the pit material should be based on parameters detailed in Table 12.1 and 12.2 Washington State Department of Ecology Pub. No. 10-09-057, Guidance for the Remediation of Petroleum Contaminated Sites, revised June 2016.

Cubic Yards of Soil	**Number of Samples**
0-3000	6
3001-6000	5

6001+	2

B. Owner may conduct additional testing for copper, vanadium and zinc at the same frequency to verify that lead results can be used as a proxy indicator for these additional metals contaminants. Samples selected for testing shall be taken from the processed Common Borrow A material and submitted under chain of custody to an accredited laboratory for analysis. Testing/analytical results shall be copied from the selected laboratory to Contractor and Owner simultaneously.

C. Should any of the test results exceed the 220 mg/kg lead level then the owner will immediately notify the contractor who shall cease operations. The Owner and Contractor will immediately develop a strategy to continue operations.

3.5 SECURITY AND PROTECTION

A. Contractor is responsible for providing Temporary Security fencing/barriers at the Mashel Prairie Road and Borrow Pit Haul Route intersection. Temporary Security Fencing shall span the opening of the Haul Route to assure unauthorized access to the Borrow Pit Haul Route.

B. Contractor shall monitor the condition of the Borrow Pit Haul Route throughout the performance period. Contractor shall place the minimum amount of Common Borrow A to provide Haul Route in a safe, drivable, and workable condition.

END OF SECTION

SECTION 312319 – DEWATERING (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 WORK IN THIS SECTION

A. This section specifies the definition, responsibilities, design requirements, and execution of trench dewatering.

B. Dewatering systems include, but are not limited to, any dewatering wells, well points, recharge or injection wells, pumps, vacuum lines, discharge lines, trash pumps, temporary water storage tanks, and other equipment, appurtenances, and related earthwork necessary to perform dewatering.

C. This section does not specify the control, removal, or disposal of surface water runoff or water generated by construction activities other than trench dewatering.

D. The Contractor is solely responsible for the proper design, installation, operation, maintenance, performance, failure, or damage resulting from any component of the trench dewatering system.

1.02 SUBMITTALS

A. Trench dewatering plan including water disposal method.

B. Dewatering Pump descriptions that include:

1. Manufacturer.
2. Capacity.
3. Rating curve.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Keep excavations free of water during construction.

B. Provide and operate the machinery and equipment necessary to keep excavations free of water.

C. Dewater and dispose of the water so as not to cause injury to public, private, or other property, or to cause a nuisance or a hazard to the public or the environment.

D. Dispose of all water in a manner that complies with all permitting and regulatory requirements. Contractor shall treat trench dewatering water such that negligible turbidity is observed in ultimate discharge location. Contractor maybe required to store trench dewatering water in temporary storage tanks (Example; Baker Tanks) to allow for settling of suspended solids.

E. Provide on-site sufficient pumping equipment and machinery in good working condition for emergencies, including power outages and flooding.

F. Provide on-site workers needed for the operation of the dewatering system.

G. Maintain electric power service connections to the dewatering system.

H. Prevent the removal of native soils during dewatering.

I. Control surface water runoff and prevent the entry or collection of surface water in excavations.

END OF SECTION

SECTION 312500 – EROSION AND SEDIMENT CONTROLS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 EROSION CONTROL

A. Comply with the specific requirements of Pierce County codes and ordinances pertaining to construction practices and temporary erosion control and sedimentation control measures and methods as they apply to work performed under this Contract.

B. Comply with all temporary erosion control procedures and requirements outlined and/or specified on the county-approved plans, specifications, and final construction permit(s).

C. Best Management Practices (BMPs) shall be in accordance with the *Stormwater Management Manual for Western Washington,* July 2024, Washington State Department of Ecology, and the *Stormwater Management and Site Development Manual*, July 2021, Pierce County Department of Public Works, and/or as specified by the Engineer.

PART 2 – PRODUCTS

2.01 EROSION CONTROL MATERIALS

A. Quarry Spalls: To be in accordance with WSDOT Standard Specification Section 9-13.6. An 8inch-maximum size, 3/4-inch-minimum (10 percent passing) size.

B. Wattles: To be in accordance with WSDOT Standard Specifications Section 9-14.5(5).

C. Hydroseeding: To be in accordance with Section 329000 – Planting.

PART 3 – EXECUTION

3.01 PREPARATION

A. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. Erosion control measures shall be in place prior to any work that will disturb soil in the work site.

3.02 TEMPORARY EROSION CONTROL

A. Erosion control measures shall be installed and maintained by the Contractor per Section 015000 – Temporary Facilities and Controls.

3.03 STABILIZATION

A. Stabilize all slopes, channels, ditches, or any disturbed area as soon as possible after the final grade or final earthmoving has been completed. Upon completion of the project, stabilize all areas that were disturbed by the project to prevent accelerated erosion. Maintain any erosion and sedimentation control facility required or necessary to protect areas from erosion during the stabilization period. Provide Visqueen sheeting and/or erosion control matting, properly anchored, to control erosion of cut or fill slopes and related construction.

B. Install erosion control matting as shown on the drawings and as needed to provide protection of seeding in high stormwater volume areas. Submit any proposed erosion control matting installation to the Engineer prior to installation.

C. Protect all stockpiled soil materials from erosion through the use of Visqueen sheeting or similar temporary measures.

D. Any area stripped of vegetation, where no further work is anticipated for a period of at least 14 calendar days, shall be immediately stabilized with an approved erosion control method such as seeding, mulching, netting, erosion control blankets, etc.

E. All disturbed areas shall be promptly and thoroughly stabilized against erosion during periods of wet weather.

3.04 MAINTENANCE

A. Maintain the erosion control measures and facilities in proper condition such that they will individually and collectively perform the functions for which they were designed. In order to ensure the effectiveness and proper maintenance of the measures and facilities, the Contractor shall make periodic inspections at sufficiently frequent intervals to detect any impairment of the structural stability, adequate capacity, or requisites of the herein approved measures and facilities that might impair their effectiveness. The Engineer will inspect all erosion control measures on each site inspection visit to verify that all facilities are being properly maintained and are functioning as intended. The Contractor shall take immediate steps to correct any deficiencies found to exist.

END OF SECTION

SECTION 321200 – FLEXIBLE PAVING (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Work includes all labor, materials, equipment, and services necessary for supply and placement of asphalt concrete pavement.

1.02 SUBMITTALS

A. Mix design.

1.03 STANDARDS

A. *Standard Specifications for Road, Bridge and Municipal Construction,* WSDOT, 2023 edition, hereinafter referred to as the "Standard Specifications."

PART 2 – PRODUCTS

2.01 HOT MIX ASPHALT PAVEMENT

A. Hot mix asphalt (HMA) for paving shall be "HMA Class 0.5 inch, PG 58-22 in accordance with WSDOT Standard Specifications Section 5-04. Asphalt content range shall be between 5 percent and 6 percent of total mix weight.

2.02 BINDER/TACK COAT

A. Binder or tack coat shall conform to the requirements of Section 5-04 of the Standard Specifications.

PART 3 – EXECUTION

3.01 SUBGRADE PREPARATION

A. Place and compact specified crushed aggregate base under all areas to receive HMA to the depths, lines, and grades specified on the Drawings and as required to match existing roadway construction.

3.02 PRIMER/TACK COAT

A. Apply primer and tack coat in accordance with manufacturer's instructions.

B. Use clean sand to blot excess primer.

3.03 PLACING HOT MIX ASPHALT

A. Place asphalt within 24 hours of applying primer and tack coat in accordance with Section 5-04 of the Standard Specifications.

B. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

C. Develop rolling with consecutive passes to achieve an even and smooth finish, without roller marks. Finish grade of asphalt patches shall match existing adjacent pavement exactly, without bumps, depressions, or other irregularities.

D. After pavement is in place, seal all joints.

3.04 INSPECTION AND ACCEPTANCE

A. The Engineer will inspect all HMA patching work. Asphalt paving that exhibits incorrect grades, excessive unevenness, depressions, humps, or joint misalignments will be rejected by the Engineer and shall be completely replaced with new pavement at no additional cost to the Owner.

3.05 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for a minimum of 2 days.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Paving and Surfacing for this work includes:

1. Hot Mix Asphalt (HMA) Pavement Type A and B for driveway and parking paving.

1.2 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Section 312000 - Earth Moving
2. Section 323116 - Security Cantilevered Slide Gate
3. Appendix A - Geotechnical Report

1.3 QUALITY ASSURANCE

A. Submittals:

1. Submit certificates from mixing plants stating that all materials supplied conform to requirements set forth by these specifications.
2. Truck load tickets for asphalt concrete at the time of delivery.
3. Technical data of asphalt for tack coat.
4. A 5-gallon sample of asphalt concrete aggregates.
5. Soil Sterilant

B. Samples:

Where test samples have been taken from the asphalt concrete, new material shall be placed and compacted to conform with the surrounding area at no additional expense to the Owner.

C. Protection:

Provide adequate protection from damage for all paved areas including graffiti, staining and spillage, until final project acceptance. Replace all damaged work.

D. Qualifications of Asphalt Concrete Supplier per WSDOTSS 5-04.

E. Construction shall conform to the details, cross sections dimensions, and grades specified. All elevations and grades stakes shall be established to provide a smooth and even surface in compliance with WSDOTSS 5-04.3(13). The Contractor shall immediately notify Owner of any discrepancy of line and level.

1.4 WARRANTY

A. Any settlement in asphalt paved areas which occur within the one (1) year Warranty period shall be considered to be caused by improper compaction methods and shall be corrected within thirty (30) days of notice at no cost to the Owner. Repair damage caused by settlement at no cost to the Owner.

1.5 BARRIERS, SAFETY GUARDS AND WARNING LIGHTS

A. Provide for public, visitors', workers' protection, as required by the Washington State Department of Labor and Industries.

PART 2 - PRODUCTS

2.1 CRUSHED SURFACING

A. Base and Top Course, Crushed Surfacing shall conform to WSDOTSS 9.03.9(3). See Section 31 20 00 Earth Moving.

B. HMA Surfacing Type A and B

1. HMA Concrete with Aggregate Grading Requirements of 1/2", as per Section 9-03.8(6) of the WSDOTSS for Roadway and Parking. Asphalt PG58-22 shall conform to Section 9-02.1(4) of the WSDOTSS. Asphalt percentage of total mixture shall be 5.0 to 7.5 percent.

2.2 TACK COAT & BLENDING SAND

A. Tack coat shall conform to the requirements of Section 5-02.3(3) of the WSDOTSS. Blending Sand shall comply with WSDOTSS 9-03.8(4).

2.3 SOIL STERILANT

A. Soil Sterilant shall be a non-organic water soluble herbicide "Polyborchlorate by U. S. Borax Company, Caseron, or approved equal.

2.4 HOT POURED SEALANT

A. Hot poured sealant for bituminous pavement shall conform to WSDOTSS Section 9-04.2(1)A2 Hot Poured Sealant for Bituminous Pavement and the most recent amendments to Section 9-04.

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrades: Establish subgrades to a neat, smooth surface of uniform slope per Section 31 20 00 Earth Moving and appropriate details. Subgrades shall be inspected and approved as specified prior to any paving or surfacing. Compact the subgrade to a depth of six (6) inches and two (2) feet beyond all areas to receive asphalt paving.

B. Provide Crushed Surfacing to compacted depths as shown in Plans and Section 312000 Earth Moving.

C. Coordinate the installation of the Slide Gate Safety Loops to be installed before the asphalt paving. Saw cutting of the asphalt pavement is not permitted for the installation of the slide gate safety loops.

3.2 ASPHALT PAVING (HMA SURFACING TYPE A & B)

A. Asphalt pavement shall be constructed in conformance with Section 5-04.3 of the WSDOTSS, except as modified herein.

B. Install with crowning or pitched surfaces as indicated on the Plans, to provide positive drainage. The final result to be an unyielding course, free from irregularities, with a smooth, firm, tight, even surface, true to grade, line and cross section indicated. Maximum variation in the surface of the surface course 1/8" in 8' in any direction. Provide for compacted depth as indicated on the Plans.

C. Compaction: As per paragraph 5-04.3(10) of the WSDOTSS.

D. Maintenance: Maintain surface until final acceptance. If ruts, soft spots, or other damage occurs, repair surface at no additional cost to the Owner.

E. Defective Work: Remove, replace defective surfaces and those which do not drain properly.

F. Outside edges shall straight with a uniform horizontal and vertical alignment and shall be hand tooled tamped firm at a 45-degree angle.

G. Manual paving shall be of uniform grade, slope and appearance with a smooth transition to machine laid paving.

H. When meeting and matching with existing asphalt paving, Contractor shall sawcut the existing pavement in a straight line and remove asphalt and apply tack coat and dry Blending Sand.

I. Adjustment of all castings, such as manhole frames and covers, catch basin frame and covers of various types of gate valves, etc. and concrete footings, slabs/curbs shall conform to the exact finished grade of new asphalt pavement. After such castings have been set to final grade, they shall not be disturbed by the rolling operations. The course shall be compacted thoroughly around the perimeter of the castings and concrete by rolling with sufficient number of crisscross passes around the castings and concrete with the wheel just touching the casting and concrete but not shaving or rolling over the casting and concrete.

J. All manhole covers, inlet covers, other similar cast iron items, and concrete located in the paved area shall be left clean of all asphalt material.

K. Ensure that each roller pass overlaps previous passes to ensure a smooth surface free of roller marks.

3.3 DEFECTIVE WORK

A. All cost involved with correcting repairing defective work shall be borne by Contractor with no extension in the Contract period.

B. The Contractor shall be responsible for maintaining all asphalt paving until Final Acceptance of the project.

3.4 PROTECTION

A. Execute all paving in an orderly and careful manner with due consideration for any existing and new improvements. Barricade and cover as necessary to protect pedestrian, workman, and adjacent properties.

3.5 CLEAN UP

A. Clean up entire area of all excess materials, debris, etc., and leave project in a neat, orderly condition.

END OF SECTION

SECTION 321500 – CRUSHED ROCK SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes providing Crushed Rock Surfacing A for trails and pads, and Gravel Backfill for Drains for pipe outlets and landscaping.

1.3 RELATED WORK

A. Coordinate related work and requirements specified in other parts of the Contract Documents, including but not limited to the following:

1. Section 311100 – Clearing and Grubbing
2. Section 312000 – Earth Moving

1.4 REFERENCE STANDARDS

A. Standard Specifications: All construction shall be in accordance with the "Latest Standard Specification for Road, Bridge, and Municipal Construction," prepared by the Washington State Department of Transportation (WSDOT) and the American Public Works Association, Washington State Chapter, most recent published edition at time of Bid.

1.5 SUBMITTALS

A. Submit sieve analysis from a certified testing laboratory showing conformance to the sieve sizes listed and sample of crushed rock material (1 gallon).

B. Submit composite data sheets on sterilant.

PART 2 - PRODUCTS

2.1 CRUSHED SURFACING BASE COURSE (CSBC)

A. Crushed Surfacing Base Course: One and one-quarter inch (1 ¼") minus base course shall meet the requirements as outlined in Section 9.03.9(3) Crushed Surfacing, of the Standard Specifications.

B. Compacted Depth: As shown in Drawings.

2.2 CRUSHED SURFACING TOP COURSE (CSTC)

A. Crushed Surfacing Top Course: Three quarter inch (3/4") minus top course shall meet the requirements as outlined in Section 9.03.9(3) Crushed Surfacing, of the Standard Specifications.

2.3 CRUSHED ROCK SURFACING A

A. Crushed Rock Surfacing A: Three eighths inch (3/8") minus crushed rock mix shall meet the requirements as outlined in Section 9.03.9(3) Crushed Surfacing, of the Standard Specifications, but shall meet the following gradation:

Sieve Size	% Passing
3/8"	100
1/4"	90-100
#10	45-50
#40	15-25
#200	8-12

2.4 GEOTEXTILE

A. X-series 500X as manufactured by Mirafi. Staples as specified by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare subgrade in conformance with Sections in Division 31 – Earthwork and in accordance with Section 2-06.3(1) Subgrade for Surfacing, of the Standard Specifications. Verify that the subgrade is completed to correct line and grade before installation of materials.

B. Install Geotextile as shown on Plans. Staples to be installed as specified by manufacturer. Overlapping of Geotextile material shall be as specified by manufacturer.

C. Install CSBC to the required depths as shown on Plans measured after compaction, in accordance with Section 4-04 of the Standard Specifications.

D. Install CSTC to the required depths as shown on Plans measured after compaction, in accordance with Section 4-04 of the Standard Specifications.

E. Install Crushed Rock Surfacing A to depth as described on Plans measured after compaction in accordance with Section 4-04. Compact to a firm, smooth finish.

3.2 CRUSHED ROCK SURFACING A

A. Install Crushed Rock Surfacing A to the required depths as shown on Plans measured after compaction, in accordance with Section 4-04 of the Standard Specifications.

B. The final surface shall be an unyielding course, free from surface irregularities, with a smooth, tight, even surface, true to grade, line, and cross section shown on the Drawings and approved in field. Depth shown on Drawings is as measured after compaction. Maximum variation in any direction in the finish surface shall be a maximum of one half (1/2) inch in ten (10) feet.

END OF SECTION

SECTION 321713 – WHEEL STOPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wheel Stops for parking areas.

1.2 RELATED SECTIONS

A. Earth Moving 312000

B. Asphalt Paving 321216

1.3 SUBMITTALS

A. Submit under provisions of Section 013300 – Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company with a minimum of two years documented experience in the installation of similar Work.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Owner.
2. Do not proceed with remaining work until workmanship is approved by Owner.
3. Refinish mock-up area as required to produce acceptable work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable manufacturer:

1. Shope Concrete, which is located in: 1618 E. Main Ave, Puyallup, WA 98372-3142; Phone: (253) 848-1551 (800) 422-7560; Website: www.shopeconcrete.com
2. Puget Sound Precast, which is located in: 2206 121st St, East Tacoma, WA 984455; Phone: (253) 531-2656; Website: www.psprecast.com

2.2 MATERIALS

A. Wheel Stops shall be precast concrete, conforming to the following:

1. Nominal Size: 5 inches high, 9 inches wide, 6 feet long

B. Cement

1. ASTM C150, Portland Type I, normal, white color

C. Concrete Materials

1. ASTM C33 aggregate, water, and sand

D. Reinforcing Steel

1. ASTM A615/A615M, deformed steel bars, unfinished finish, strength and size commensurate with precast unit design

E. Air Entrainment Admixture

1. ASTM C260

F. Concrete mix

1. Minimum 5,000 psi, 28-day strength, air entrained to 5 percent to 7 percent.

G. Use rigid molds, constructed to maintain precast units uniform in shape, size, and finish. Maintain consistent quality during manufacture.

H. Embed reinforcing steel, and drill or sleeve for 2 dowels.

I. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

J. Minor patching in plant is acceptable, providing appearance of units is not impaired.

K. Dowels shall be hot dip galvanized 5/8 inch bolts with mushroom heads, 18 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Owner of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION, GENERAL

A. Install units without damage to shape or finish. Replace or repair damaged units.

B. Install units in alignment with adjacent work.

C. Fasten units in place with 2 dowels per unit.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work includes constructing pavement markings for asphalt roadway and parking surfaces, Electric Vehicle (EV) and ADA striping in accordance with the Plans, WSDOT Standard Plans, and MUTCD.

1.2 RELATED SECTIONS

A. Section 321216 – Asphalt Paving

1.3 STANDARD SPECIFICATIONS

A. All work to be performed and materials to be used shall be in accordance with the current edition of the Standard Specifications for Road, Bridge, and Municipal Construction, and the current edition of the Standard Plans as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.

B. Contractor shall have one (1) copy of the Standard Specifications and all amendments therein, and applicable WSDOT Standard Plans at job site.

1.4 SUBMITTALS

A. Contractor shall submit manufacturer's material data sheets to the Engineer, at least one (1) week prior to anticipated use.

B. Product Data: Submit manufacturer's product data, installation instructions, standard drawings, and catalog cuts for the following:

1. Painted Pavement Marking Products.
2. Signage Products

PART 2 - PRODUCTS

2.1 PAINT

A. Paint for pavement markings shall comply with WSDOTSS 9-34.1 General and 9-34.2 Paint. The paint shall be factory mixed, quick drying and non-bleeding.

B. PAINT COLOR

1. All pavement marking colors shall be as indicated on the plans. In general, pavement markings shall be white except:

    a. ADA Parking Stall symbols shall be standard blue and white per WSDOT Standard Plan M-24.60-04.

2. EV stall pavement marking colors shall be in accordance with WAC 172-100-150 Electric Vehicle Charging Stations. Colors as indicated in Drawings.

PART 3 - EXECUTION

3.1 PRELIMINARY SPOTTING

A. Paint Pavement markings installation shall conform with Section 8-22.3 of the WSDOTSS, except that the Contractor shall be responsible for all layout and control points, striping shall not deviate more than 1/4-inch in 10 feet from a straight line and striping shall not be more than 1-inch from the specified locations.

B. Paint striping shall only be applied after the pavement has been allowed to cure 14 days minimum, when the pavement is clean and dry and when the temperature is above 50 degrees F. Paint thickness measured above pavement shall be 15 mils. Protect from any traffic for 48 hours.

3.2 SURFACE PREPARATION

A. All surfaces shall be prepared in accordance with WSDOT Section 8-22.3(2) PREPARATION OF ROADWAY SURFACES prior to application of pavement marking.

3.3 TOLERANCES FOR LINES

A. Allowable tolerances for lines are as follows:

1. Length of Line – The longitudinal accumulative error within a 40-foot length of broken line shall not exceed plus or minus 1 inch. The broken line segment shall not be less than 10 feet.
2. Width of Line – The width of the line shall not be less than the specified line width or greater than the specified line width plus ¼ inch.
3. Lane Width – The lane width, which is defined as the lateral width from the edge of pavement to the center of the lane line or between the centers of successive lane lines, shall not vary from the widths shown in the Contract by more than plus or minus 4 inches.
4. Thickness – A thickness tolerance not exceeding plus 10 percent will be allowed for thickness or yield in paint and plastic material application.
5. Parallel Lines – The gap tolerance between parallel lines is plus or minus ½ inch.

B. Two applications of paint will be required to complete all painted pavement markings. The second application of paint shall be squarely on top of the first pass. The time period between paint applications shall meet the requirements of WSDOT Section 8-22.3(3)E.

C. APPLICATION THICKNESS

1. Pavement markings shall be applied to thicknesses meeting the requirements of WSDOT Section 8-22.3(3)F APPLICATION THICKNESS.

3.4 STRIPING

A. Paint striping for parking stalls shall be four inches wide (4”), color; white.

3.5 ACCESSIBLE PARKING SYMBOL

A. Accessible Parking Symbol shall be paint, color: blue. Symbol shall be centered on stall and oriented with the bottom of symbol in line with the end of parking stall stripe. Symbol shall conform to WSDOT M-24.60-04 Standard Plan. Contractor is required to submit paint template for Owner Approval.

B. Handicap Parking striping shall be 4 inches wide: blue.

3.6 ELECTRIC VEHICAL CHARGING SYMBOL

A. E-Charge Symbol shall be in accordance with WAC 172-100-150 and MUTCD federal specifications. Transpo Color-Safe Marking Paint, Bike Lane Green background or equivalent, symbol shall be white.

END OF SECTION

SECTION 323100 – FENCES AND GATES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Furnishing and erecting of chain link fencing and gates.

1.02 REFERENCES

A. ASTM A36/A36M, "Standard Specification for Carbon Structural Steel," 2001.

B. ASTM A123/A123M, "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," 2001a.

C. ASTM A153/A153M, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware," 2001a.

D. ASTM A269-01, "Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service."

E. ASTM A276-00ae1, "Standard Specification for Stainless Steel Bars and Shapes."

F. ASTM A283/A283M, "Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates," 2000.

G. ASTM A307, "Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength," 2000.

H. ASTM A632-01, "Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small Diameter) for General Service."

I. ASTM A666-00, "Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar."

J. AWS A2.4, "Standard Symbols for Welding, Brazing, and Nondestructive Examination," American Welding Society, 1998.

K. AWS D1.1, "Structural Welding Code – Steel," American Welding Society, 2002.

L. SSPC-Paint 15, "Steel Joist Shop Primer," Society for Protective Coatings, 1999 (ed. 2000).

M. SSPC-Paint 20, "Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")," Society for Protective Coatings, 2002.

N. SSPC-SP 2, "Hand Tool Cleaning," Society for Protective Coatings, 1982 (ed. 2000).

1.03 SUBMITTALS

A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

B. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

C. Complete detail drawings and material specifications to be used for the fence, gates, and accessories shall be submitted prior to the start of construction.

PART 2 – PRODUCTS

2.01 MATERIALS – STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing (TS or HSS Sections): Square or rectangular sections, ASTM A500, Grade B (Fy = 46 ksi); round sections, ASTM A500, Grade C (Fy = 46ksi); structural tubing.

C. Plates: ASTM A283.

D. Pipe: ASTM A53, Type E or S (welded or seamless), Grade B (Fy = 35 ksi) or ASTM A501 (Fy = 35 ksi), black and hot-dip galvanized finish, as indicated.

E. Bolts, Nuts, and Washers: ASTM A307, galvanized to ASTM A153/A153M where connecting galvanized components.

F. Welding Materials: AWS D1.1; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I; inorganic, complying with VOC limitations of authorities having jurisdiction.

I. Fencing: Galvanized-coated fabric, with a top rail, bottom tension wire, and three strands of barbed wire mounted on vertical extension arms. The fabric height shall be 6 feet. The upper strand of barbed wire shall be approximately 12 inches above the top of fabric. Posts shall be set in concrete. All steel or malleable iron parts and accessories shall be hot-dipped galvanized or aluminum coated after fabrication. Provide materials per Table 323100-1.

Table 323100-1. Steel Fence Materials

Fabric:	Fence fabric shall meet the requirements of AASHTO M181 using a uniform 2-inch mesh made from 9-gauge wire. Galvanizing shall conform to AASHTO M181, Type 1, Class C (zinc coating), or Type II (aluminum coating).
Posts:	Posts, gate frames, and braces shall be galvanized steel pipe conforming to the requirements of AASHTO M181, Type 1, Grade 1.
Line Posts:	2-3/8-inch OD pipe, 3.65 pounds per foot.
Terminal Posts:	End corner and pull posts. 2-7/8-inch OD pipe, 5.79 pounds per foot.
Gate Posts:	4-inch OD pipe, 9.10 pounds per foot.
Top Rails:	1-5/8-inch OD steel pipe, 2.27 pounds per foot.
Rail Couplings:	Sleeve type, 6 inches long, meeting AASHTO M181.
Bracing:	Pipe braces same as top rail, 3/8-inch-diameter steel rod truss and tightener.
Post Tops:	Pressed steel, malleable iron with pressed steel extension arm meeting AASHTO M181, or one-piece aluminum casting.
Barbed Wire:	Two, 12-1/2-gauge steel wires with four-point barbs spaced at 5-inch intervals conforming to the requirements of ASTM A121, Class 2, or aluminum coated, ASTM A585, Type I.
Stretcher Bars:	Steel bars, 3/16 by 3/4 inch, or equivalent area with a full length of the fabric.
Fabric Ties:	Galvanized wires.
Gate Frames:	Steel tubing, 1-7/8-inch OD, 2.28 pounds per foot.
Tension Wire:	Galvanized or aluminum coated coil spring wire, 7 gauge, AASHTO M181.
Concrete:	Concrete shall be of a commercial grade with a minimum 28-day compressive strength of 2,500 psi or an approved, premixed, sacked concrete.

J. Gates: Shall be swing type, hinged to swing 90 degrees each way from closed to open, complete with frames, latches, stops, keepers, hinges, braces, three strands of barbed wire, and fabric. Gate leaves shall have intermediate members and diagonal truss rods as required for rigid construction and shall be free from sag or twist. When adjacent fence is topped with barbed wire, gates shall be fitted with vertical extension arms or shall have frame end members extended to carry barbed wire. Joints between frame members shall be made by welding or by means of heavy fittings, and shall be rigid and watertight. Gate fabric shall be same as fence fabric and shall be attached to frame ends by stretcher bars, bolt hooks, or other mechanical means.

K. Hinges: Shall be of heavy pattern, with large bearing surfaces, and shall not twist or turn under the action of the gate. Latches shall be plunger bar type, full gate height, and arranged to engage the gate stop and provided with a forked latch. Latches shall be arranged for padlocking, with the padlock accessible from both sides of the gate. Stops shall consist of a roadway plate with anchor set in concrete and arranged to engage the plunger. Keepers shall consist of mechanical devices for securing and supporting the free end of the gates when in the fully open position.

L. Locks: Provide two heavy-duty outdoor-rated locks, 1/4-inch-diameter bar minimum, Master Lock or equal. All locks shall be keyed alike. Provide ten keys to Agency.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler or as shown, whichever is the most restrictive.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FINISHES – STEEL

A. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 ounces per square foot galvanized coating.

B. Galvanizing of Nonstructural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.04 FABRICATION TOLERANCES

A. Squareness: 1/8-inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation from Plane: 1/16 inch in 48 inches.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Fit and shop assemble fencing components in largest practical sizes for delivery onto site.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

1. Do not leave exposed surfaces unprimed for more than 4 hours.

F. Fencing:

1. The installed fence shall conform to the alignment on the drawings. All posts shall be plumb. Unless otherwise indicated on the drawing, posts shall be spaced no more than 10 feet apart. Install corner or slope posts where changes in line or grade exceed a 30-degree deflection. Where necessary, the fence grade shall be adjusted to fit the ground contour by slipping the fence fabric links. Ground surface irregularities shall be graded as required to maintain no more than a 6-inch clearance below the bottom of the fence fabric.
2. Concrete foundation, 36 inches deep, shall be provided for the posts. Concrete foundations shall be circular in horizontal section, not less than 8 inches in diameter for line posts, and with a diameter not less than the post OD, plus 9 inches for terminal and gate posts, except that foundations in bedrock shall be at least 6 inches larger than the outside dimension of the post. Foundations shall extend above the ground surface and shall be crowned approximately 1 inch. Concrete for foundations shall be Class 3000. Each foundation shall be cured for at least 72 hours before further work is done on the post.
3. Top rails and bottom tension wires shall be installed before the fabric. Top rails shall be furnished in at least 18-foot lengths and shall be securely connected to gate and terminal posts. Tension wires shall be installed approximately 6 inches above grade and shall be attached to each post and securely anchored at terminal and gate posts.
4. Fabric shall be attached to the top rail and bottom tension wire at 24-inch centers, and to the line posts at 15-inch centers. Barbed wire shall be fastened to each extension arm by internal clips or external fabric ties. Stretcher bars shall be provided at each gate post and terminal post. Each stretcher bar shall be threaded through the fabric and anchored to the post at 15-inch centers by positive mechanical means.
5. Each gate post and terminal post shall be braced by a horizontal pipe brace and an adjustable truss extending to an adjacent line post. Corner posts shall be braced in both directions.
6. Fabric shall be stretched taut and anchored so that pull of 150 pounds at the middle of a panel will not lift the bottom of the fabric more than 6 inches.
7. Gates shall be installed so that they cannot be removed without disassembly of the hardware. Hardware attachment bolts shall be peened so that removal will be difficult.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, noncumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Chain link fences.
   2. Swing gates.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Conduct meeting at Project site.
   1. Inspect and discuss equipment bases and other preparatory Work specified elsewhere.
   2. Review coordination of interlocked equipment specified in this Section and elsewhere.
   3. Review required testing, inspecting, and certifying procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
      a. Fence **and gate** posts, rails, and fittings.
      b. Chain link fabric, reinforcements, and attachments.
      c. Hardware **and gates**.

B. Shop Drawings: For each type of fence **and gate** assembly.
   1. Include plans, elevations, sections, **gate locations,** post spacing, and attachments to other Work.
   2. Include accessories, hardware, and operational clearances.

C. Samples for Verification: For each type of component **with factory-applied finish**, prepared on Samples of size indicated below:
   1. Polymer-Coated Components: In 6 inch lengths for components and on full-sized units for accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of chain link fence **and gate**.

C. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Sample Warranty: For special warranty.

1.5 REFERENCE STANDARDS

A. ASTM F 567-07 Standard Practice for Installation of Chain Link Fence

B. ASTM F 626-06 Standard Specification for Fence Fittings

C. ASTM F 1043-08 Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework

D. ASTM F 1553-06 Standard Guide for Specifying Chain Link Fence

E. ASTM A653 / A653M - 08 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

F. ASTM A924 / A924M - 08a Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

G. ASTM F 1083-04 Standard Specification for Pipe, Steel, Hot Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

H. CLFMI SFR 2445 Security Fence Recommendations

I. CLFMI CLF TPO211 Tested and Proven Performance of Security Grade Chain Link Fence Systems

J. CLFMI WLG2445 Chain Link Fence Wind Load Guide for the Selection of Line Post and Line Post Spacing

1.6 QUALITY ASSURANCE

A. Manufacturer: Company operating in the United States having U.S. manufacturing facility/facilities specializing in manufacturing chain link fence products with at least 5 years of experience.

B. Fence contractor: Company with demonstrated successful experience installing similar projects and products in accordance with ASTM F567 and have at least 5 years of experience.

C. Tolerances: Current published edition of ASTM specifications tolerances apply. ASTM specification tolerances supersede any conflicting tolerance.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain link fences **and gates** shown on Drawings in relation to existing structures. Verify dimensions by field measurements.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain link fences **and gates** that fail in materials or workmanship within specified warranty period.
   1. Failures include the following:
      a. Failure to comply with performance requirements.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 12 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
   1. Gregory Industries. Canton, OH
   2. Master-Halco, Inc. Kent, WA

3. Merchants Metals. Tacoma, WA
4. Pacific Fence & Wire Co. Clackamas, OR
5. Approved substitution.

B. Source Limitations: Obtain each type of fencing **and gates** from single source from single manufacturer.

2.2 PERFORMANCE CRITERIA

A. Structural Performance: Chain link fence **and gate** frameworks shall withstand design wind loads and stresses for fence heights and under exposure conditions indicated according to ASCE 7.
1. Design Wind Load: **110 mph**.
   a. Minimum Post Size: Determine in accordance with ASTM F1043 for post spacing not to exceed 10 feet for Material Group IA, ASTM F1043, Schedule 40 steel pipe or Group IC, electric-resistance-welded round steel pipe.
   b. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

2.3 CHAIN LINK FENCE FABRIC

A. Provide fabric in 1 piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric:
   a. Wire Diameter: 0.148 inch.
   b. Mesh Size: 2 inches.
   c. Zinc-Coated Fabric: ASTM A392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving (GAW).
3. Selvage:
   a. Fabric Up To 72 Inches: Knuckled at both selvages.
   b. Fabric 72 Inches and Greater: Twisted top and knuckled bottom.

2.4 FENCE FRAMEWORK

A. All Steel Framing shall comply with Table 3, Group IC of ASTM F 1043-08

B. FABRIC BANDS: Fasten fabric to line post, top rail, mid rail, and bottom rail at 15” intervals.

C. POST TOPS: All posts shall be equipped with heavy malleable, cast iron or pressed steel, galvanized and designed as to exclude moisture from post. Post tops shall be rounded with no sharp protrusions. Install tops on line posts which permit passage of top rail. End Post tops shall have a cut and fitted round plate of corresponding thickness of pipe welded flat.

D. END, CORNER AND TERMINAL POSTS: Terminal posts shall be 4-in OD, Group IC Pipe per ASTM F 1043-08 or Schedule 40 pipe galvanized in accordance with A.S.T.M. Designation A-120. Corner posts shall be placed when the line of fence changes direction 20 or more degrees.

E. TERMINAL POST AT TEMPORY FENCE: Terminal posts shall be 4-in. OD, Group IC Pipe per ASTM F 1043-08 or Schedule 40 pipe galvanized in accordance with A.S.T.M. Designation A-120. Located per Plan.

F. PULL POSTS: Pull posts shall be placed not over 1500' apart in each line of fence or when a grade change of more than 20 degrees occurs.

G. INTERMEDIATE (Line) POSTS: Line posts shall be 2.875 in. OD, Group IC Pipe per ASTM F 1043-08 or Schedule 40 pipe galvanized in accordance with A.S.T.M. Designation A-120.

H. TOP AND BOTTOM RAIL: Shall be 1.66" O.D., Group IC Pipe per ASTM F 1043-08 or Schedule 40 pipe galvanized in accordance with A.S.T.M. Designation A-120. Top rail shall form a continuous brace from terminal post to terminal post in each line of fence and shall be securely held in place at the terminals, with bands and cups or a positive receptacle pocket.

I. TERMINAL POST BRACING: Terminal post brace sections shall adjustable steel truss rods. Brace is to be installed between the top rail and the grade line and is to extend from the terminal post to the first adjacent line post. Braces shall be securely attached to the terminal and line posts with bands and cups or at the terminal with a positive receptacle pocket and at the line post with a tamper-proof staple attachment.

2.5 SWING GATES

A. Comply with ASTM F900 for gate posts and **single** swing gate types.
1. Swing Gates: Single leaf.
2. Gate Leaf Width: As indicated.
3. Framework Member Sizes and Strength: Based on gate fabric height **of more than 72 inches**.

B. Pipe and Tubing:
1. Heavy-Industrial-Strength Material: Group IA, ASTM F1043, Schedule 40 steel pipe or Group IC, electric-resistance-welded round steel pipe.
   a. Exterior Size: 1.90 inch OD.
   b. Interior Size: 1.66 inch OD.
2. Zinc-Coated Steel: ASTM F1043 and ASTM F1083; protective coating and finish to match fence framework.
3. Gate Posts: Round tubular steel.
4. Gate Frames and Bracing: Round tubular steel.
5. Gate Frame Size: Space gate frame members no more than 8 ft. apart horizontally or vertically.
6. Frame Corner Construction: Welded.

C. Hinges: Non-lift-off type hinge design fabricated from galvanized malleable iron or heavy gauge pressed steel, structurally capable of supporting gate leaf allowing opening and closing without binding, with 180 deg. inward or outward swing, as indicated on Drawings.

D. Latch: Pressed steel positive locking gate latch requiring 1 padlock for locking both gate leaves, accessible from either side.
1. Galvanize after fabrication.

E. Double Gates: Provide galvanized, lockable drop rod with center gate stop pipe or receiver to secure inactive leaf in closed position. and gate holdbacks.

2.6 ACCESSORIES

A. Chain link fence accessories per ASTM F 626: Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

B. Top Rail and Brace Rail Ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

C. Top Rail Sleeves: 7" (178 mm) long expansion sleeve with spring, allowing for expansion and contraction of top rail.

D. Wire Ties: 9 gauge [0.148" (3.76 mm)] galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge [0.092" (2.324 mm)] for rails and braces. Hog ring ties of 11 gauge for attachment of fabric to tension wire.

E. Brace and Tension (stretcher bar) Bands: Pressed steel.

F. Tension Bars: One-piece lengths equal to 2 inches (50 mm) less than full height of fabric with a minimum cross-section of 3/16" x 3/4" (4.76 mm x 19 mm) or equivalent fiber glass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

G. Tension Wire: Galvanized coated steel wire, 7 gauge, [0.177"(4.5 mm)] diameter wire with tensile strength of 75,000 psi (517 MPa).

H. Truss Rods & Tightener: Steel rods with minimum diameter of 5/16" (7.9 mm). Capable of withstanding a tension of minimum 2,000 lbs.

I. Nuts and bolts are galvanized.

2.7 COATING

A. Chain Link Fencing Fabric: Hot dipped galvanized.

B. Steel Fence Framing: Standard weight schedule 40; minimum yield strength of 30,000 psi (205 MPa); sizes as indicated. Hot-dipped galvanized with minimum average 1.8 oz/ft² (550 g/m²) of coated surface area (0.30 mil).

C. Fencing Accessories: Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

2.8 SETTING MATERIALS

A. Concrete: Minimum 28-day compressive strength of 4000 psi (20 MPa).

B. Hand mixing of concrete will be permitted on batches under one (1) cubic yard. All batches exceeding this volume shall be machine mixed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement Work, and other conditions affecting performance of Work.
   1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines**, gates,** and terminal posts.
   1. Do not exceed intervals of 500 feet or line of sight between stakes.

2. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F 567 and manufacturer's instructions.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 20° or more.

C. Locate Terminal Post at Temporary Fence at the transition to temporary security fencing, locate per plan.

D. Check each post for vertical and top alignment and maintain in position during placement and finishing operations.

E. Tension Wire: Provide a continuous tension wire at the mid-point of fencing where shown on Plans. Install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 11 gauge [0.0985" hog rings 24" (610 mm) on center.

F. Bottom Rail: Install 1.66 in. OD bottom rails continuous, where shown on Plans. Set bottom edge of rail at 3 in. clear of finish grade.

G. Post Spacing: Posts shall be evenly spaced in the line of fence on a maximum of 9-foot center unless otherwise noted.

H. Concrete: Concrete for post foundations shall be Class 4000 (4000 psi) concrete mixture.

I. Locate fence posts and install fence fabric in a manner so that the clearance between the twisted selvage and the finish grade of the mulch is not greater than one inch (1").

3.4 CHAIN LINK FABRIC INSTALLATION

A. Fabric Install fabric on the side indicated on Plans. Attach so that fabric remains in tension after pulling force is released. Bottom of fabric selvage shall be one inch (1") from finish grade. Attach fabric with wire ties to line posts at 15" on center and to rails and braces. Attach fabric with Hog Rings to tension wire at 24" (600 mm) on center.

B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15" (381 mm) on center.

3.5 ACCESSORIES

A. Tie wires: Bend ends of wire minimum two times around fabric. Single folding of tie ends is not acceptable under any circumstances. Assure clipped ends do not protrude beyond the fence fabric and face away from the fabric side of fence to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.6 NUTS AND BOLTS

A. Carriage bolts for fitting shall be installed with the nut on the secure side of the fence. All bolts shall be peened secure.

3.7 INSTALLATION OF GATES

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference.
   1. Attach fabric as for fencing.
   2. Attach hardware using tamper-resistant or concealed means.
   3. Install ground-set items in concrete for anchorage.
   4. Adjust hardware for smooth operation.

3.8 ADJUSTING

A. Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.
   1. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.9 CLEANING

A. Clean up debris and unused material. Completely remove all concrete, mud, and dirt from posts, fabric, and fittings. Police all wire ties, clipped metals, and fencing related debris and remove from the site.

B. All excess concrete shall be disposed of off-site.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests.

B. Grounding Tests: Comply with requirements in Division 26 Section for Lightning Protection for Structures.

C. Prepare test reports.

3.11 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain link fences and gates.

END OF SECTION

SECTION 323116 - SECURITY CANTILEVERED SLIDE GATES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section shall include furnishing all labor, materials, equipment, and appliances necessary to complete construction of all Security Cantilevered Slide Gates and Slide Gate Operators (also known as Hydraulic Gate Operators) required for this project in strict accordance with this specification section and drawings.

B. References used below, and in other instances in this Section, are generally accepted industry standards. The edition of the criteria cited shall be the most recently published edition, including amendments, at the time of bid.

1.2 REFERENCES

A. Underwriters Laboratory Gate Operator Requirements (UL 325).

1. Operators shall be built to UL325 standards and be listed by a testing laboratory. Complete all electrical work according to local codes and National Electrical code. All fieldwork shall be performed in a neat and professional manner, completed to journeyman standards.
2. Current safety standards require the use of multiple external sensors to be capable of reversing the gate in either direction upon sensing an obstruction. Also see 2.02 D.
3. Vehicle gates should never be used by pedestrians. Separate pedestrian gates must always be provided when foot traffic is present.
4. Current safety standards require gate operators to be designed and labeled for specific usage classes. Hydraulic Operator 222 E ST gate operators are to be used on Classes I, II, III and IV installations.

B. ASTM F 2200 - Standard Specification for Automated Vehicular Gate Construction.

C. ASTM F 1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates, Type II, Class 2.

D. American Welding Society AWS D1.2 Structural Welding Code.

1.3 SUBMITTAL

A. Product Data:

1. Provide manufacturer’s catalog cuts with printed specifications and installation instructions.
2. Deliver two (2) copies of operation and maintenance data covering the installed products, including name, address and telephone number of the nearest fully equipped service center.

3. Each operator shall bear a label indicating that the operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.

B. Shop drawings:

1. Supply shop drawings showing the relationship of operating systems with gate components, including details of all major components.
2. Include complete details of gate construction, gate height and post spacing dimensions.

C. Certification of Performance Criteria:

1. Manufacturer of gate system shall provide certification stating the gate system includes the following material components that provide superior performance and longevity. Alternate designs built to minimum standards that do not include these additional structural features shall not be accepted.

    a. Gate track system shall be keyed to interlock into gate frame member (providing 200% additional strength when compared to weld only keyless systems). When interlocked with and welded to the "keyed" frame top member, gate track forms a composite structure.
    b. Gate shall have a minimum counterbalance length of 50% opening width which provides a 36% increase in lateral resistance (when compared to ASTM minimum of 40% counterbalance). If gate is ever to be automated, counterbalance section shall be filled with fabric or other specified material.
    c. To provide superior structural integrity, intermediate vertical members shall be used - with spacing between verticals to be less than 50% of the gate frame height.
    d. Entire gate frame (including counterbalance section) shall include 2 adjustable stainless or galvanized steel cables (minimum 3/16”) per bay to allow complete gate frame adjustment (maintaining strongest structural square and level orientation).
    e. Gate truck assemblies shall be tested for continuous duty and shall have precision ground and hardened components. Bearings shall be pre-lubricated and contain shock resistant outer races and captured seals.
    f. Gate truck assemblies shall be supported by a minimum 5/8” plated steel bolt with self-aligning capability, rated to support a 2,000 # reaction load.
    g. Hanger brackets shall be hot dipped galvanized steel with a minimum 3/8” thickness that is also gusseted for additional strength.
    h. Gate top track and supporting hangar bracket assemblies shall be certified by a licensed professional engineer to withstand a 2,000 lb. vertical reaction load without exceeding allowable stresses.
    i. Gate is to be designed to meet specified ASCE-7 wind load requirements with the gate in the closed and latched condition only. Typical gate design is expected to operate satisfactorily in winds up to 30 MPH. Depending on gate panel infill, winds higher than 30 MPH may cause gate operational problems (if automated, operator entrapment may trigger; gate panel may not engage receiver). For sites with higher operational, non-typical, or specified wind loadings, manufacturer should be advised of the site conditions and a specifically engineered design will be offered.

D. Certifications:

1. The Structural Cantilever Slide Gate must be cycle-tested and certified per section 2.04 B.
2. The aluminum welders and welding process for gate manufacture must be certified per section 2.04 C.
3. Operator Manufacturer: A company specializing in the manufacture of hydraulic gate operators of the type specified, with a minimum of ten years' experience.
4. Manufacturer shall supply gate design performance certification as per section 1.03 C.

PART 2 - PRODUCTS

2.1 SLIDE GATE OPERATOR (HYDRAULIC GATE OPERATOR)

A. Slide Gate Operator (Hydraulic Gate Operator) shall be SlideDriver 40 (222 E ST) with Smart Touch Controller as manufactured by HySecurity (Phone: 800-321-9947) or approved equal.

B. Operation shall be by means of a metal rail passing between a pair of reinforced composite wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 lb (136 kg) without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 4,000 lb (1,814 kg). Gate panel velocity shall not be less than 1 ft/s (304 mm/s) and shall be stopped gradually to prevent shock loads to the gate and operator assembly. The "soft-stop" feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction).

C. Standard mechanical components shall include as a minimum:

1. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed, 1 1/2" (38 mm) bronze bearing surface, acting on arm pivot pins. (item 2 below)
2. Arm pivot pins: 3/4" (19 mm) diameter, stainless steel, with integral tabs for ease of removal.
3. Tension spring: 2 1/2" (63 mm) heavy duty, 800 lb (363 kg) capacity.
4. Tension adjustment: Finger tightened nut, not requiring the use of tools.
5. Drive release: Must instantly release tension on both drive wheels and disengage them from contact with drive rail in a single motion, for manual operation.
6. Limit switches: Fully adjustable, toggle types, with plug connection to control panel.
7. Chassis: 1/4" (6 mm) steel base plate, and 12 Ga. (3 mm) sides and back welded and ground smooth.
8. Cover: 16 Ga. (1 mm) zinc plated steel with textured TGIC polyester powder coat finish. All joints welded, filled and ground smooth. Finished corners square and true with no visible joints.
9. Finish: Zinc plated steel with textured TGIC polyester powder coat finish, proven to withstand 1,000 hour salt spray test.
10. Drive wheels: Two 6" diam (152 mm) AdvanceDrive wheels. High-strength composite hub with polyurethane over mold.
11. Drive rail: Shall be extruded 6061 T6, not less than 1/8" (3 mm) thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.
12. Hydraulic hose: Shall be 1/4" (6 mm) synthetic, rated to 3,000 psi (20.6 MPa).

13. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.
14. Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.
15. Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range -40° F to 158° F (-40° C to 70° C).
16. A zero to 2,000 psi (13.7 MPa) pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.
17. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.

D. Minimum standard electrical components:

1. Pump motor: 1 hp, 3450 RPM, 56C, TEFC. Standard voltages available in single or three phase.
2. All components shall have overload protection.
3. Electrical enclosure: Type 1, metal, with hinged lid gasketed for protection from intrusion of foreign objects.
4. Controls: Smart Touch Controller Board containing:

    a. inherent entrapment sensor;
    b. built in audible “warn before operate” system;
    c. built in timer to close;
    d. 32 character OLED display for reporting of functions and codes;
    e. multiple programmable output relay options;
    f. anti-tailgate mode;
    g. built-in power surge/lightning strike protection;
    h. menu configuration, event logging and system diagnostics easily accessible with a PC and HySecurity’s free Smart Touch Analyze and Retrieve Tool;
    i. RS-232 port for connection to laptop or other computer peripheral and RS-485 connection for network interface.
    j. Dual gate communication connection for bi-parting, sally port, or sequenced gates.
    k. Electromechanical and solid state relays.
    l. Radio option outputs.
    m. 21 inputs for site specific configurations.

5. Transformer: 75 VA, non-jumpered taps, for all common voltages.
6. Control circuit: 24VDC.
7. Power: 208 VAC single phase

E. Obstruction Sensing Systems:

1. The inherent motor current sensors are part of the gate operator system and may not be removed or bypassed.
2. Required external sensors: See 1.02 B2. EMX IRM-MON Photo Eyes and ASO Edge Sensor, or approved equals, to be installed such that the gate will reverse in either direction upon sensing an obstruction. All safety devices conform to the UL 325 approved safety devices for HySecurity operators.

F. Additional control devices:

1. Radio control: Inti Transmitters (Model: INTI2/A) and OXI/A Receiver or approved equal. Provide one (1) OXI/A Receiver per slide gate ophydraulic gate operator and (3) Inti Transmitters per hydraulic gate operator. Intii transmitters shall be color-coded by gate. Submit product cutsheet to Owner for color selection during shop drawing process.
2. Fire Box with Knox Keyswitch: Security Bran 15-013 Fire box with Knox keyswitch or approved equal, emergency vehicle open device to be installed as dictated by local code.
3. Key operated cable manual release (secure side of gate).
4. Detection Loops: HY5B automatic loop detector assembly or approved equal.
5. Card Readers: Card reader per Drawings.

2.2 FACTORY TESTING

A. Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing, and electrical connection integrity. Apply physical loads to the operator to simulate field conditions. Tests shall simulate physical and electrical loads equal to the fully rated capacity of the operator components.

B. Check all operator mechanical connections for tightness and alignment. Check all welds for completeness and continuity. Check welded corners and edges to assure they are square and straight.

C. Inspect operator painted finish for completeness and gloss. Touch up imperfections prior to shipment.

D. Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

2.3 SECURITY CANTILEVER SLIDE GATE MANUFACTURERS

A. The cantilever sliding gate shall be manufactured by Tymetal Corp., 678 Wilbur Avenue, Greenwich, NY 12834 (Phone: 800-328–4283), or approved equal.

B. Cantilever Slide Gate manufacturer shall submit test results upon request stating that the gate panel has been tested in an operated system for 200,000 cycles.

C. Gate manufacturer shall provide independent certification as to the use of a documented Welding Procedure Specification and Procedure Qualification Record to insure conformance to the AWS D1.2 welding code. Upon request, Individual Certificates of Welder Qualification documenting successful completion of the requirements of the AWS D1.2 code shall also be provided.

2.4 SECURITY CANTILEVER SLIDE GATE

A. Security Cantilever Slide Gate System dimensions shall be as shown on the detail drawings.

B. Structural Gate Frame:

C. The gate frame shall be fabricated from 6063-T6 aluminum alloy extrusions. The top member shall be a 3" x 5" aluminum structural channel/tube extrusion weighing not less than 3.0 lb/lf (4.4kg/m). To maintain structural integrity this frame member shall be "keyed" to interlock with the "keyed" track member. If fabricated as a single horizontal piece, the bottom member shall be a 2" x 5" aluminum structural tube weighing not less than 2.0 lb/lf. If fabricated in two horizontal pieces, the bottom member shall be a 5" aluminum structural channel weighing not less than 2.65 lb/lf, and the two horizontal pieces or sections shall be spliced in the field (the gate frame shall be fabricated in one or multiple sections depending on size requirements or project constraints).

1. Vertical Members:

    a. The vertical members at the ends of the opening portion of the frame shall be "P" shaped in cross section with a nominal base dimension of no less than 2" x 2" (51mm x 51mm) and weighing not less than 1.6 lb/lf (2.3kg/m). The intermediate vertical members shall alternate between 2" x 2" (51mm x 51mm) and 1" x 2" (25mm x 51mm) in cross section weighing not less than 1.1 lb/lf (1.6kg/m) and 0.82 lb/lf (1.2kg/m) respectively.
    b. Intermediate 1" x 2" (25mm x 51mm) vertical members weighing not less than .82 lb/lf shall alternate between 2" x 2" major members.

D. Splicing:

1. A ¼" x 5" x 24" galvanized steel splice plate shall be used to secure the two bottom channel members together utilizing eight (8) plated carriage bolts with lock nuts. The top members will be spliced together using a ¼" x 2" x 24" aluminum splice plate secured with six (6) drive rivets on one side and welded to the top member on the other side. The track is overlapped onto the opposing section in an alternating fashion, interlocking with the top primary member.

E. Gate Track:

1. The gate shall have a separate semi-enclosed "keyed" track, extruded from 6005A-T61 or 6105 T5 aluminum alloy, weighing not less than 2.9 lb/lf. Track members are to be located on each side of the top member. When interlocked and welded to the "keyed" top member, it forms a composite structure with the top of the gate frame. Welds are to be placed alternately along the top and side of the track at 9" centers with welds being a minimum of 2" long.

F. All welds on the gate frame shall conform to Welding Procedure Specification and Procedure Qualification Record to insure conformance to the AWS D1.2 Structural Welding Code. All individual welders shall be certified to AWS D1.2 welding code. See 1.02 D.

G. Gate Mounting:

1. The gate frame is to be supported from the track by four (4) swivel type, self-aligning, 4 wheeled, sealed lubricant, ball-bearing truck assemblies.
2. The bottom of each support post shall have a bracket equipped with a pair of 3" (76mm) UHMW guide wheels. Wheel cover protectors shall be included with bottom guides to comply with UL325.
3. Gap protectors shall be provided and installed, compliant with ASTM F 2200.

H. Diagonal Bracing:

1. Diagonal "X" bracing of 3/16" or ¼" diameter stainless or galvanized steel cable shall be installed throughout the entire gate frame.

I. Gate Panels:

1. Gate Panels shall be provided by the Owner and installed by the Contractor.

J. Posts:

1. Double sets of support posts shall be minimum 4" O.D. (102mm) round SS40 or 4" x 4" x 3/16" wall square steel tubing, grade 500. Gate posts shall be galvanized or coated and supported in concrete footings as specified by the design team.

K. Finish:

1. Gate to be mill finish aluminum.

L. Gate Lock:

1. Gate system shall be furnished with a secure gate catcher. The catcher shall prevent the gate panel from being pried open while the gate is in the closed and locked position.

PART 3 - EXECUTION

3.1 SITE INSPECTION

A. Final grades and installation conditions shall be examined. Installation shall not begin until all unsatisfactory conditions are corrected.

B. Locate concrete mounting pad in accordance with approved shop drawings.

C. Make sure that gates are level and operating smoothly under manual conditions before installation of gate operators. Do not proceed until gate panel is aligned and operates without binding.

D. The existing Security Cantilevered Slide Gate at the Maintenance building should be inspected prior to production of shop drawings and installation of the slide driver and all additional safety systems for this gate.

3.2 INSTALLATION

A. Equipment in this section shall be installed in strict accordance with the manufacturer's printed instructions, current at the time of installation (unless otherwise shown on the contract drawings).

B. Coordinate locations of operators with contract drawings, other trades, existing site conditions and shop drawings.

C. Installer shall insure that the electric service to the operator is at least 20 AMPS. Operator wattage is 1500.

D. The gate and installation shall conform to:

1. ASTM F 1184 standards for aluminum cantilever slide gates, Type II, Class 2.
2. ASTM F 2200 standard specification for automated vehicular gate construction.
3. UL325 standards.

E. The installing contractor shall be responsible to ensure that appropriate external primary entrapment safety devices be installed for the specific site conditions to protect against all potential entrapment zones. Proper operation of these safety devices shall be verified and training as to the operation and maintenance of these devices for the users and owners shall be documented.

F. Safety Loops installed in asphalt are to be installed before/during the installation of the asphalt paving. Saw cutting of the asphalt paving for the installation of the safety loops is not permitted.

3.3 SYSTEM VALIDATION

A. The complete system shall be adjusted to assure it is performing properly. Test gate operator through a minimum of ten full cycles and adjust to ensure operation without binding, scraping or uneven motion. Test limit switches for proper "at rest" gate position.

B. Gate lock shall be aligned properly to lock and unlock without binding. Test gate lock through a minimum of ten full cycles and verify secure locking.

C. All anchor bolts shall be fully concealed in the finished installation.

D. Test and Explain Safety Features:

1. Each system feature and device is a separate component of the gate system.
2. Read and follow all instructions for each component.
3. Ensure that all instructions for mechanical components, safety devices and the gate operator are available for everyone who will be using the gate system.
4. The warning signs shipped with the gate operator must be installed in a prominent position on both sides of the gate.

3.4 OWNER TRAINING AND DOCUMENTATION

A. Train Owner’s personnel on how to safely shut off electrical power, release, and manually operate the gate. Additionally, demonstrate the general maintenance of the gate operator and accessories and provide one copy of “Programming and Operations Manual” for the Owner’s use. Manuals will identify parts of the equipment for future procurement. Direct maintenance personnel to the technical support sections on HySecurity’s website at www.hysecurity.com (or technical support website of approved equal manufacturer, if selected).

END OF SECTION

SECTION 323253 – LANDSCAPE BOULDERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. On-site Boulders from earthwork operations shall be installed as shown on plans; Boulders in excess of those required in the Site Plan shall be stored at the Borrow Pit as directed by Owner. Contractor shall coordinate final Boulder placement and orientation with Landscape Architect.

1.2 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Section 015713 – Temporary Erosion and Sedimentation Control
2. Section 311100 – Clearing and Grubbing
3. Section 312000 – Earth Moving
4. Section 312100 – Borrow Pit

1.3 SITE CONDITIONS

A. Environmental Protection:

1. Soil Moisture Content: Do not work when soil moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Landscape Boulders:

Boulders shall be salvaged by the Contractor and stored in an Owner determined location on site until installation operations occur. Approval of Boulders for use in the Site Plan shall be at the sole discretion of Landscape Architect. All Boulders in excess of the Boulders required in the Site Plan shall be stored at the Borrow Pit in a location determined by the Landscape Architect. Access to the Borrow Pit for boulder relocation will not be available until 10/1/2025.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Subgrade:

1. Verification: Verify that the subgrades have been graded to within one tenth of a foot (minus the topsoil depth) of the grades shown on the grading Plan.
2. Notification of Discrepancies: Notify the Owner in writing of any discrepancies.

3.2 SURVEY REQUIREMENTS

A. Lines and Levels: Establish lines and levels locate and lay out by instrumentation and similar appropriate means for all finish grades and landscape boulders.

3.3 EQUIPMENT

A. Excavator with Hydraulic Rotating Grapple attachment shall be used to pick up and place Boulders in locations as shown on plans.

3.4 PREPARATION

A. Protection of Existing Conditions:

B. General: Use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the Work.

C. Surface Preparation:

D. Removal: Perform all Work when necessary to remove the deleterious materials before and after subgrade preparation.

E. Boulder Material Storage:

F. Verify Storage Area with Owner.

3.5 BOULDER PLACEMENT

A. Contractor shall coordinate a Pre-Installation Conference with Landscape Architect prior to the placement of Boulders.

B. Contractor shall retain the services of a Landscape Professional skilled in Boulder Placement with the appropriate equipment, such as rotating grapple, to place and orientate each Boulder at the discretion of mutual agreement of Landscape Architect and Landscape Boulder Professional.

C. Boulders shall be buried one third of the rock's depth with the widest side down. Boulders shall be examined and oriented with the most aesthetic side towards the paved areas.

D. Boulders shall be secured with zero movement under human power.

E. Before completion of boulder placement, Contractor will meet with Landscape Architect on-site for final adjustments. Landscape Architect shall be the sole discretion of final Boulder placement.

3.6 CLEANUP

A. Daily: Keep all areas of Work clean, neat, and orderly at all times.

B. Final: Clean up and remove all deleterious materials and debris from the entire Work area prior to Final Completion.

END OF SECTION

SECTION 323300 – SITE FURNISHINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. ADA Fire Ring

B. Ecology Block Enclosure

C. ADA Picnic Table

1.2 DESCRIPTION

A. Furnish and install all site furnishings and miscellaneous site construction items; assemble and install with all hardware, as described in the Contract Documents. Install Owner Furnished ADA Picnic Table and Fire Ring.

1.3 RELATED SECTIONS

A. Section 033001 Cast-in-Place Concrete – Sitework

B. Section 055213 Pipe and Tube Railings

C. Section 312000 Earth Moving

D. Section 321313 Portland Cement Concrete Paving

E. Section 321500 Crushed Rock Surfacing

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawing, Metal Fabrication and Assemblies: Indicate materials, dimensions, layout, perimeter conditions, junctions with dissimilar materials, accessories, and setting details.

C. Provide shop drawings for all furnishings for approval prior to fabrication.

D. Submit manufacturers' catalogue cuts and manufacturers' recommended installation instructions of items for all miscellaneous Site Furnishings.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of all components.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five years experience in producing site furnishings of the type specified.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.

C. Single Source Responsibility:

1. Obtain each type and color of stone from a single source.
2. Obtain each type and color of mortar, adhesive and grout from the same source.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Locate mock-up in location as directed by the Engineer.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Engineer.
3. Mock-up area may become part of finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

1.7 PROTECTION

A. Protect all work installed under this section from any cause whatsoever, including subsequent construction activities and vandalism until final acceptance.

PART 2 - PRODUCTS

2.1 ECOLOGY BLOCK ENCLOSURE

A. Approved Manufacturer: Miles Sand & Gravel or Stanwood Redi-Mix or approved equal

1. Miles Sand & Gravel, Address: 400 Valley Ave. N.E. Puyallup, WA 98372, Phone: (253) 833-3705 Website: www.miles.rocks
2. Stanwood Redi-Mix, Address: 2431 Larson Rd, Stanwood, WA 98292, Phone: 360-652-7777, Website: www.stanwoodredi-mix.com

B. Finish: Plain

C. Size per plan.

2.2 ADA BENCH

A. ADA Bench shall be Owner Furnished and Contractor installed.

2.3 ADA PICNIC TABLE

A. ADA Picnic Table shall be Owner Furnished and Contractor Installed.

2.4 ADA FIRE RING

A. ADA Fire Ring shall be Owner Furnished and Contractor Installed.

PART 3 - EXECUTION

3.1 GENERAL

A. Stake alignment and location for Owner approval prior to installation.

B. Install rigid, plumb and true to lines and levels shown. Verify that all elements called for in this Section "fit" according to the drawings and existing site features.

C. Assemble and install all equipment specified by name/manufacture as per approved manufacture's printed instructions/recommendations. Provide Owner with all printed instructions/recommendations.

D. Provide painting where specified.

3.2 CAST-IN-PLACE CONCRETE FOOTINGS

A. Construct footings for all furnishings in accordance with Section 033000 Cast-In-Place Concrete – Architecture.

3.3 ADA FIRE RING

A. Assemble tight and secure and install per manufacturer's instructions.

B. Install plumb and level with zero lateral or vertical movement.

C. Install as shown on Drawings.

3.4 ECOLOGY BLOCK ENCLOSURE

A. Ecology block enclosure shall be level and plumb with zero lateral or vertical movement. Assemble per plan.

3.5 ADA Picnic Table

A. Assemble tight and secure and install per manufacturer's instructions.

B. Locate and install ADA Picnic Table per Plan and Drawings and Owner's direction.

C. Install plumb and level with zero lateral or vertical movement.

3.6 CLEANING

A. Clean up debris and unused material.

B. Power wash and clean all Site Furnishings.

C. Paint all scratches, marks, and minor gouges less than 1/16 in. deep/wide to match the color of the surrounding material. Any scratches, marks, and minor gouges greater than 1/16 in. deep/wide requires the replacement of the damaged furnishing.

END OF SECTION

SECTION 323913 – FIXED BOLLARD

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide Fixed Bollards where shown on the Plans.

1.2 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Metal Fabrications – 055000

2. Earth Moving – 312000

1.3 REFERENCES

A. ASTM A36 - Structural Steel.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fixed Bollard materials shall comply with Section 055000 Metal Fabrications.

B. Concrete: per Section 033000, Class 4000 psi.

PART 3 - EXECUTION

3.1 FIXED BOLLARD INSTALLATION

A. Fixed Steel Pipe Bollards: Install at all locations shown, set in concrete as detailed or otherwise required for rigidity, and conforming to the following additional requirements:
1. Unless otherwise shown, pipe bollards shall extend into concrete footing as detailed with rebar installed.
2. Excavate holes for footings in firm, undisturbed or compacted soil.

3. Place concrete around bollards in a continuous pour, tamp/vibrate for consolidation. Check each bollard for vertical and top alignment.
4. After bollards have set, fill pipe bollard with concrete and form top to a 1/2 inch convex shape. Cap Bollard with Metal dome cap set into concrete.
5. Fixed Bollard shall be set at the elevations in the Plans. Fixed Bollard shall be plumb
6. Finish texture of exposed concrete footing shall be a medium broom in circle direction, ninety degrees to the Fixed Bollard's center point.

3.2 CLEANUP

A. Clean powder coated finish of Fixed Bollard free of all concrete splatters and other surface materials.

B. Final: Clean up and remove all deleterious materials and debris from the entire Work area prior to Final Completion.

END OF SECTION

SECTION 329000 – PLANTING (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Work includes preparation for seeding, hydroseeding, fertilizing, mulching, and watering. Work also includes maintenance of all completed landscaping for the duration of the contract.

1.02 SUBMITTALS

A. Submit complete “erosion control” seed mix specifications, ingredients, composition, purity, etc.

B. Furnish list of material source(s) and list of specific materials to be purchased from each source. Include nursery names, addresses, and telephone numbers.

1.03 WARRANTY

A. The Contractor shall warranty all landscaping work and materials for a period of one year from project acceptance. Replace any/all defective, dead, or dying landscape plantings identified by the Engineer during the warranty period. Also, reseed any/all dead or defective seeded areas and/or any seeded areas, which do not grow in properly within the warranty period.

B. The Contractor will not be held responsible for replacement of landscape materials which have been clearly damaged by actions which are beyond the control of the Contractor, such as uncontrolled vehicles or pedestrians after the landscaping has been approved and accepted by the Engineer. The Contractor will be responsible for any/all damaged landscaping materials due to improper or lack of proper maintenance during the warranty period, plants which are diseased or otherwise defective, and landscaping which is damaged as a result of a lack of adequate and proper protection of planted or seeded areas during the establishment period.

1.04 SITE AND PLANTING CONDITIONS

A. Schedule all seeding operations to occur between August 15 and October 1, or between March 1 and May 15. Seeding may be allowed to occur prior to or following each seeding window depending on the Contractor’s proposed plant management, watering and assurances. Current weather conditions, trends, and precipitation amounts which are deemed to be conductive to satisfactory establishment and growth of vegetation will be considered. Engineer’s approval must be obtained to seed outside the established seeding windows.

B. In the event that the Engineer determines that weather conditions are inappropriate for seeding or planting, either during or outside the seeding windows, seeding and/or planting shall be delayed or suspended until appropriate weather conditions exist.

C. In the event that seeding and planting is delayed due to excessively dry or wet conditions, the Contractor shall install and maintain appropriate erosion control measures for the duration of the delay, unless such measures are formally waived by the Engineer because of dry conditions rather than wet.

D. Seeding and/or planting shall be scheduled to take place as early as possible following completion of each graded area. Graded areas shall not be allowed to sit idle and unseeded or planted for an extended period of time, unless proper and appropriate temporary erosion control measures are installed and in-place and meet with the approval of the Engineer.

E. Schedule and coordinate all landscaping work to occur only after all grading, utility work, trenching work, or other work which would cause undue damage to completed landscaping. The Contractor will be responsible for repairing and/or replacing any/all damaged landscaping materials due to improper sequencing and scheduling with other work. Contractor will also be responsible to replace or repair any landscaping materials damaged because of work done by other trades.

F. Inspect the site for adverse drainage conditions, excessive compaction, obstructions, toxic or contaminated soils, existing site conditions (outside the work zone), or other conditions which would be detrimental to seed or plant establishment and growth and inform the Engineer of any/all such conditions. The Contractor will be responsible for correction of all such conditions which are the direct result of Contractor activities or performance. Such conditions which are obviously not the direct result of Contractor activities, as determined by the Engineer, shall be corrected under the direct supervision of the Engineer and associated costs will be reimbursed as deemed appropriate by the Engineer.

PART 2 – PRODUCTS

2.01 SEED MIX – EROSION CONTROL

A. Pro-Time Companion (or equal). Available from Hobbs & Hopkins LTD., 1712 SE Ankeny, Portland, OR 97214. (503) 239-7518. Composed in weight of the following:

1. Erosion Control Seed – Hobbs & Hopkins (or equal):

Common Name	**Botanical Name**	**Percent by Weight**
Elka Perennial Ryegrass	*Lolium perenne 'Elka'*	50
Essence Perennial Ryegrass	*Lolium perenne*	20
Cindy Creeping Red	*Festuca ruba 'Cindy'*	20
Cobra Creeping Bentgrass	*Agrostis sp.*	10

Application Rate: 2.2 pounds per 1,000 square feet.

2.02 HYDROSEEDING

A. Seeding shall be applied by hydroseeding. Hydroseeding shall conform to the following:

1. Seed: Same seed as specified in Part 2.

2. Fertilizer: Conform to WSDOT Section 9-14.3.
3. Hydromulch: Wood cellulose fiber mulch such as "Natures Own Hydromulch" or as otherwise approved by the Engineer.
4. Lime: Agricultural lime.
5. Tacking Agent: Soil binders and tacking agents in accordance with latest quality hydroseeding practices.

2.03 WATER

A. Water supply on site is extremely limited. The Contractor shall import all water necessary for landscaping purposes.

B. In the first 6 weeks after germination, irrigate seeded areas 1/2 inch every 3 days during periods of no precipitation or as directed by the Engineer.

2.04 MULCH

A. Mulch shall be bark or wood chip mulch derived from Douglas fir, pine, or hemlock species. It shall be ground so that a minimum of 95 percent of the material shall pass through a 1-1/2-inch sieve and no more than 55 percent by loose volume shall pass through a U.S. No. 4 sieve. The mulch shall not contain resin, tannin, or other compounds in quantities that would be detrimental to plant life.

PART 3 – EXECUTION

3.01 SEEDING

A. For erosion control areas, prepare for seeding by lightly raking to create furrows to catch seed and to level out the soil. Remove all/any weed growth that may have occurred since applying stockpiled soil.

B. Apply seed to all areas using hydroseeding methods.

C. Apply seed at a rate of not less than 5 pounds per 1,000 square feet, or as otherwise recommended by the seed manufacturer.

D. Following seed application, roll all seeded areas to lightly compact and level the soil layer and "set" the seed into the soil.

E. Do not seed during windy or excessively wet or dry weather.

3.02 FERTILIZING

A. Make first application of fertilizer at the same time as seeding. Apply at a rate of 6 pounds per 1,000 square feet or as otherwise recommended by manufacturer.

B. Approximately 2 days after seed germination, fertilize with a follow-up application of fertilizer at a rate of 6 pounds per 1,000 square feet.

C. Reseed any barren areas at the time of second fertilizer application.

3.03 MAINTENANCE

A. Properly maintain and water all completed hydroseeding until final acceptance and continuing throughout the warranty period.

B. Reseed and fertilize any/all bare or damaged seeded areas.

END OF SECTION

SECTION 329113 – BARK MULCH & WOOD CHIPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Plans and general provisions of Contract, including General Conditions and Specification Sections apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Scope of work. This Work includes providing Bark Mulch and Wood Chips as shown in the Plans.

1.3 SUBMITTALS

A. Provide one cubic foot sample of Bark mulch.

1.4 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Section 311100 – Clearing and Grubbing
2. Section 312000 – Earth Moving
3. Section 329119 – Topsoil Placement & Grading

PART 2 - PRODUCT

2.1 BARK MULCH

A. Bark Mulch shall be Medium Bark Mulch and shall comply with WSDOT 8-02.3(11)B.

B. Bark Mulch shall not contain deleterious material, and shall not contain paint, petroleum products, herbicides, fungicides, or other chemical residues that would be detrimental to animal/plant life. There shall be zero presence of deleterious material such as, not but limited to, plastic, glass, metal, or rocks.

2.2 WOOD CHIPS

A. Wood Chips shall be chipped from organic material and timber cleared and grubbed from site, as indicated in Plans, and per Section 311100 – Clearing and Grubbing. Wood Chips shall be per WSDOT section 2-01.2(3). Wood Chips shall be Hog Fuel as processed by a Tub Grinder or similar on-site wood processing equipment.

B. Owner and Contractor shall ascertain the projected volume of Wood Chips produced from project organic material and mutually agree as to the Wood Chip processing and storage location(s) and area size required.

C. Wood Chips shall not contain deleterious material, and shall not contain paint, petroleum products, herbicides, fungicides, or other chemical residues that would be detrimental to animal/plant life. There shall be zero presence of deleterious material such as, not but limited to, plastic, glass, metal, or rocks.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor shall grade the landscape surfaces to receive Bark Mulch or Wood Chips to a smooth and even grade per Plans.

3.2 BARK MULCH AND WOOD CHIPS INSTALLATION

A. Bark Mulch shall be installed after plants have been installed. Contractor shall take precautions and measures to protect all installed plants from damage during the process of Bark Mulch installation to the depths shown on Plans. Damaged plants will be replaced by Contractor at no cost to Owner.

B. Install Bark Mulch to depths shown on the Plans after plants have been installed. Mulch depth shall be a uniform depth and shall be graded to produce a smooth landscape surface.

3.3 MAINTENANCE

A. Contractor shall be responsible to weed and maintain Bark Mulch and Wood Chip areas to be free of weeds and to assure a full design depth of Bark Mulch up to and at the time of Final Acceptance.

END OF SECTION

SECTION 329119 – TOPSOIL PLACEMENT & GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK

A. Installation of Topsoil Type A.

B. Placement and Finish Grading of Topsoil Type A.

1.3 REFERENCES

A. ASTM D 1557: Method for Laboratory Compaction Characteristics of Soil using Modified Effort

1.4 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:

1. Section 015713 – Temporary Erosion and Sedimentation Control
2. Section 312000 – Earth Moving

1.5 DEFINITIONS

A. Percent Compaction: The required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material determined by ASTM D1557-78 test procedure.

B. Soil Subgrade: The soil surface on which topsoil is placed.

C. Finished Grades: The final grade elevations indicated on the Grading Drawings.

D. Aesthetic Acceptance of Grades: Acceptance by the Owner's Representative in writing of the Aesthetic Correctness of the contours as observed without a survey instrument. Aesthetic Acceptance does not address whether an area drains properly, whether the areas are at the correct elevation, or whether it has been compacted properly.

E. Acceptance: Wherever the terms "acceptance" or "accepted" are used herein, they mean acceptance of the Owner's Representative in writing.

F. Grading Drawings: Plans, sections, and profiles showing finished surface grades.

G. Elements with Fixed Elevations: Paths, paving, concrete pads, footings, foundations, walls, and other structures with fixed-spot elevations.

1.6 SITE CONDITIONS

A. Environmental Protection:

1. Soil Moisture Content: Work soil only when within 2% of optimum moisture content.
2. Do not work soil when it is so dry that dust will form in air or that clods will not break readily.
3. Perform work in such a manner as to prevent overworking and over-saturation of on-site soils.
4. This shall include any/all precautions necessary throughout the entire work area (including access drives/haul roads/staging areas) to control surface water, to protect soils and subgrades from heavy vehicle loads, and to achieve soil moisture levels capable of achieving specified compaction.
5. No extra compensation will be paid to the Contractor due to work performed at non-optimum times or under non-optimum conditions resulting in unsatisfactory soil conditions.
6. The Contractor shall correct unsatisfactory conditions at no additional cost to the Owner.

1.7 SUBMITTALS

A. Submit product data, physical analysis, and one gallon sample of each type of topsoil.

B. Submit soil analysis, sieve analysis, lime fertilizer and other soil amendment recommendations based on growing ornamental plants. Soil analysis shall include any recommendations for amendments, fertilizers and the like, for planting.

C. Provide a transmittal with each sample and data that provides the project name, testing facility, date of test, contact information for testing facility, and the information listed below:

Date Submitted_____ Date Approved _____

Sub-Contractor/Supplier

PART 2 - PRODUCTS

2.1 MATERIALS

A. Contractor shall be responsible for the supply of all natural soil and soil additives required for the performance of this Contract and for determining the volume of soil and additives required to fulfill Contract obligations.

B. Soil shall be free of weeds, pests, toxic substances and other undesirable material harmful to turf grass or ornamental plant growth.

C. Topsoil Type A shall be a mixture of 10% Compost and 90% Sandy loam as follows:

1. Sandy Loam shall meet the following chemical and mechanical analysis:

PERMISSIBLE RANGE

a. Salinity (millimhos per centimeter of Saturation extract @ 25 degrees C)Nil – 3.0
b. Boron (saturation extract Concentration) Nil – 1.0 ppm
c. Sodium (sodium absorption ratio – SAR) Nil – 6.0

2. Planting soil shall be a biologically active, two-way mix soil consisting of 90 percent sandy loam and 10 percent recycled plant waste compost or composted dairy manure by weight thoroughly mixed together. Mixed soil shall have pH range of 5.2 to 6.5 with dolomite limestone added as necessary to attain this range.

D. Grading Equipment: Appropriate size and flexibility to achieve the sculptural forms, profiles, straight slopes, and slope rounding indicated on the Grading Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Subgrade:

1. Verification: Verify that the subgrades have been graded to within one tenth of a foot (minus the topsoil depth) of the grades shown on the grading Drawings.
2. Aesthetic Acceptance: Verify that Owner's Representative has given the subgrade aesthetic acceptance. Do not place topsoil until subgrade has been accepted for aesthetic correctness.
3. Notification of Discrepancies: Notify the Owner's Representative in writing of any discrepancies.

3.2 SURVEY REQUIREMENTS

A. Lines and Levels: Establish lines and levels, locate and lay out by instrumentation and similar appropriate means for all planting area finish grades.

B. General Staking: Provide a sufficient quantity of grade stakes as required to provide minimum depth layer of topsoil.

3.3 PREPARATION

A. Protection of Existing Conditions:

1. General: Use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the Work.

B. Surface Preparation:

1. Inspection: Inspect subgrade soil for stones over one inch in diameter, sticks, oils, chemicals, plaster, concrete, and other deleterious materials.
2. Removal: Perform all Work necessary to remove the deleterious materials before and after subgrade preparation.

3.4 PREPARING SUBGRADE

A. Prepare subgrade to avoid excessive compaction beyond what is specified in Section 312000 Earth Moving for landscape areas. If Owner's Representative determines that excessive compaction has occurred, it shall be corrected as follows:

1. Immediately before Topsoil Placement, scarify with a roto-tiller to a depth of 4 inches minimum in one direction.

3.5 TOPSOIL PLACEMENT

A. Topsoil Type A

1. Topsoil type A shall be spread evenly in 10-inch compacted lifts to the full, compacted depth specified over the areas as shown on the Plans.
2. The soil shall be uniformly placed to a depth as shown in Plans.
3. All large clods, hard lumps and rocks 2-inches in diameter or greater and litter shall be raked up, removed and disposed of by the Contractor.

3.6 FINISH GRADING OPERATIONS

A. General: Grade with uniform slope between points where elevations are given or between such points and existing grades, unless indicated otherwise.

B. Soil Surface Tolerances:

1. Planting Areas: Bring finished soil surface to within 0.05 foot of finish grades indicated on Grading Drawings. Grade flatter areas at tighter tolerance if required to provide positive drainage.
2. Allowances: Make proper allowances for settlement, spoils from plant pits, etc.

C. Surface Drainage:

1. Slope finish grades to drain surface water away from buildings, walks, paving, and other structures unless otherwise indicated.
2. Slope finish grades to drain surface water to catch basins, area drains or swales as shown on the Drawings.

D. Depressions and Loose Material: Fill and compact depressions and remove all loose material to finish surface true to line and grade, presenting a smooth, compacted, and unyielding surface.

E. Excessive Compaction: Rip areas that have become compacted more than 85 percent compaction to a 12-inch depth. Roto-till and blade smooth prior to planting and irrigation.

3.7 PROTECTION

A. Erosion: Correct erosion and siltation damage at no cost to the Owner.

B. Settlement Repair: Correct settlement within the Warranty period at no cost to the Owner.

C. Drainage: Keep surface of topsoil in such condition that it will drain readily and effectively.

D. Materials, Tools, and Equipment: In handling materials and operating tools and equipment, protect the topsoil from damage by laying down planks, plywood, or other accepted protective materials where required.

E. Vehicular Traffic: Do not allow vehicles to travel in a single track. If ruts are formed, blade the topsoil smooth.

F. Storage of Materials: Do not store or stockpile materials on topsoil.

G. Dust Control: Use water trucks or temporary irrigation and take all precautions needed to prevent a dust nuisance to adjacent public or private properties.

3.8 CLEANUP

A. Daily: Keep all areas of Work clean, neat, and orderly at all times.

B. Final: Clean up and remove all deleterious materials and debris from the entire Work area prior to Final Completion.

END OF SECTION

SECTION 329200 – SEED MIX

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Soil preparation for all areas to be seeded.
2. Seed Mix A
3. Watering and Maintenance

1.2 RELATED SECTIONS

A. Section 311100 – Clearing and Grubbing

B. Section 312000 – Earth Moving

C. Section 329119 – Topsoil Placement & Grading

1.3 REFERENCES

A. AAN: American Association of Nurserymen

B. ANSI: American National Standards Institute

1. American Standard for Nursery Stock, ANSI Z60.

C. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1.4 SUBMITTALS

A. Seeding Schedule indicating dates anticipated for seed application.

B. Data for approval before seeding commences:

1. Cut sheet(s) indicating mix name, description, confirmation that seed mixes matches the areas and site conditions specified, and that the seed varieties are formulated for Pacific Northwest applications.
2. Complete analysis of each seed mix, include seed varieties description, percent of pure seed, germination, other crop seed, inert and weeds, and the germination test data. All crop seed in excess of one (1) percent must be itemized.
3. Commercial Fertilizer product information, including product label, fertilizer analysis, release rate, release mechanism, etc.

4. Technical data for the hydromulch and tackifier.

C. Data for Approval After Seed Mixes are Delivered.

1. Actual product labels from two (2) of the seed mix bags delivered to the site.
2. Confirmation that Owner's Representative has inspected all seed mixes, fertilizer, hydromulch, and tackifier containers, and confirmed that each item matches the products specified.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company operating in the United States having U.S. manufacturing facility/facilities specializing in manufacturing products specified in this section with a minimum of five years documented experience.

B. Installer Qualifications: shall be licensed in the State of Washington, shall have a minimum of 5 years demonstrated, successful, experience on projects similar in scope and materials.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Manufacturer's standard limited warranty unless indicated otherwise.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Acceptable manufacturer: Acceptable manufacturer: Sunmark Seeds, Address: 12775 NE Marx St., Building 14 Portland, OR 97230, Phone: 503.241.7333, Website: www.sunmarkseeds.com

B. Requests for substitutions will be considered in accordance with provisions of section 016000 Product Requirements.

2.2 GENERAL

A. Seed Mix shall be the mix indicated on the Plans, and shall meet or exceed the following:

1. Seeds shall be 98 percent pure with a minimum of 90 percent germination.
2. Total weed seed shall not exceed 0.5 percent.
3. Maximum percent inert and other crop shall be 1.50 percent of total seed mix
4. Seeds shall conform to the requirements of RCW Chapter 15.49, Washington State Seed Law, and where applicable, the Federal Seed Act.
5. All seeds shall be free of weed seed listed as primary noxious by RCW 15.49. Seeds shall not contain weed seeds listed as secondary noxious by RCW 15.49, single or collective in excess of the labeling tolerance specified by RCW 15.49
6. Rejection. When seeds furnished under this specification fail to meet the requirements within tolerance, as provided by RCW 15.49, the lot shall be rejected or subjected to fiscal adjustment.
7. Preparation for Delivery. Seeds shall be packed in clean, sound containers of uniform weight, and labeled as required by RCW 15.49

2.3 SEED MIX A

A. Seed Mix A shall be a 50/50 Blend of the following equivalent of Sunmark Seeds Woodlands Mix and Native Uplands seed mix:

1. Woodland Mix shall be a native tree and shrub mix comprised of the following:

Botanical Name	**Common Name**	**% By Weight**	**Seeds per lb. of Mix**	**Seeds per lb.**	**Actual % by Seed Size**
Rosa nutkana	Nootka Rose	25.00%	11250	45,000	
Symphoricarpos alba	Common Snowberry	20.00%	15200	76,000	
Cornus sericea	Redosier Dogwood	18.00%	31140	173,000	
Amelanchier alnifolia	Saskatoon Serviceberry	14.75%	5679	38,500	
Mahonia repens	Creeping Barberry	10.00%	5400	54,000	

Sambucus racemosa	Red Elderberry	9.00%	19440	216,000	
Alnus rubra	Red Alder	3.00%	20010	667,000	
Holiduscusdiscolor	Oceanspray	0.25%	17000	6,800,000	
	Totals:	**100.00%**	**125119**		**100.00%**

*Varieties may change at time of blending

2. Native Uplands Mix shall be a seed combination of the following drought-tolerant native grasses:

Botanical Name	**Common Name**	**% By Weight**	**Seeds per lb. of Mix**	**Seeds per lb.**	**Actual % by Seed Size**
Elymus glaucus	Blue Wildrye	50.00%	55000	110000	9.24%
Festuca rubra rubra	Native Red Fescue	30.00%	150000	500000	25.21%
Bromus carnatius	California Brome	10.00%	10000	100000	1.68%
Agrostis exarata	Spike Bentgrass	10.00%	380000	3800000	63.87%
	Totals:	**100.00%**	**595000**		**100.00%**

*Varieties may change at time of blending

2.4 HYDROSEEDING EQUIPMENT

A. A commercially produced hydroseeder with mechanical agitation shall be used, with the following characteristics:

1. Mechanical hydroseeder that utilizes water as a carrying agent, and a continuous, paddle-blade agitation system, capable of operating in two directions to ensure homogenous mixing of the specified materials, and equipped with distribution and discharge spray nozzles that will provide a uninform distribution of the slurry.
2. Homemade equipment or equipment with agitation by recirculation only shall not be permitted.
3. Hydroseeding equipment shall meet all federal, state, and local codes for backflow prevention during loading operation.

2.5 HYDROSEEDING MIX MATERIALS

A. Hydromulch shall be SILVA MULCH at forty-five (45) pounds per 1,000 square feet, or approved equal.

B. Binder shall be J-TAC at two (2) pounds per 1,000 square feet, or approved equal.

2.6 FERTILIZER

A. Commercial Fertilizer seed areas before and after planting shall be a commercially available, general purpose, 10-20-20 fertilizer for initial applications, and shall include the following analysis:

Total Nitrogen (N)	10 percent
3.4% Ammoniacal Nitrogen	
3.2% Urea Nitrogen	
3.3% Coated Slow Release Urea Nitrogen	
Available Phosphoric Acid ($P_2 0_5$)Slow Release	20 percent
Soluble Potash ($K_2 0$) Slow Release	20 percent
Sulfur (S)	4 percent
Boron (B)	0.06 percent
Copper (Cu)	0.06 percent
Iron (Fe)	1 percent
Manganese (Mn)	0.15 percent
Zinc (Zn)	0.14 percent

Derived from Urea, Sulfur-Coated Urea, Methylene Ureas, Ammonium Phosphate, Sulfate of Potash, Muriate of Potash, Iron Sulfate, Calcium and Sodium Borate, Copper Oxide and Sulfate, Iron Oxide Sulfate and Frit, Manganese Oxide and Sulfate, Zinc Oxide and Sulfate.

* Slowly Available Water-Soluble Nitrogen from Methylene Ureas.

B. Fertilizer shall be standard free flowing. Fertilizer shall be packaged in new, waterproof, non-overlaid bags clearly labeled as to weight, manufacturer and content.

C. Application rate of nitrogen: 1 lb Actual N_2/1000 square feet

PART 3 - EXECUTION

3.1 TIMING

A. Unless otherwise approved by the Owner's Representative, seeding shall conform to WSDOTSS Section 8-01.3(2)F, Dates for Application of Final Seed, Fertilizer, and Mulch.

B. If seeding application and establishment is not achieved due to the onset of the dormant season for growth, approval will be issued in April of the following spring, or at a date mutually agreed upon by the Owner and Contractor, once active seed growth has restarted, and an acceptable stand of turfgrass can be achieved.

C. The Contractor shall only be held to the 30 day maintenance period, during periods of active turfgrass growth. Maintenance is not required during dormant periods for turfgrass.

3.2 EXAMINATION

A. Examine areas to receive seed mix for compliance with requirements and other conditions affecting performance.

B. Verify finish grade is correct before beginning work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by seeding operations.

B. Loosen grade to a minimum depth of 2 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them offsite.

C. Finish Grading:

1. Finish grade is defined as the top surface of areas to receive seed prior to the installation, unless otherwise noted on the Drawings.
2. Grade, roll, rake to remove ridges and fill depressions, and meet finish grades.
3. Remove surface debris and rocks larger than one (1) inch in diameter. Any portion of a partially buried rock that measures greater than or equal to 1" diameter which is visible at the surface must be removed.
4. Do not disturb or interfere with surface drainage and/or drainage swales.
5. Finish grade within a tolerance of plus or minus 0.05 foot in ten (10) linear feet.
6. Use a cultipacker for final rolling of the prepared compacted bed prior to installing seed, to create a smooth, uniform plane, with loose, uniformly fine texture.

D. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

E. Obtain Owner’s Representative inspection and approval of finish grade prior to installation.

3.4 HYDROSEEDING EQUIPMENT FOR SEED MIX A APPLICATION

A. A commercially produced hydroseeder with mechanical agitation shall be used, with the following characteristics:

1. Mechanical hydroseeder that utilizes water as a carrying agent, and a continuous, paddle-blade agitation system, capable of operating in two directions to insure homogenous mixing of the specified materials, and equipped with distribution and discharge spray nozzles that will provide a uninform distribution of the slurry.
2. Homemade equipment or equipment with agitation by recirculation only shall not be permitted.
3. Hydroseeding equipment shall meet all federal, state, and local codes for backflow prevention during loading operation.

3.5 HAND SEED BED PREPARATION AND APPLICATION EQUIPMENT

A. Hand seed to provide even and uniform coverage. Hand seed half of the seeds while walking in one direction (e.g. north to south), and the other half in a perpendicular direction (e.g. east to west).

B. Contractor may use manual bed preparation and seeding equipment for seed application, with approval from the Owner's Representative, only in areas where seeding using the specified equipment is impractical, as a result of available space, or the potential to damage existing or constructed improvements.

C. Water-filled, hand pulled rollers shall be used to roll and smooth the seed beds.

3.6 INSTALLATION

A. Seed Mix A Establishment

1. Keep the seed bed uniformly moist until germination is evident (seedlings break the seedbed surface) by using a water truck as many times a day required to maintain constant moisture on the seedlings without drying out.
2. Apply a second half-rate application of fertilizer ten working days after seed application is completed.
3. Once all seedlings have reached approximately ½ inch above the seedbed, reduce watering frequency as necessary to maintain uniform moisture for healthy seed growth, but not dry out the seed bed.
4. Grow and maintain, including, but not limited to, watering, and clean-up of the seeded area until it has filled into an acceptable condition.
5. Acceptable condition shall mean a full stand of grass free of bare spots, weeds, and/or other undesirable plant species, as approved by the Owner.
6. Hand water to provide adequate moisture required for active grow-in, at least one (1) inch of water per week divided into waterings every other day.
7. Request the Owner inspect the seeded area to determine substantial completion, and if approved, immediately commence the 30 day Maintenance Period.
8. Substantial Completion shall be established if the seeded area is clean and free from trash and debris, grass is full green and vigorously growing; and the condition of the turfgrass meets the requirements established herein.
9. If the Owner finds any seed area unacceptable, the Contractor shall immediately repair the areas at Contractor's expense until the Owner determines acceptance.

3.7 30 DAY MAINTENANCE PERIOD

A. The 30-day Maintenance and Establishment Period will begin on the date Substantial Completion is issued by the Owner's Representative.

B. It is expressly understood that the Contractor will be responsible during the 30 maintenance and establishment period for normal landscape maintenance of the seeded areas.

C. Maintenance shall include, but not be limited to, watering, mowing, weeding, monitoring and treating any disease and/or pest-problems, and any other maintenance requirements (per standard trade practices) to keep the areas in a normal healthy growing condition.

D. Replace all seed areas if plants are dead, or dying to the point they are no longer in a satisfactory growing condition, as determined by the Owner for the duration of the period.

E. Make replacements within seven (7) working days of notification from the Owner. Remove dead seed areas within two (2) working days of notification and mark planting plan showing the exact location of replaced areas.

F. The fertilization, watering, and maintenance requirements specified in this Section are the minimum requirements. Provide additional fertilizer applications, waterings, mowings, and maintenance methods necessary, beyond the minimum requirements specified, to provide an acceptable stand of seed at Contractor's cost.

G. Owner's Recourse to Lack of, or Inadequate/Improper Maintenance

1. It is agreed that the Owner will suffer damage and be put to additional expense in the event that the Contractor does not perform maintenance duties as specified above, and as it may be difficult to accurately compute the amount of such damage, the Contractor hereby expressly covenants and agrees to the following maintenance performance measures:

   a. Weeding: The Owner will issue the Contractor up to two written notices during the maintenance period to weed contract planting areas. Whereupon the Contractor shall have seven calendar days, per notice, to complete the weeding. If weeding is not performed after the second notice, the Owner shall terminate the contract with the Contractor and contact the Contractor's Bonding Company to perform the work for the rest of the maintenance period.

   b. Replacing Dead or Dying Seed: The Owner will issue the Contractor up to two written notices during the maintenance period to replace dead or dying seed. Whereupon the Contractor shall have seven calendar days, per notice, to replace the dead or dying seeded areas. If replacement is not performed after the second notice, the Owner shall terminate the contract with the Contractor and contact the Contractor's Bonding Company to perform the work for the rest of the maintenance period.

   c. Regular watering: The Owner will issue the Contractor up to two written notices during the maintenance period to water the contract plants. Whereupon the Contractor shall have seven (7) calendar days, per notice, to water contract turfgrass. If plant irrigation is not performed after the second notice, the Owner shall terminate the contract with the Contractor and contact the Contractor's Bonding Company to perform the work for the rest of the maintenance period.

3.8 ACCEPTANCE OF ESTABLISHED AREAS

A. After completion of all seed mix installation and the 30 day maintenance period, the Owner will review all areas for compliance.

B. Areas with an acceptable, uniform stand of turfgrass, meadow and shrub mix, as determined by the Owner's Representative, shall be considered acceptable.

C. Once the date of acceptance has been agreed upon between the Owner and Contractor, the Owner shall immediately take over the maintenance of all accepted areas.

D. Seeded areas without an acceptable, uniform stand, or areas damaged through any other cause prior to this inspection shall be re-seeded using the material specified for that area as herein specified at the Contractor's expense, and regrown, including specified maintenance, until an acceptable stand is achieved.

3.9 CLEAN-UP

A. Regular policing of the project site of trash and project debris will be required.

B. The disposal to all trash will be the Contractors' responsibility.

C. Repair and replace broken or defective pavement, fencing, utilities, and all existing or constructed improvements damaged by the work of this section, as directed by the Owner's Representative.

D. Clean and remove tire tracks on all pavement, related to the work of this Section.

E. Clean and remove all material stockpiles and waste materials, dispose legally off site, and restore pavements, natural turf areas, and planting beds.

F. Sweep concrete pavement and wash free of stains, discoloration, dirt, infill materials, and other foreign material just prior to final inspection.

G. Remove surplus planting materials and rubbish from planting beds, rake beds neatly to an even, fine grade around all plants and wash clean all paved areas.

H. Leave project clean, and free from all plating operation debris.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work included in this Specification (whether mentioned or not) shall include, but not be limited to providing all plants, trees, groundcovers, and seed mix A specified on the Drawings, all equipment, labor, excavation, backfill, fertilizers, soil amendments, staking, protection, waste disposal, restoration, tools, materials, tests, permits, and other related items necessary for the complete installation and maintenance tasks specified herein, of all plant- materials described in the Drawings, in a first quality, workmanlike manner.

1.2 RELATED SECTIONS

A. Section 311100 – Clearing and Grubbing

B. Section 312000 – Earth Moving

C. Section 329113 – Bark Mulch & Wood Chips

D. Section 329119 – Topsoil Placement & Grading

E. Section 329200 – Seed Mix

1.3 REFERENCES

A. AAN: American Association of Nurserymen

B. ANSI: American National Standards Institute

1. American Standard for Nursery Stock, ANSI Z60.

C. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1.4 SUBMITTALS

A. Plant Documentation:

1. Within 30 days after award of Contract, submit documentation that all specified plant materials have been ordered. Should the Contractor neglect to provide this documentation within the allocated time, Contractor may forfeit any substitution benefits.
2. List respective growing or storage locations with addresses.
3. List suppliers' names, addresses, and phone number.

1.5 QUALITY ASSURANCE

A. The Contractor shall provide one person who:

1. Directs work performed under this section.
2. Is familiar with the materials and best methods for installation.
3. Is present at all times during execution of work in this section.

B. Installer Qualifications: The Landscape Contractor shall hold a currently active, license in the State of Washington, shall have a minimum of 5 years' experience, and shall have completed landscaping work similar in material, design, and extent to that indicated for this Project, and with a record of successful landscape establishment.

C. Contractor must be familiar and comply with American Standard for Nursery Stock published by the American Association of Nurserymen.

D. The Contractor shall continuously maintain a competent superintendent or foreman during the progress of the work, with the authority to act for the Contractor in all matters pertaining to the work. The Contractor shall give personal attention to the fulfillment of the Contract and shall keep the work under control. Subcontractors shall not be recognized, and all persons engaged in the work will be considered employees of the Contractor and their work shall be subject to the provisions of the Contract and Specifications.

E. The Contractor shall confine operations to the working areas allotted by the Owner for operations, including material and equipment storage.

F. The Contractor shall progressively clean the work site of debris and rubbish as the work proceeds.

G. Plant Material:

1. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of the current edition of ANSI Z 60.1 "American Standard for Nursery Stock."
2. All plants shall be shipped with certificates of inspection, as required by law.
3. Each tree and shrub shall bear a securely attached waterproof tag bearing legible designation of botanical and common name.
4. Plant names shall conform to the latest edition of Standard Plant Names as adopted by the American Joint Committee of Horticulture Nomenclature.

H. Measurements: Measure trees and shrubs according to the current edition of ANSI Z 60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes.

I. Field quality control and inspections:

1. All plant material shall be inspected by the Owner's Representative prior to planting.
2. Notify the Owner of delivery schedule 24 hours in advance to allow inspection upon arrival at the work area.
3. Rejected plant materials shall be set apart from approved materials, and removed from the project site by the end of the day of rejection.

1.6 DELIVERY

A. Bare root and balled and burlapped plants shall conform to ANSI Z60.1.

B. Notify the Owner of delivery schedule 24 hours in advance to allow inspection upon arrival at the work area.

C. Remove unacceptable plant material from the work area immediately.

D. Do not deliver more plant materials than can be planted in one week.

E. Protect plants during delivery to prevent damage to root balls or desiccation of leaves.

1.7 STORAGE

A. Heel in bare-root or balled and burlapped plants immediately upon delivery if not planted within 4 hours.

B. Store plants in shade and protect from harmful weather until planted.

C. Water, maintain, and protect stored material from drying or other injury or damage.

D. Store plants in upright position and allow sufficient ventilation.

1.8 HANDLING

A. Do not pick up containerized or balled plants by stems or trunks.

B. Do not drop plants.

1.9 SITE CONDITIONS

A. Plant after preparation of plant beds and when soil conditions are suitable in accord with locally accepted practice.

B. Planting Conditions: Planting is not permitted under the following conditions, unless otherwise approved:
1. Cold Weather: Less than 32°F.
2. Hot Weather: Greater than 90°F.
3. Wet Weather: Saturated soil.
4. Windy Weather: Wind velocity greater than 20 mph.

1.10 WARRANTY PERIOD

A. The Contractor will not be held responsible for vandalism, theft, atypical weather conditions or hidden peculiarities of work area during the warranty period.

B. Plant materials shall be in healthy condition at end of the warranty period.

C. Remove dead and rejected material within five days of being so directed. Replace as soon as possible.

D. Repair, at no additional cost to the Owner, any damage to other plants or other property caused by the Contractor during replacement of plant materials during the warranty period.

PART 2 - PRODUCTS

2.1 WATER

A. Provide all arrangements necessary to ensure an adequate supply of water to maintain all plants in this Contract.

B. Furnish necessary hose, equipment, attachments, pumps, watering trucks, and/or accessories for the adequate irrigation of planted areas, as may be required to complete the work specified.

2.2 PLANTS

A. Quantities and Species/Varieties

1. Compliance with Types and Quantities: The Contractor shall plant the specified plant species, varieties, and quantities as shown on the Plans, the plant list and as described herein.
2. A list of specified plants, quantities, condition, and sizes can be found on the plans.
3. Substitutions: No substitutions shall be made without written approval by the Owner. Requests for substitutions must be accompanied by written proof, on supplier letterhead from no less than five sources, I.E. major sources that supply the specified plant material, that any plant is not available.
4. Plants shall be from stock well acclimated to prevailing conditions at the project site, and which have been consistently cultivated in these conditions.
5. Cold storage plants shall be rejected.
6. Plants shall be First Quality, fresh, well foliaged, in prime condition when in leaf, exhibiting normal habit of growth, having all buds intact, and viable.
7. Plants shall be free from disease, injury, insects, insect eggs, root and other types of weevils, larva, all seeds, weed roots, and defects such as knots, sun scald, injuries, abrasions, disfigurement and irregular growth arising from frost damage.
8. Encircling Roots:
   a. Do not deliver any plants with encircling roots to the job site.
   b. Plants with roots encircling the root mass more than once shall be rejected.

B. General Plants Requirements

1. Do not prune or top the plant before delivery.
2. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage.

3. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape.
4. Provide protective covering during delivery.
5. Dry and/or broken root balls and/ or damaged containers shall be rejected.
6. Do not drop trees and shrubs, or transport them by the trunk without supporting the rootball, during delivery.

C. Container Grown Plants:

1. Shall have been grown in their containers for at least one full year to develop a root ball incapable of falling apart, once it is removed from the container.
2. Shall not be root bound in the container to the point that the root mass encircles the root ball, or to the point the container must be cut off for removal.
3. Shrubs with root balls incapable of holding together after removal from the container, or with excessive root masses enveloping the rootball shall be rejected by the Owner's Representative.
4. Root Crowns: Root crowns shall be above ground level. Plants delivered to the site with root crowns buried in root ball or nursery ground level shall be inspected by the Owner to determine if removing the soil above the root crown is sufficient a measure to gain acceptance of the plant. If removing soil from the top of the root ball to expose the top of the root crown is insufficient measure to gain acceptance, then the Contractor shall remove the plant from the site and replace it with another acceptable plant.

D. Plugs: Plugs shall be in deep, open bottomed, 10 cubic inch containers. No species shall be substituted without approval of the Landscape Architect.

E. Field Grown Plants:

1. Deliver freshly dug ball and burlap stock with firm, natural balls of earth of sufficient diameter to encompass fibrous and feeding root systems, necessary for the full recovery of the plant, in accordance with American Standard for Nursery Stock.
2. Root ends shall have been cleanly cut flush with the sides of the root ball.
3. Rootballs shall be firm, unyielding, and do not fall apart when the wrapping is removed for planting.
4. Shall not be root bound to the point that the root mass encircles the root ball, or to the point roots must be pruned before planting.
5. Shrubs with root balls incapable of holding together after the burlap is removed for planting, or with excessive root masses enveloping the rootball shall be rejected by the Owner's Representative.
6. Handle ball and burlap stock by the root ball, never by the main stem.
7. Trees found to be handled by the main stem shall be rejected by the Owner.

2.3 BARK MULCH

A. Refer to Section 329113 – Bark Mulch & Wood Chips.

PART 3 - EXECUTION

3.1 GENERAL

A. All areas shall be finish graded and approved by the Owner before planting of plants.

B. Finished grades and elevations in all areas shall allow for planting soil and mulch added to individual planting areas as specified herein.

C. All grades shall flow smoothly into one another and produce positive drainage.

D. Mitigate adverse drainage conditions that may affect plant growth.

E. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately.

F. If planting is delayed more than 6 hours after delivery, set planting materials in a nursery area as approved by the Owner.

G. Protect stockpiled materials from weather and mechanical damage.

H. Set balled stock on ground and heel-in in the holding area. Heeling-in includes covering root ball with topsoil mix, mulch, or compost.

I. Maintain plants in a moist condition in the heeling mix.

J. Do not remove container-grown stock from containers before time of planting.

K. Water as often as necessary with a fine-mist spray to maintain root systems in a moist condition.

3.2 STAKING AND LAYOUT

A. Stake all tree locations in the field with flagging, with the tree name written boldly and clearly in ink, for the Owner's Representative to verify against the Drawings.

B. Draw the outlines of all shrub beds with marking paint, for Owner's Representative to verify against the Drawings.

C. Make minor adjustments as marked in the field by the Owner's Representative.

3.3 PLANT INSTALLATION

A. Planting Trees & Shrubs

1. Transport carefully to prevent damage. Tie branches as necessary. Use burlap bags to protect bark from rope chafing. Do not drag plant material, or pull or carry plant materials by the crown, foliage, or trunk.
2. Dig pits for plants as indicated on Plans, and consistent with good horticultural practice.
3. The inside surfaces of all planting pits are to be rough, not smooth.
4. Backfill material for plantings is to be Topsoil Type A and Common Borrow A per the Drawings.

5. If the Contractor encounters clay soil or any unusual condition which may be detrimental to the new planting, the Contractor shall notify the Owners Representative immediately.
6. The Contractor will ensure that the sides of the planting pit are scarified to help in root penetration.
7. Place the plant in an upright and vertical position in the center of the hole, with the side containing the fullest amount of foliage faced toward the primary direction viewed by the public.
8. Weeds in the top of the root balls shall be removed prior to planting.
9. The root crown shall not be buried in the originally dug root ball.
10. If the root crown of a plant is found to be buried in the root ball, the Contractor shall gently remove soil from the top of the root ball to expose the top of the root crown. If this measure is insufficient to gain acceptance from the Owner, then the Contractor shall immediately replace the plant with another acceptable specimen.
11. Place Topsoil Type A around ball in layers, tamping to settle backfill and eliminate voids and air pockets.
12. When pit is approximately ½ back filled, water thoroughly before placing remainder of backfill.
13. Allow water to infiltrate into soil.
14. Repeat watering until no more is absorbed.
15. Water again after placing and tamping final layer of backfill.
16. Stake trees and large shrubs as indicated on the Drawings.
17. Fine grade the planting area to remove rocks and debris, and create a smooth, uniform surface that provide positive drainage, and is free of humps, and low spots.
18. Apply the mulch as indicated on the Drawings.
19. Maintain plants in a vigorous thriving condition by watering, correct pruning practices, cultivating, weeding, fertilizing, and other necessary operations, until Substantial Completion is awarded.

3.4 30 DAY MAINTENANCE AND ESTABLISHMENT PERIOD

A. The 30-day Maintenance and Establishment Period will begin on the date Substantial Completion is issued by the Owner's Representative.

B. Maintenance shall include, but not be limited to, watering, weeding, monitoring and treating any disease and/or pest-problems, and all other maintenance requirements specified below, required to keep all plant materials in a normal healthy growing condition.

C. Application of pesticides shall be done only as approved by the Owner by workers possessing a State Pesticide Certification.

D. Keep plant materials and planting areas free from weeds and grasses by the application of suitable herbicides per manufacturer's instructions, or hand pulling.

E. Consult with the Owner before pruning plant materials.

F. Staking, guys, and saucers shall be kept intact and adjusted as required to provide firm support.

G. Maintain fully formed watering saucers.

H. Replace all dead or dying plants when no longer in a satisfactory growing condition as determined by the Owner, for the duration of the period.

I. Make plant materials replacements within seven (7) working days of notification from the Owner. Remove dead plant materials within two (2) working days of notification and mark planting plan showing the exact location of replaced areas.

J. Replace mulched areas that are damaged, to the specified compacted depth, using the specified mulch.

K. Do not add new mulch over existing mulch contaminated with soil or other deleterious materials.

L. The fertilization, watering, and maintenance requirements specified are the minimum requirements, and do not relieve the Contractor of the responsibility to provide acceptable plant materials. Contractor shall provide all additional fertilizer applications, waterings, and maintenance methods necessary beyond the minimum requirements specified in this Section to provide acceptable plant materials at Contractor's cost as part of the unit price.

3.5 OWNER'S RECOURSE FOR LACK OF REPLACEMENT

A. It is agreed that the Owner will suffer damage and be put to additional expense in the event that the Contractor does not perform duties as specified above, and as it may be difficult to accurately compute the amount of such damage, the Contractor hereby expressly covenants and agrees to the following maintenance performance measures:

B. Replacing Dead or Dying Plants: The Owner will issue the Contractor up to two written notices during the Maintenance Period to replace dead or dying plants. Whereupon the Contractor shall have seven (7) calendar days, per notice, to replace the dead or dying plants. If plant replacement is not performed after the second notice, the Owner shall terminate the contracts with the Contractor and contact the Contractor's Bonding Company to perform the work for the rest of the maintenance period.

C. Regular Watering: The Owner will issue the Contractor up to two written notices during the maintenance period to water the contract plants. Whereupon the Contractor shall have seven (7) calendar days, per notice, to water contract plants. If plant irrigation is not performed after the second notice, the Owner shall terminate the contract with the Contractor and contact the Contractor's Bonding Company to perform the work for the rest of the maintenance period.

3.6 ACCEPTANCE OF PLANT MATERIAL INSTALLATION

A. After completion of all plant material installation and the 30 day maintenance period, the Owner will review all plantings for compliance.

B. Areas with acceptable, healthy, and vigorous growing plants, and free from all visible injury or deleterious conditions, with clean, uniform mulch layer at the depth specified, as determined by the Owner's Representative, shall be considered acceptable.

C. Once the date of acceptance has been agreed upon between the Owner and Contractor, the Owner shall immediately take over the maintenance of all accepted plant materials.

D. Plant materials and planting areas not containing acceptable plant materials or condition, or areas damaged though any other cause prior to this inspection, shall be repaired using the material specified for that area as herein specified at the Contractor's expense, including specified maintenance, until an acceptable condition is achieved.

3.7 CLEAN-UP

A. Regular policing of the project site of trash and project debris will be required.

B. The disposal to all trash will be the Contractors' responsibility.

C. Repair and replace broken or defective pavement, fencing, utilities, and all existing or constructed improvements damaged by the work of this section, as directed by the Owner's Representative.

D. Clean and remove tire tracks on all pavement, related to the work of this Section.

E. Clean and remove all material stockpiles and waste materials, dispose legally off site, and restore pavements, natural turf areas, and planting beds.

F. Sweep concrete pavement and wash free of stains, discoloration, dirt, infill materials, and other foreign material just prior to final inspection.

G. Remove surplus planting materials and rubbish from planting beds, rake beds neatly to an even, fine grade around all plants and wash clean all paved areas.

H. Leave project clean, and free from all plating operation debris.

END OF SECTION

SECTION 331100 – WATER UTILITY DISTRIBUTION PIPING – FOR SCHEDULE B ONLY

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes water-distribution piping and specialties outside of building footprints, including, but not limited to submersible pump, wellhead completion, piping, valves, fittings, disinfection, flushing, and testing.

1.02 SUBMITTALS

A. Product Data: For the following:

1. All types of piping used.
2. Valves and accessories.
3. Pump and accessories.

    a. Complete shop drawings and manufacturer's information to include pump and motor performance data, complete dimensions, discharge pipe size, materials of construction, control system, electrical data, and factory pump tests.

B. Field quality control test reports.

C. Operation and Maintenance Data: For the following:

1. Valves.
2. Pump.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with standards of authorities having jurisdiction for potable-water service piping, including materials, installation, testing, and disinfection.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water service piping.
2. Comply with NSF 61 for materials for water service piping and specialties for domestic water.

1.04 LAYOUT OF WORK AND SURVEYING

A. Construction staking shall be per Section 015100 – Field Engineering.

PART 2 – PRODUCTS

2.01 GENERAL

A. Pipe sizes are nominal inside diameter unless otherwise noted.

B. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data, such as thickness for piping.

C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in this section.

2.02 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.03 PIPING MATERIALS

A. Refer to Part 3, “Piping Installations” article, for applications of pipe, tube, fitting, and jointing materials.

2.04 WATER SERVICE PIPE AND FITTINGS

A. Water Service Lines: Water service lines 2 inches in diameter or less shall meet the requirement of AWWA C901, IPS SDR 11, 160 psi, high-density polyethylene PE3408, and be per WSDOT 9-30.6(3) B.

B. Joining system shall be by butt-fusion and electrofusion techniques.

C. Insert Fittings for PE Pipe: ASTM D2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.

D. Molded PE Fittings: ASTM D3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

2.05 MISCELLANEOUS FITTINGS AND ACCESSORIES

A. Dielectric Insulated Unions: Dielectric insulated unions shall be used to connect dissimilar metals. They shall separate the metals so that the passage of more than 1% of the galvanic current, which would exist with metal-to-metal contact, is prevented. Unions shall be of the same material as the pipe to which attached, and pressure and temperature ratings shall be no lower than that of the piping system in which installed.

2.06 MISCELLANEOUS MATERIAL

A. Utility marking tape shall be provided and installed by the Contractor, per the Drawings.

PART 3 – EXECUTION

3.01 LAYOUT

A. Construction staking shall be per Section 015100 – Field Engineering.

3.02 TRENCH EXCAVATION AND BACKFILL

A. Perform trench excavation, bedding, and backfill in accordance with Section 312000 – Earth Moving.

3.03 PIPING INSTALLATION

A. All pipe shall be installed in conformance with manufacturer's recommended procedures for the particular pipe being installed. In addition, comply with the installation requirements of the Uniform Plumbing Code.

B. Do not install any piping when the temperature drops below freezing nor until trenches have been thoroughly and properly dewatered.

C. Pipe shall be firmly and properly bedded and then partially backfilled between pipe joints and valves.

D. Pipe ends shall be neatly and squarely cut, all burrs removed, and reamed inside to provide a tight joint and clean, smooth flow line.

E. The Contractor shall be responsible for determining appropriate and correct radii of curves in the lines and providing whatever combination of pipe lengths and/or standard and special couplings are necessary for proper completion of the work. No pipe shall be installed under tension.

F. Threaded joints shall be made up with approved joint compound applied smoothly and evenly per manufacturer's directions. All joints shall be made up tight with tongs and wrenches without the use of handle extensions.

G. Once a joint has been tightened, it shall not be backed off unless threads are recleaned and new compound applied. Any joints that leak shall be cleaned and remade with new material. Caulking or thread cement to make joints right will not be accepted by the Owner.

H. Unions shall be installed in all threaded joint piping to facilitate removal of valves, meters, etc., for maintenance/repair in accordance with accepted trade practice and also in accordance with the Plans.

I. Temporarily cap the ends of specified piping runs as called for on the drawings and mark the termination location with a 2x4 post painted and installed, as shown on the drawings.

3.04 UTILITY CROSSINGS

A. Water lines and sewer lines shall be separated by a 10-foot lateral separation or by a combination of 5-foot lateral separation and 1.5-foot vertical separation.

B. Where crossings are required with domestic water and sanitary sewer lines, no joint shall be laid closer to the crossing than one-half the length of a standard length of pipe, and where practical at the crossing, there shall be a 36-inch vertical separation. Where a 36-inch separation between the lines cannot be maintained, the drain line shall be inserted into a 20-foot minimum length of PVC pipe, which will act as a protective "conduit" and keep the exposed drain line joints 10 feet away from the crossed line. The drain line shall be cut as necessary to place a joint at the ends of the conduit, not inside. Where the necessary length of conduit is more than 20 feet, the Contractor shall glue "bridging" pieces to the sewer pipe to prevent sag in the line.

3.05 HYDROSTATIC PRESSURE TESTING

A. All water mains shall be hydrostatically tested. Water for testing must be obtained by the Contractor by arrangement with the Owner. A positive displacement type pump shall be furnished by the Contractor for the testing. Feed for the pump shall be from a clean container, wherein the actual amount of "makeup" water can be measured.

B. Upon completion of a section of the pipe installation, no more than 1,500 linear feet of water main shall be subjected to a pressure test of 150 pounds per square inch, or twice the system pressure, using the greater value for a period of not less than 1 hour. Valves shall be provided to withstand the pressure as outlined herein. During this test, the rate of leakage shall not exceed 50 gallons per inch diameter per mile per day. Any leakage caused by defective workmanship or materials shall be repaired, and the line shall again be tested to full compliance at the Contractor's expense.

C. Prior to calling for the inspector to witness the pressure test, the Contractor shall first perform a satisfactory pressure test. The allowable leakage rate per 100 feet of each size pipeline is as follows:

$$\frac{L = N \times D \times (P)^{0.5}}{7{,}400}$$

in which: L = Allowable leakage, gallons per hour.
N = Number of joints in the length of the pipeline tested.
D = Nominal diameter of the pipe in inches.
P = Average test pressure during the leakage test, psi.

3.06 DISINFECTION

A. Water mains and appurtenances shall be disinfected before being placed in service. Water for disinfection must be obtained by the Contractor by arrangement with the Owner. The following paragraphs describe specific procedures to be used by the Contractor in maintaining a satisfactory environment for prevention of contamination of the proposed water system installation, the cleanliness of the pipe and fittings, and the actual method of disinfection.

B. Disinfection Methods:

1. When the line is completed and ready to disinfect, water shall be allowed to flow in slowly until it appears at the far end of the line so as not to displace the disinfecting agent. The system shall then be allowed to stand for at least 24 hours. The line shall then be flushed until a test shows no more than 0.2 parts per million of available chlorine.
2. The Contractor is herein advised that prior to making any restorations, the Contractor shall first demonstrate to the Owner that the new water main has adequately passed a pressure test, been adequately flushed, and finally passed the required bacteriological test.
3. During the disinfection process, the Contractor shall take particular care in flushing and wasting the chlorinated water from the mains to ensure that the flushed and chlorinated waste does no physical or environmental damage to property, streams, storm sewers, or any waterways. The Contractor shall chemically or otherwise treat the chlorinated water to prevent damage to the effected environment, particularly aquatic and fish life of receiving streams.
4. Before placing the lines in service, a satisfactory report or approval shall be received from a state Department of Social and Health Services (DSHS)-approved laboratory on samples collected from representative points in the new system. The Owner shall collect all samples for the bacteriological tests. However, the Contractor shall notify the Owner for collection of samples 2 days in advance, and schedule on days wherein samples can be conveniently processed by a state DSHS-approved laboratory. If any of the pipeline materials are replaced thereafter, then that section shall again be disinfected and tested for bacteriological count.

5. If disinfection of mains by the above methods prove unsatisfactory and the lab report indicates any type of bacteria count, then the Owner may direct the Contractor to use one of the following two disinfection methods until a satisfactory report is obtained:

   a. Method No. 1:

      1) A chlorine gas-water mixture, or dry chlorine gas, may be applied by means of a chlorinator, or the gas may be fed indirectly from a chlorine cylinder equipped with the proper devices for regulating the flow, and the effective diffusion of gas within the pipe. (Use of the chlorinator is preferred to direct feed from the cylinder.)
      2) Point of Application: The preferable point of application for the chlorinating agent is at the beginning of the pipeline at the wellhead, or any valved section thereof, and through a corporation stop inserted in the horizontal axis of the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension.

         a) Rate of Application: Water source of supply shall be controlled to flow very slowly into the newly-laid pipeline during application of the chlorine. The rate of chlorine gas/water mixture or dry gas feed shall be in such proportion to the rate of water entering the newly-laid pipe that the dose applied to the water entering the newly-laid pipe will be at least 50 parts per million. A color comparator set shall be used to determine chlorine residual.
         b) Cross-Connection Prevention: A cross-connection control device (DSHS-approved) shall be utilized to prevent potential cross connections.
         c) Retention Period: Treated water shall be retained in the pipe at least 24 hours and preferably longer. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least 5 parts per million.
         d) Chlorinating Valves and Hydrants: In the process of chlorinating newly-laid water pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent under normal operating pressure.
         e) Final Flushing and Chlorine Residual Test: Following chlorination, all treated water shall be thoroughly flushed from the newly-laid pipe at this extremity until the replacement water throughout its length, upon test, shows the absence of chlorine (or in the event chlorine is normally used in the source of supply, then the tests shall show a residual not in excess of that carried by the system.)
         f) Repetition of Procedure: Should the initial treatment prove ineffective, the chlorination procedure shall be repeated until tests show that the water sample from the newly laid pipe conforms to the requirements of these Specifications.

   b. Method No. 2:

1) Calcium or Sodium Hypochlorite or Chlorinated Lime in Water: A mixture of either calcium of sodium hypochlorite or chlorinated lime of known chlorine content and water may be substituted as an alternative for liquid chlorine. (Typical commercial products of this type are HTH, Perchloron, Chlor, Purex, etc.)
2) Proportions of Chlorine Compound and Water Mixtures: Prepare a solution containing approximately 5% available chlorine by weight, in the case of HTH or Perchloron, at 70% available chlorine, use 6 pounds per 10 gallons of water. In the case of Chlor, at 15% available chlorine, add 2 parts water to 1 part of Chlor. For other strength compounds, adjust the dilution accordingly.
3) Preparation and Application of Chlorine Compound: To prepare the chlorine-compound/water mixture, first make a paste, and then thin to a slurry to ensure getting all active ingredients into solution. The prepared solution shall be injected by means of a hypochlorinator, or hand- or engine-operated pump approved by the Owner. Pumping into the newly laid pipe shall follow the conditions outlined under Method No. 1 for chlorine application. See Item Nos. “a” to “e” inclusive under Method No. 1. For solutions containing approximately 5% available chlorine, the rate of bleeding the main to be sterilized should be 1,000 times the rate of feed or injection of the chlorine solution.
4) Further Procedure: Provisions for final flushing and bacteriological testing under this alternative should be the same as those described in Item Nos. “f” and “g” under Method No. 1 above.

C. Bacteriological Tests:

1. Before placing the lines or appurtenances in service, a satisfactory report or approval shall be received from a state DSHS-approved laboratory on samples collected from representative points in the new system. The Owner shall collect all samples for the bacteriological tests.

END OF SECTION 331100

SECTION 331300 – WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes the procurement and installation of water lines, valve, and appurtenances.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections apply to this Section.

1.3 STANDARD SPECIFICATIONS

A. All work to be performed and materials to be used shall be in accordance with the current edition of the Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.

B. Contractor shall have one copy of the Standard Specifications and all amendments therein, and applicable WSDOT Standard Plans at job site.

C. Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. Legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

D. All work shall conform to the specifications listed in WAC 246-290 (Group A Public Water Supplies) and the latest editions of the following references: The Washing State Department of Health Water System Design Manual, Washington State Department of Transportation (WSDOT) standard specifications, APWA standard specifications, AWWA standards, UPC, and the applicable county rules, regulations, and ordinances. The standards are listed in order of preference in the event that a conflict in standard arises.

1.4 QUALITY ASSURANCE

A. Contractor is responsible for all effort necessary to complete work in accordance with drawings and standards, until certified by the engineer and state and local agencies for correct installation and satisfactory operation of all equipment.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, standard drawings, and catalog cuts for the following:

1. Pipe and pipe fittings

2. Valves

3. Connections, bends, and saddles

4. All miscellaneous components and appurtenances

1.6 STORAGE, AND HANDLING

A. Contractor shall practice the preventive and corrective measures during construction specified in Section 4 of AWWA Standard C651 which covers requirements for protecting the pipe and fittings from contamination and describes disinfection procedures to be followed during pipe installation.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Pipe size and material is specified on construction documents. Water mains equal to or over 4" diameter shall be Polyvinyl Chloride (PVC) pipe Class 150 DR 18 pressure rated pipe per AWWA C900 or Class 350 Ductile Iron unless otherwise specified.

B. Water main running to and from reservoir shall be Class 350 Ductile Iron.

C. Water service lines shall be NSF approved blue polyethylene pipe, meeting the requirements of AWWA C901, sized per the Plans.

D. Pipe joints shall use elastomeric-gasket couplings and fittings. Gaskets shall be by the same manufacturer as the pipe and intended for use with the exact pipe installed herein.

E. All fittings for ductile iron mains equal to or over 4" diameter shall be Class D, Cast Iron, short body type according to AWWA Standard C110. Fittings shall be either Cast Iron Fittings, Flange End, with flange adapters suitable for joining PVC pipe for Ductile Iron Fittings, or Mechanical Joint End.

F. Backwash shall be 3" Sch 80 Polyvinyl Chloride (PVC) pipe, or approved equivalent.

1. Air gap shall be provided at backwash disposal outflow.

2.2 VALVES

A. All gate valves shall conform to ANSI/AWWA Standard C509 or latest revision, Gate Valves for Ordinary Water Service, as manufactured by Mueller or AVK only with the following modifications:

1. All gate valves shall be Mueller or AVK resilient wedge gate valves unless otherwise noted on the plans.

2. All gate valves shall be non-rising stems, furnished with O-Ring stem seals. Number, size and design shall conform to Section 3.12 of the AWWA Standards for gate valves.

3. All gates shall have square operating nut which operates left (counterclockwise) to open.

B. Corporation stops for service connections shall conform to Section 9-30.6(2) of the WSDOT Standard Specifications. Valve boxes shall be installed on all corporation stops.

C. Traffic-rated valve boxes and lids shall be as indicated in the plans. All buried valves shall be provided with a traffic-rated valve box and lid.

2.3 DETECTABLE MARKING TAPE

A. Detectable marking tape shall meet the requirements of Section 9-15.18 of the WSDOT Standard Specifications.

2.4 BLOW-OFF ASSEMBLY

A. Blow-off assemblies shall be in conformance with the Plans.

2.5 WATER METERS

A. Service meters shall be consistent for all services for the development, submitted to Engineer for approval, sized per Plans.

2.6 CONCRETE (THRUST BLOCKING)

A. Unreinforced concrete shall be commercial class conforming to Section 6-02.3(2)B of the current Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation and as shown in the plans.

PART 3 - EXECUTION

3.1 PIPE AND FITTINGS

A. Pipes shall be installed in conformance with Section 7-09.3 of the WSDOT Standard Specifications.

B. Detectable Marking tape shall be installed over all water lines including service lines. The tape shall be placed approximately 1-1.5 feet below the ground surface and shall extend the full pipe length. Detectable marking tape shall meet the requirements of Section 9-15.18 of the WSDOT Standard Specifications.

3.2 VALVES

A. Valves shall be installed in conformance with Section 7-12.3 of the WSDOT Standard Specifications.

B. The Contractor shall maintain the location and provide access to all valves within the project. No valve shall remain buried during construction.

3.3 SERVICE CONNECTIONS

A. Service connections shall be installed in conformance with Section 7-15.3 of the WSDOT Standard Specifications.

3.4 TESTING AND STERILIZATION

A. Testing and sterilization of the water mains shall be in conformance with Section 7-09.3 of the WSDOT Standard Specifications.

B. Testing and sterilization of the service connections shall be in conformance with Section 7-15.3(1) of the WSDOT Standard Specifications.

END OF SECTION

SECTION 331443 – PACKAGED PUMPING SYSTEM

Lead-free statement: Several plumbing fixtures described in this section fall under jurisdiction of the Federal Reduction of Lead in Drinking Water Act (42 USC 300G) which mandates that effective January 4, 2014 the wetted surfaces of any valve, fitting or fixture that comes in contact with potable water must have a weighted-average lead content of no more than 0.25 percent. The end user of this document is urged to be aware of the requirements of authorities having jurisdiction and to specify Lead-Free products when editing this document. Additional information can be found online at www.zurn.com/leadfree.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procurement and installation of above ground pump house plumbing and appurtenances including:

1. Pipe & Fittings
2. Valves
3. Pressure Gauges
4. Booster Pumps

1.2 RELATED DOCUMENTS

B. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.3 STANDARD SPECIFICATIONS

A. All work to be performed and materials to be used shall be in accordance with the current edition of the Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.

B. Contractor shall have one (1) copy of the Standard Specifications and all amendments therein, and applicable WSDOT Standard Plans at job site.

C. All work shall conform to the specifications listed in WAC 176-160 (Minimum Standards for Construction and Maintenance of Wells), WAC 173-162 (Regulation and Licensing of Well Contractors and Operators), WAC 246-290 (regulations pertaining to Public Water Systems), and the latest editions of the following references: The Washington State Department of Health (WSDOH) Water System Design Manual, APWA standard specifications, AWWA

standards, UPC, and the applicable county rules, regulations, and ordinances. The standards are listed in order of preference in the event that a conflict in standard arises.

D. Execute and inspect all electrical work in accordance with Underwriters Laboratories (UL), and all local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the more stringent requirement shall be followed. Follow application sections and requirements and testing procedures of NFPA, IEEE, NEMA, CBM, ANSI, NECA, ICEA, and NETA.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop drawing showing pump house plumbing and electrical.

C. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals

D. Record Drawings: Contractor shall maintain a set of As-Built Drawings to indicate all deviations from the original design

1. Changes shall be legibly documented on Drawings while work is in progress.

2. Final “As-Built” drawings shall be prepared by the Contractor on a clean set of drawings after final inspection.

3. Final “As-Built Drawings” shall be delivered to the Engineer for transmittal to the Owner

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. NSF Compliance: All products in contact with potable water shall:

1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

2. Comply with NSF 372, "Drinking Water System Components – Lead Content.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Protect stored piping and equipment from moisture and dirt. Elevate above grade.

C. Protect flanges, fittings, and specialties from moisture and dirt.

D. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron Pipe: Class 52, AWWA C151

1. Joints: Flanged Joints per AWWA C115, Class 125 or 150

2. Fittings: Shall be ductile iron and shall meet the requirements of AWWA C110 or AWWA C153. Fittings shall be cement mortar lined, meeting the requirements of AWWA C104.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.2 JOINING MATERIALS

A. Type and material recommended by piping system manufacturer, unless otherwise indicated. Must have pressure rating at least equal to piping being joined.

2.3 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as piping to be joined, with pressure rating at least equal to and ends compatible with piping.

2.4 BALL VALVES

A. Ball Valves (Above Grade Piping):

1. PVC Schedule 80 Ball Valve less than 4 inches:

a. True Union Type

b. CWP Rating: 200 psi minimum.

c. Full Port Opening

d. NSF Approved

2.5 GATE VALVES

A. OS&Y, Rising-Stem, Resilient-Seated Gate Valves (Above Grade Piping):

1. Description:

a. Standard: AWWA C509

b. CWP Rating: 200 psig

c. Body Material: ASTM A 126, gray iron with bolted bonnet.

d. Ends: Flanged

e. Trim: All bronze.

f. Disc: Solid wedge with resilient coating.

g. Packing and Gasket: Asbestos free.

2.6 PRESSURE SUSTAINING VALVE

A. Basis-of-Design Product: subject to compliance requirements, provide Watts ACV Pressure Sustaining Valve with Solenoid Feature Model F116-31 or an engineer approved equivalent.

1. Description:

a. Type: Globe

b. Solenoid Action: Energize to Open (normally closed)

c. Voltage: Compatible with pump house electrical service

d. Pressure Sustaining Range: Adjustable between 20 – 200 psi

e. Pressure Rating: minimum 200 psi (operating)

f. Ends: Class 150 Flanged

g. Temperature Rating: 140° F Maximum

h. Body Material: Ductile Iron, ASTM A536

i. Coating: NSF Listed Fusion Bonded Epoxy Lined and Coated.

j. Trim: Stainless Steel

2.7 PRESSURE GAUGE

A. Visual Pressure Gauge:

1. 2.5” dial size

2. 0-160 psi readout

3. Stainless Steel case rated for marine environments

4. Glycerin filled

2.8 BOOSTER PUMPS

A. All pumps shall be ANSI/NSF 61 approved for drinking water.

B. The pumps shall be of the in-line vertical multi-stage design.

C. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.

D. Vertical Multi-Stage Pumps shall have the following features:

1. The pump impellers shall be secured directly to the smooth pump shaft by means of a split cone and nut design.

2. The suction/discharge base shall have ANSI Class 125 or Class 250 flange connections in a slip ring (rotating flange) design as indicated in the drawings or pump schedule.

3. Pump Construction:

a. Suction/discharge base, pump head: Ductile Iron (ASTM 65-45-12)

b. Shaft couplings, flange rings: Ductile Iron (ASTM 65-45-12)

c. Shaft: 431 Stainless Steel

d. Motor Stool: Cast Iron (ASTM Class 30)

e. Impellers, diffuser chambers, outer sleeve: 304 Stainless Steel

f. Impeller wear rings: 304 Stainless Steel

g. Intermediate Bearing Journals: Tungsten Carbide

h. Intermediate Chamber Bearings: Leadless Tin Bronze

i. Chamber Bushings: Graphite Filled PTFE

j. O-Rings: EPDM

4. The shaft seal shall be a single balanced metal bellows cartridge with the following construction:

a. Bellows: 904L

b. Shaft Sleeve, Gland Plate, Drive Collar: 316 Stainless Steel

c. Stationary Ring: Carbon

d. Rotating Ring: Tungsten Carbide

e. O-rings: EPDM

5. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, motor couplings, motor and seal cover. The entire cartridge shaft seal shall be removable as a one piece component. Pumps with motors equal to or larger than 15 hp (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

E. Basis-of-Design Product: Subject to compliance requirements, provide product indicated on the Drawings or an engineer approved equivalent:

1. Duty Pump shall be close coupled, single stage, end suction top discharge design, cast iron stainless steel fitted construction.

a. Model Number: Grundfos 12709 LC

b. Series: LC

c. Suction Size: 1.5 inches

d. Discharge Size: 1.25 inches

e. Motor Power: 10 horsepower

f. Motor Rotations per Minute (RPM): 3600

g. Stage No: 1

h. Number of Pumps: 1

2. Fire Flow Pump shall be split coupled, single stage, end suction top discharge design, cast iron stainless steel fitted construction.

a. Model Number: Grundfos 30127 LC

b. Series: LC

c. Suction Size: 4 inches

d. Discharge Size: 3 inches

e. Motor Power: 25 horsepower

f. Motor Rotations per Minute (RPM): 1800

g. Stage No: 1

h. Number of Pumps: 1

F. Performance Requirements:

1. Operation: Shall be capable of maintaining constant pressure based on pressure sensor inputs with multiple programmable operating modes and meeting the requirements of the Operational Control Flow Chart shown in the Drawings.
2. Primary Fire Flow Operating Point: 500 GPM @ 123 feet of head
3. Capacity of Duty Pump: Minimum of 130 GPM @ 148 feet of head
4. Low Flow Capacity: Capable of continuous low flow of 10 gpm or less
5. Efficiency: 64% or greater at primary operating point.
6. Back-up Pump: System shall be able to meet Primary Design Operating Point with largest pump out of operation.
7. System Input Power: 230/460V, 3 PH, 60 Hz
8. Motor Rated Horsepower: Duty Pump: 10 hp; Fire Flow Pump: 25 hp

G. Component Requirements:

1. Shall be a packaged unit provided by a single supplier.
2. Number of Pumps: 2 or more.
3. Check Valves: Isolation check valves on both suction and discharge side of all pumps.
4. Variable speed pump logic controller with programmable interface.
5. Capable of programmable inputs and outputs.
6. Variable speed drives for each pump.
7. Controller shall have visual status indicator for all system operational modes and alarms.

2.9 CONTROL PANEL

A. For each station, a duplex pump control panel shall be provide as per specification drawings and shall have as a minimum, main disconnect, digital level control system with submersible level transducer.

B. Component Requirements:

1. Enclosure shall be UL Type 4X stainless steel with pad-lockable 3 point latch. A swing out inner door shall be provided.
2. A GFCI convenience receptacle shall be provided. Receptacle shall be industrial grade, 120V 20A.
3. Control panel shall have a thermostatically controlled heater with fan. Heater package shall be Hoffman DAH1002A or approved equal.

4. Main disconnect switch shall be UL98 listed and sized to handle full load amps of the panel, with pad-lockable door interlocking handle.

5. VFD for each pump shall be Schneider Electric/Square D ATV21 type or approved equal
   a. Circuit Breaker with pad-lockable door mounted disconnect handle.

6. Control power transformer with primary fuse protection.

7. An HOA selector switch, RUN indicator, and OUT-OF-SERVICE indicator shall be provided for each pump. All pilot devices shall be UL Type 4X rated, 22mm type manufactured by Square D or equal. The indicators shall be long life LED type.

8. An alarm horn shall be provided and mounted on the side of the panel. Horn shall be Federal Signal model 350 or equal with a minimum sound level of 100 db. A silence pushbutton shall be located on the inner door.

9. An alarm light shall be mounted on the top of the panel, and shall be red polycarbonate and UL Type 4X rated.

10. Control relays shall be provided as shown on plan drawings and shall be blade type, with indicator lights. Relays shall be IDEC or approved equal.

11. Analog 4-20mA loops shall be provided with fuse protection.

C. Wire Ends: All wire ends shall be finished with crimped ferrules to prevent strands from splaying.

D. UL Listing: The panel shall be manufactured in by a UL508A registered shop and provided with a UL 508A label. A plastic laminated copy of the wiring diagram shall be attached to the inside of the panel door with waterproof adhesive.

E. Pressure Controller:

1. The pressure booster control system shall include a digital pressure controller (DPC). The DPC shall, as a minimum, consist of a microprocessor with I/O and a color touch screen operator interface panel. The DPC shall be an integrated system and factory programmed to start, stop and sequence the pumps based on the relationship between the user accessible set points on the interface panel and the analog input from the pressure transducer.

2. The DPC shall be an industrial type controller designed for harsh environments and a standard catalog item of a manufacturer with at least five years of experience in manufacturing micrologic pressure controllers. The DPC shall be rated for a minimum of 0-50 C operating temperature.

3. The digital pressure controller shall be mounted on the control panel door and shall include:

   a. 3.5 Inch 320 x 240 pixel TFT touch screen

   b. 5 key sealed membrane keypad

c. 4.5M application memory

d. 312K data table memory

e. 8GB micro SD card

f. (1) RS232 programming port

g. (1) 4-20ma or 0-10V analog inputs

h. (22) 24VDC digital inputs

i. (12) 5A relay contact outputs rated for up to 230VAC

j. (2) 10 KHz high-speed inputs

4. The DPC shall have pull-apart terminals so that the controller can be easily replaced without disconnecting or disturbing any wiring from the unit.

F. Digital Input And Outputs: Inputs shall be provided for each pump to include pump starter auxiliary contact to confirm pump operation when called and HOA Auto position to confirm the pump is available. Outputs shall be provided for each pump run command, out-of-service indicator for each pump, alarm horn and general fault contact.

G. Configuration:

1. The DPC shall have the following minimum configuration capabilities, all accessible by simply enabling them by touching a button in a user friendly setup wizard:

a. Simplex, duplex, triplex or quadraplex operation – system shall automatically adjust all screens and functions for the number of pumps in the system.

b. Constant speed or variable speed pumps

c. 0-10V or 4-20ma pressure sensor input

d. User scalable pressure sensor range and units

H. Monitoring And Set Points:

1. The pressure controller shall be designed with easy to navigate screens that will allow user access to the following functions and data:

a. Pressure display – in PSI

b. Number of pumps called

c. Pump status (Running, Stopped, Called, Failed, Out-of-service) for each pump

d. HOA selector (in controller to allow remote control of the pumps) for each pump

e. Run hour meter for each pump – minimum 100,000.00 hours (hundredths Resolution)

f. Number of starts counter for each pump

g. Alternation status

h. Alternation mode selector (Automatic, time clock, or manual)

i. Lead pump start and target set point

j. Lag pump start and stop set point

k. High and low discharge pressure alarm set point

l. High and low suction pressure alarm set point

m. Lead pump start delay and minimum run timer

n. Lag pump(s) start and stop delay timer

I. Alarm Configuration:

1. The DPC shall have alarm configuration screens for each of the following alarm conditions:

   a. High suction pressure

   b. Low suction pressure High discharge pressure

   c. Low discharge pressure

   d. Pump failure

   e. Transducer failure

2. Each alarm condition shall have touch buttons that enable or disable each of the above alarm conditions individually to:

   a. Enable/disable alarm condition

   b. Shutdown pumps

   c. Manual or Auto reset

   d. Turn on the horn output

   e. Turn on the alarm light output

   f. Flash the alarm light

   g. Turn on the general fault contact

   h. Send email and/or text message

   i. Adjust time delay

1. All enabled alarms shall be recorded in the DPC alarm history log and in an alarm handler that provide data regarding time of alarm, active or not, and number of same faults since last time cleared.

J. Password Protection: All set points shall be password protected with two levels of passwords.

K. Fault Data Logging: Fault logging shall be provided with a screen that gives access to the past 1000 fault conditions, complete with date and time stamp. The system data log shall log any alarm condition that is enabled. A separate fault log shall be provided for each VFD that will log the last 250 VFD fault conditions.

L. Trend Graph And History:
1. The DPC shall have a trend graph that automatically saves suction pressure, system pressure, motor speed and number of pumps running data at one second interval to a file on an SD card. A new file shall be automatically created at the beginning of each month. A minimum of 64 months of data shall be stored and can be retrieved by the DPC for on screen display in real time, or history mode.
2. A Windows based software utility shall be available, at no additional charge, which can copy the file to a PC and display the data on the PC screen in graphical format (trend chart).
3. This trend data shall serve the purpose of providing data regarding peak flow periods, system efficiency, and pump run times and duration.

M. Pump Run Data Logging: The DPC shall log every pump run event. The log shall record the start time, stop time and run duration, complete with date stamp, every time the pump runs. The log shall record a minimum of 10 years of data based on a frequency of 30 seconds between events.

N. Serial Port: The DPC shall have a serial port that can be configured, with simple on the screen touch, for the following configurations:
1. RS232 programming mode

O. DDE Server: A DDE .dll shall be available, at no additional charge, that allows the owner to configure a customized Excel spreadsheet that displays data from any register within the DPC.

P. Manufacturer: The digital level controller shall be supplied by PumpTech Engineered Systems, or approved equal.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used on aboveground piping and piping in vaults.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

B. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23 and WSDOT Standard Specifications Section 7-09.3.

C. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed. Sleeves shall be PVC Pipe.

3.3 FITTING AND JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Fittings and joints shall be installed in accordance with the manufacturers printed specifications and instructions, and to the standards of AWWA for the type of pipe used.

3.4 ANCHORAGE INSTALLATION

A. Securely anchor above ground piping to pump house floor or wall with manufacturer approved fittings.

3.5 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44.

B. Ball Valves: Comply with manufacturer recommendations.

C. Pressure Sustaining Valves: Comply with manufacturer recommendations.

D. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.6 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

3.7 CONNECTIONS

A. Connect water-distribution piping to interior domestic water piping

B. Install unions in above ground piping 3” and smaller, adjacent to each valve and at final connection to each piece of equipment.

C. Connect pressure switches to pump motor controls per manufacturer’s requirements and applicable electrical code.

D. Connect reservoir level controls to booster pump skid input.

3.8 HYDROPNEUMATIC TANKS

A. Must meet the construction and installation requirements of chapter 296-104 WAC, but is exempt from routine L&I inspections and fees (RCW 70.79.090(6)).

1. Maximum allowable working pressure shall be 150 psi.

B. Pressure Relief Valve

1. Tanks must be protected against over-pressurization with a properly sized and installed ASME-approved pressure relief valve (PRV) (WAC 29-104-316).

a. Must be installed as close as possible to the vessel without any valves between the PRV and the pressure tank.

b. The set pressure of the PRV must not exceed the design pressure of the vessel or the pressure vessel manufactures requirements.

C. Must meet the installation requirements of chapter 296-104 WAC, but is exempt from routine L&I inspections and fees (RCW 70.79.090(6)).

3.9 BOOSTER PUMPS

A. Performance: Must be capable of meeting the operational requirements identified on the Drawings.

1. Must be able to automatically modulate between two operating sequences based on input from pressure transducers.

B. Input and Output Connections:

1. Inputs From:

a. Reservoir Float Controls

b. Pressure Transducers

2. Outputs To:

a. Pressure Sustaining Solenoid Valve

b. Exterior Mounted Alarm Light

3.10 TESTING

A. Each pump shall be factory performance tested as a unit prior to shipment. The performance test shall consist of five (5) points over the operating range of the pump. One point will be the specified primary design point of the pump. The performance tests will meet the acceptance criteria of the Hydraulic Institute. Verified test data will include head vs. capacity, motor output (HP), RPM and pump efficiency.

B. Job-site programming shall be entered into the controller prior to shipment (details of installation requirements shall be communicated to the pump system manufacturer). A verified Controller performance test report shall be made available from the system manufacturer.

C. The system shall undergo a hydrostatic test of 250 psig for a minimum of 15 minutes prior to shipment.

3.11 CLEANING AND DISINFECTION

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.

c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system. Chlorinated water shall be captured and dechlorinated prior to discharge to storm drain system or downstream water ways.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

e. Submit bacteriological test results to Engineer.

f. System shall show no signs of bacteriological contamination prior to final acceptance. Repeat disinfection, sampling, testing, and system modifications necessary to produce final acceptance shall be the responsibility of the Contractor.

END OF SECTION

SECTION 33 16 00 - WATER STORAGE TANK

Lead-free statement: Several plumbing fixtures described in this section fall under jurisdiction of the Federal Reduction of Lead in Drinking Water Act (42 USC 300G) which mandates that effective January 4, 2014 the wetted surfaces of any valve, fitting or fixture that comes in contact with potable water must have a weighted-average lead content of no more than 0.25 percent. The end user of this document is urged to be aware of the requirements of authorities having jurisdiction and to specify Lead-Free products when editing this document. Additional information can be found online at www.zurn.com/leadfree.

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes the procurement and installation of a 26’ Dia. x 15’ H. at-grade concrete water reservoir and appurtenances.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.3 STANDARD SPECIFICATIONS

A. All work to be performed and materials to be used shall be in accordance with the current edition of the Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.

B. Contractor shall have one (1) copy of the Standard Specifications and all amendments therein, and applicable WSDOT Standard Plans at job site.

C. Concrete, formwork, reinforcement, and details of the concrete support structure and foundation should conform to the requirements of ACI 318.

D. All work shall conform to the specifications listed in WAC 246-290 (Group A Public Water Supplies) and the latest editions of the following references: The Washington State Department of Health Water System Design Manual, Washington State Department of Transportation (WSDOT) standard specifications, APWA standard specifications, AWWA standards, UPC, and the applicable county rules, regulations, and ordinances. The standards are listed in order of preference in the event that a conflict in standard arises.

1.4 QUALITY ASSURANCE

A. Contractor is responsible for all effort necessary to complete work in accordance with drawings and standards, until certified by the engineer and state and local agencies for correct installation and satisfactory operation of all equipment.

1.5 SUBMITTALS

A. Engineer signed structural drawings and calculations for permit application use.

B. Concrete Test Results: A minimum of 6 test cylinders shall be cast for each 50 cubic yards of concrete. The cylinders shall be tested by a certified testing lab and each set of cylinders shall have 1 cylinder tested at 7 days, 3 cylinders at 28 days, and 2 cylinders at 28 days.

C. Operation and Maintenance Data: For reservoir and appurtenances to include in emergency, operation and maintenance manuals.

D. Record Drawings: Contractor shall maintain a set of As-Built Drawings to indicate all deviations from the original design.

1. Changes shall be legibly documented on Drawings while work is in progress.

2. Final "As-Built" drawings shall be prepared by the Contractor on a clean set of drawings after final inspection.

3. Final "As-Built Drawings" shall be delivered to the Engineer for transmittal to the Owner.

1.6 BASIS OF DESIGN

A. Basis-of-design product for the concrete reservoir is the following or an Engineer approved equivalent:

1. Reservoir Contractor: Mt. Baker Silo, Inc.
   PO Box 979, Lynden, WA 98264
   Phone: (360) 354-4940

2. Reservoir Size: 26' Diameter, 15' Height.

3. Structural Design: Shall be in accordance with most current edition of the following codes: IBC, ASCE 7, ACI 350, ACI 350.3, AWWA D-110, and AWWA D-115.

4. Shall meet all requirements of the state and local health departments for potable domestic water storage.

5. Design Loads:

   a. Seismic: Shall be designed to resist seismic forces per the applicable codes listed above with reservoir full.

   b. Wind: Shall be designed for a basic wind speed of 125 mph with a minimum factor of safety of 4 against overturning and 3 against sliding.

   c. Snow Load: The roof shall be designed for a minimum ground snow load of 45.4 psf.

   d. Hydraulic Load: Hoop steel stresses shall not exceed an average of 38 kips at full volume.

   e. Soil Bearing: Static loading shall be uniformly distributed by the base in conformance with the site geotechnical soil investigation.

1.7 PERMITS

A. Contractor shall obtain and pay all fees for building permits and inspections required by laws, ordinances, and rules governing the work specified herein.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Cement: Shall conform with ASTM Specification C150 for Portland Cement, Type 1. It shall contain a minimum of 6 sacks of cement per cubic yard and shall have a 28-day minimum compressive strength of 4,500 psi.

B. Aggregate:

   a. Maximum Aggregate Size shall be 1.5” for the base unless otherwise noted.

   b. Maximum Aggregate Size shall by 0.75” for the walls and roof unless otherwise

C. Water Content: Water to cement ratio shall be kept below 0.42 with target goal of 0.40.

D. Slump: slump shall be 4” ± 0.5”. Slump may be increased to improve workability by incorporating water reducing agents and plasticizers. Maximum slump shall be 9”.

E. Air Entrainment: 6% ± 1.5%.

F. Curing: After placement, the concrete shall be sprayed with an approved curing compound. Curing compound should be membrane forming or combination curing/surface hardening types conforming to ASTM C 309.

2.2 REINFORCING STEEL

A. All reinforcing steel shall conform with ASTM specification A615, Grade 60, having a minimum yield stress of 60,000 psi.

B. Bars shall be free from loose scale, dirt, grease, or any other substance which will impair the bond between the concrete and reinforcing bars.

C. Tie Wire shall be steel, black annealed, 16 gauge minimum.

2.3 WATER STOPS

A. Water stops shall be installed in all construction joints below maximum reservoir water level.

B. Water stops shall be spliced per manufacturer's recommendations or lapped a minimum of 12 inches.

C. Base-to-wall: Water stops for base-to-wall connection shall be minimum of 6 inches wide, ribbed with centerbulb and rated for a watertight seal for 100 feet of hydrostatic pressure or greater.

D. Wall-to-wall: A Bentonite based hydrophilic waterstop rated for 100 feet of hydrostatic pressure or greater and approved for vertical application on concrete shall be used on wall-to-wall construction joints.

2.4 COATINGS, FORM RELEASE AGENTS, AND CURE SPRAYS

A. All coatings, form release agents, and cure sprays used on surfaces that will come into contact with water stored in the reservoir must have NSF approval for use with potable water or adequate cleaning procedures must be employed to ensure that all latent residue is removed prior to placing the reservoir into service.

2.5 ACCESSORIES

A. Accessories shall comply with "Recommended Standards for Water Works" latest edition, by Great Lakes Upper Mississippi Board of State Public Health and Environmental Managers and the general details provided in the Drawings.

B. Access Hatch

1. Material: Aluminum, Minimum of 14 gauge

2. Dimensions: 2.5’ x 4’

3. Other: Shall include provision for a padlock and shall have weather stripping where the hatch cover meets the hatch.

C. Ladders

1. Locations:

   a. Exterior: Exterior ladder shall extend from reservoir top to within 10 feet of the ground.

   b. Interior: Interior ladder shall extend the full height of the reservoir.

2. Material: Hot dipped galvanized after fabrication.

D. Ladder Cage

1. A ladder cage with lockable gate shall be installed around exterior ladder.

2. Material: Hot dipped galvanized after fabrication.

E. Air Vent

1. Size: 8” minimum diameter

2. Screen: non-corrosive 24 mesh over entire vent area

3. Cover: shall be designed to prevent entrance of surface water, rainwater, birds, animals, insects and dust.

F. Interior Piping

1. Interior piping within reservoir shall be PVC, Schedule 80.

2. Connections to Exterior Piping: Connections to exterior piping stubbed up through reservoir base shall be galvanized couplings.

G. Overflow

1. Size: 4” minimum diameter

2. Screen: non-corrosive 24 mesh over opening at reservoir wall.

3. Connection: Shall have pipe thread protruding beyond exterior wall.

4. Exterior Pipe: PVC pipe routed to within 18 inches of ground surface and mounted to exterior reservoir wall with non-corrodible brackets.

H. Exterior Water Level Indicator

1. Material: Non-corrodible material

a. Indicator board to be white with black numerals and gradation numbers.

b. Rubber Float

c. Weatherproof pulleys with 1/16-inch minimum stainless steel cable.

I. Control Wire Blockouts

1. Provide (2) 2" galvanized pipes cast into roof adjacent to the access hatch for mounting water system controls.

2.6 BACKFILL

A. Material: Backfill shall be 3/4" road base. Native soils shall not be used adjacent to the tank shell without geotechnical engineer's approval.

PAERT 3 - EXECUTION

3.1 PLACEMENT OF REINFORCING STEEL

A. Bending and placing will be in accordance with "Specifications for Structural Concrete for Buildings" (ACI 301-latest edition). Laps and splices shall be staggered and all reinforcing steel shall be accurately place as shown on the plans. All reinforcing steel shall be firmly secured to prevent movement during the placing of the concrete. The only exception to this shall be where dowel bars are used at the connection of the base and wall. These dowels may be installed after the concrete is placed ("wet set") as long as the depth of embedment and the location are accurately controlled, and installation is done prior to the initial setting of the concrete.

3.2 CONCRETE WORK

A. Before each wall pour, the existing concrete shall be thoroughly cleaned by pressurized water or whatever means may be necessary to remove all loose scale, oil and any foreign material that may prevent a good bond with the existing concrete.

B. Formwork: Formwork design, installation and removal should conform to the requirement of ACI 318 and ACI 347R.

1. Formwork should ensure that concrete components of the structure will conform to the correct dimensions, shape, alignment, elevation, and position within the established tolerances. Formwork systems should be designed to safely support construction and expected environmental loads, and should be provided with ties and bracing as required to prevent leakage of mort and excessive deflection.

2. Form surfaces should be cleaned of foreign materials and coated with a non-staining release agent prior to placing reinforcement.

3. Prior to placing concrete, the forms should be inspected for surface condition, accuracy of alignment, grade and compliance with tolerance, and reinforcing steel clearances.

C. Pouring: In the pouring process, concrete shall not be allowed to free-fall more than 5 feet. The concrete shall be deposited in horizontal layers not to exceed 18 inches in depth and shall be placed as closely as possible to its final position to avoid segregation. Drop chutes or tremies should be used to avoid segregation of the concrete. These chutes or tremies should be moved at short intervals to prevent stacking.

D. Vibration: Vibrate all concrete with high frequency internal vibrators as it is placed. Penetrate the concrete with a sufficient number of vibrations to thoroughly work the concrete around reinforcement and embedded fixtures without separation of aggregate. Vibration should not be used to move concrete through the chute or tremie.

E. Base and Roof Slope: Unless specified to slope, the base will be flat. The roof shall slope from the center to the outside edge at a minimum of ¼" per foot of radius.

F. Form Removal: Forms should remain in place until the concrete has gained sufficient strength not to be damaged by the removal and subsequent loads.

1. Normal elapsed time on wall form removal shall be approximately 16 hours unless low temperatures or poor weather conditions dictate otherwise.

2. The normal elapsed time for roof form removal shall be 10 to 14 days.

G. Concrete Finishes:

1. Base and Roof: All slab finishes shall be a "wood float" finish only, to prevent slippery surfaces. The concrete shall be worked no more than is necessary to produce a "wood float" finish that is uniform in texture and relatively free from screed/float marks.

2. Walls: Steel forms shall be used on all wall pours. Forms may be built with a minimum of refinement but at a minimum must not leak excessive amounts of mortar or yield beyond specific tolerances when the concrete is vibrated. Rock pockets, honeycombed

areas, form tie holes and any holes over ½" deep shall be repaired. No sacking or hand-rubbing is required to be performed on any concrete finishes.

a. Exterior and interior exposed surfaces of the structure and foundations should have a smooth as-cast finish.

H. Tolerances: Tolerances for concrete shall conform to ACI 117 and the following:

1. Variation in wall thickness: -3.0 to +5.0%

2. Wall variation from plumb:

a. In any 5 feet of height: 3/8 in

b. Maximum in total height: 3 in

3. Wall diameter variation: 0.4%, not to exceed 3 in

4. Offset between adjacent piece of formwork facing material:

a. Exterior exposed surfaces: Not to exceed 1/8 in

b. Interior exposed surfaces: Not to exceed 1/4 in

5. Out-of-tolerance Construction: The effect on the structural capacity of the element shall be determined by the engineer if construction does not satisfy the tolerances. When structural capacity is not compromised, repair or replacement of the element is not required unless other governing factors, such as lack of fit and aesthetics, requires remedial action.

I. Surface Repair:

1. Patching: Concrete should be patched with proprietary patching material or site-mixed Portland cement mortar. Patching material for exterior surfaces should match the surrounding concrete in color and texture.

2. Repair of defects: Concrete should be repaired as soon as practicable after form removal. Defective concrete should be removed to sound concrete and patched.

3.3 BACKFILL

A. Backfilling shall not commence until at least 7 days after the final concrete pour has been completed.

B. Bury depth shall be equal to base slab thickness.

C. Road base backfill width shall be 3' around the base slab. Backfill shall be placed in loose 6" lifts, compacted to 95% modified proctor using hand operated equipment.

D. Heavy equipment shall not be used adjacent to the tank shell.

3.4 CLEANING AND DISINFECTION AND TESTING

A. Cleaning: clean and pressure wash the interior of the reservoir after construction.

B. Disinfection: Disinfect reservoir prior to placing into service per the requirements of AWWA C652-11.

1. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

2. Submit bacteriological test results to Engineer.

3. System shall show no signs of bacteriological contamination prior to final acceptance. Repeat disinfection, sampling, testing, and system modifications necessary to produce final acceptance shall be the responsibility of the Contractor.

C. Water Tightness Testing: Testing shall be performed after concrete has cured to achieve adequate compressive strength.

1. Unless approved by Engineer, reservoir shall not be filled sooner than 28 days after all concrete pouring is complete and no later than 60 days after completed.

2. To test the reservoir, fill to full, close all valves and let set for 24 hours. Note the height of the water. Check the water height after 3 consecutive 24-hour periods. Allowing for evaporation, the water level shouldn't drop more than 1 tenth of one percent in any 24-hour period.

3.5 AESTHETICS

A. Cracking: A few minor, vertical, cracks are acceptable in the exterior surface of the walls. Surface cracks on the magnitude of .002 - .005-inch wide are considered structural defects and shall be repaired.

B. Weeping and Efflorescence:

1. Weeping: Minor weeping is acceptable as long as there is no measurable water loss.

2. Efflorescence: aesthetic efflorescence staining is acceptable.

C. Inspection: Upon substantial completion of the tank, the contractor shall schedule a visual inspection with the engineer, architect, and the owner. The inspection will focus on visual appearance, surface finishes, and any other aesthetic attributes specified in the contract documents.

1. Identification of Deficiencies: If, during the aesthetic inspection, the Owner identifies any deficiencies in the appearance or finish of the concrete storage tank, these deficiencies shall be documented and communicated to the Contractor in writing. Deficiencies may include, but are not limited to:

    a. Inconsistent surface finishes

    b. Visible cracks or imperfections in the concrete

    c. Uneven or improperly cured surfaces

    d. Poorly executed formwork or joint treatments

    e. Non-compliance with specified aesthetic standards

2. Contractor Responsibility: In the event of deficiencies identified by the Owner, the Contractor shall be required to take immediate action to address the issues. If the deficiencies are deemed severe or irreparable, the Owner may require the tank to be completely rebuilt. Rebuilding shall include the removal of the non-conforming tank and the construction of a new tank, ensuring full compliance with the contract documents and all specified aesthetic requirements.

3. Conditions: Should the Owner determine that the concrete storage tank does not meet the required aesthetic standards, the following actions shall occur:

    a. The Contractor shall dismantle and remove the non-conforming tank, including all associated materials and work.

    b. The Contractor shall reconstruct the tank to meet the aesthetic requirements as outlined in the contract documents and as deemed acceptable by the Owner.

    c. All costs associated with rebuilding the tank shall be borne by the Contractor, including demolition, removal, and reconstruction.

4. Acceptance: Final acceptance of the concrete storage tank shall be contingent upon the Owner’s satisfaction with both the structural integrity and aesthetic quality of the tank. The Owner will provide formal written approval once all deficiencies have been rectified and the tank meets the specified aesthetic criteria.

END OF SECTION

SECTION 331600.1 – STORAGE TANKS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes underground wastewater equalization tanks.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer’s data sheets on each product to be used, including, but not limited to, the following:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation manual and operating guidelines.

B. Shop Drawings: Tank manufacturer shall submit the following for review and approval prior to fabrication of the tanks:

1. Detailed shop drawings of each tank, complete with all accessories supplied by the manufacturer.
2. Detailed shipping, handling, and installation instructions.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with tank manufacturer's Installation and Operating Guidelines and recommendations for delivery, storage, and tank handling.

1.05 WARRANTY

A. Warranty: Provide manufacturer’s standard limited warranty.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Tank Installations in the United States:

1. Acceptable Manufacturer: Xerxes Corporation
2. Distributor Contact: Fextex Systems Inc. Brandon Nation (800) 905-8467

B. Substitutions: Not permitted.

C. Request for substitutions will be considered in accordance with Section 016000 – Product Requirements.

2.02 UNDERGROUND WATER TANKS

A. Tank Design - Fiberglass reinforced plastic (FRP) tanks:

1. The tank size, fittings and accessories shall be as shown on the Drawings.
2. Tank shall be manufactured with structural ribs which are fabricated as in integral part of the tank wall.
3. Tank shall be manufactured with a laminate consisting of resin and glass fiber reinforcement only. No sand/silica fillers or resin extenders shall be used.
4. Tank shall be vented to atmospheric pressure.
5. Tank shall be capable of handling liquids with specific gravity up to 1.1.
6. Tank shall be compatible with liquids identified in the manufacturer's standard limited Warranty.

B. Loading Conditions - Tank shall meet the following design criteria:

1. Internal Load - Tank shall be designed to withstand a 5-psig (35 kPa) air-pressure test with a 5:1 safety factor.
2. Surface Loads - Tank shall be designed to withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current Installation Manual and Operating Guidelines.
3. External Hydrostatic Pressure - Tank shall be designed for 7 feet (2.1 m) of overburden over the top of the tank, the hole fully flooded, and a safety factor of 5:1 against general buckling.

C. Onsite Wastewater Storage Application:

1. Governing Standards, as applicable:

a. ANSI/AWWA D120 - Thermosetting Fiberglass-Reinforced Plastic Tanks.
b. American Concrete Institute (ACI) standard ACI 318, Building Code Requirements for Structural Concrete.
c. IAPMO/ANSI Z1000 - Prefabricated Septic Tanks. Tank shall be IAPMO/ANSI Z1000 listed and labeled.

d. Tank manufacturer shall be recognized by Underwriters Laboratories (UL) as a manufacturer of tanks listed to the UL-1316 standard..

2. Tank Design: Single-Wall or Double-Wall vessel as specified and shown on the Drawings.

   a. Interstitial Space (Double-Wall Tanks only).

      1) The interstitial space between the primary and secondary walls shall be constructed with a glass reinforcement material such as Parabeam, which provides a structural bond between the two tank walls, while creating a defined interstice that allows for free flow of liquid.
      2) A tank top fitting shall be provided to allow for a monitoring sensor to be installed at the bottom of the interstice.
      3) The interstice of the tank shall be designed to withstand 20-psig (138 kPa) pressure.

3. Tank Accessories - Onsite Wastewater Storage Applications:

   a. Tank Anchoring:

      1) Anchor straps shall be as supplied by tank manufacturer and designed for a maximum load of 25,000 lbs (11,340 kg).
      2) Galvanized turnbuckles shall be supplied by the tank manufacturer.
      3) Prefabricated concrete anchors shall be supplied by the tank manufacturer, designed to the ACI 318 standard, manufactured with 4,000 psi concrete and shall have adjustable anchor points.

   b. Access Openings:

      1) All access openings shall have a diameter of 24 inches or 30 inches (610 mm or 762 mm), complete with riser, lid and necessary hardware.

   c. Attached Access Risers:

      1) Attached access risers shall be PVC or FRP as supplied by tank manufacturer.
      2) Attached access risers shall be 24 inches or 30 inches (610 mm or 762 mm) in diameter.
      3) Access risers shall be attached to access openings during installation utilizing adhesive or FRP bonding kits as supplied by the tank manufacturer.

   d. Piping and Fittings:

      1) Tank shall be equipped with factory-installed threaded fittings, or pipe stubs.
      2) PVC piping shall at a minimum meet the requirements of ANSI Schedule 40.
      3) All flanged nozzles shall be flanged and flat-faced and conform to Class 150 bolting patterns as specified in ANSI/ASME/ B16.5.
      4) Carbon steel and stainless-steel NPT fittings shall withstand a minimum of 150 foot-pounds (203 NM) of torque and 1,000 foot-pounds (1356 NM) of bending, both with a 2:1 safety factor.

e. Manway Openings:

1) The standard manway shall be flanged, 22 inches (559 mm) I.D. and complete with gaskets, bolts and cover.
2) Manway openings shall be designed to withstand 5-psig (35 kPa) test pressure with a 5:1 safety factor.

f. Ladders:

1) Ladders shall be the standard FRP ladder as supplied by tank manufacturer.

g. Baffles and Partitions:

1) Baffles and Partitions shall be capable of withstanding hydrostatic loads occurring when one compartment is empty, and the remaining compartment(s) is full.

PART 3 – EXECUTION

3.01 TESTING

A. Tank shall be tested according to the tank manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.

3.02 INSTALLATION

A. All Tank shall be tested according to the tank manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.

END OF SECTION

Section 331700 – Non-Potable Water Distribution System (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes non-potable water distribution piping and specialties, including, but not limited to piping, valves, vaults, yard hydrants, fittings, storage tanks, flushing, and testing.

1.02 SUBMITTALS

A. Product Data: For the following:

1. All types of piping used.
2. Valves and accessories.
3. Tanks.

B. Field quality control test reports.

C. Operation and Maintenance Data: For the following:

1. Valves.
2. Tanks.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with standards of authorities having jurisdiction for potable-water service piping, including materials, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.04 LAYOUT OF WORK AND SURVEYING

A. Construction staking shall be per Section 015100 – Field Engineering.

PART 2 – PRODUCTS

2.01 GENERAL

A. Pipe sizes are nominal inside diameter unless otherwise noted.

B. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data, such as thickness for piping.

C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in this section.

2.02 PIPES AND FITTINGS

A. Pressure Pipe and Fittings:

1. Buried yard piping and fittings shall be AWWA C901, IPS SDR 11, PE 3408 HDPE per ASTM D3350. Joining system shall be by butt-fusion and electrofusion techniques. Pipe shall be specially marked (purple stripe or similar) for use in reclaimed water products.
2. Buried Yard Piping Molded PE Fittings: ASTM D3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
3. Aboveground liquid process piping shall be Schedule 80 PVC. Joining system shall be solvent welded joints.
4. See Pipe System Schedule in Section 400500 – Process Piping.

2.03 VALVES (2-INCH AND SMALLER)

A. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1, polyvinyl chloride body, ball and stem, end entry, double union design, solvent-weld socket ends, elastomer seat, and Viton or Teflon O-ring stem seals to block flow in both directions.

B. Manufacturers and Products:

1. Nibco; Chemtrol Tru-Bloc.
2. ASAHI/America; Duo-Bloc.
3. Spears; True Union.

2.04 ELECTRIC ACTUATORS

A. Provide electric actuators for valves as shown on Drawings and as follows:

1. NEMA 4 housing.
2. De-clutchable manual override with valve position indication.
3. Non-intrusive integral control components.
4. Mounting hardware.
5. Voltage: 115 Vac, Single-phase, 60 Hz.
6. Control relay control for means of opening and closing valve with maintained control signals.
7. Two (2) auxiliary switches for remote fully open and fully closed valve indications.
8. Electromechanical brake.

B. Manufacturer:

1. BETTIS.

2. No Substitutes.

2.05 HOSE BIBB

A. Freeze-Proof Hose Bibb:

1. Rough bronze body with removable key or wheel handle, 3/4-inch threaded or solder-joint inlet, 125 psig, integral, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads on outlet.
2. Jay R. Smith #5609QT, or approved equal.

2.06 FROST-FREE HYDRANT

A. Hydrant shall be freeze-proof "Merrill" C-1000 series with cast iron head, galvanized standpipe, stainless steel operating rod, Teflon packing, level controlled, with 3/4-inch brass vacuum breaker "Merrill" model BVBAD75 or approved equivalent.

2.07 NON-POTABLE WATER STORAGE TANK

A. Tanks shall be rotationally-molded, vertical, high density crosslinked polyethylene one-piece seamless construction, cylindrical in cross-section and vertical with flat bottoms. Where indicated, tanks shall be provided with ancillary mechanical fittings and accessories. Tanks shall be marked to identify the manufacturer, date of manufacture and serial numbers must be permanently embossed into the tank. Tank exterior shall include 2-inch polyurethane foam insulation with white coat.

B. Service: Storage tanks shall be suited for the following operating conditions:

1. Storage Volume: 4,000 gallons.
2. Ambient Temperature Range: 0 to 100 degrees F.
3. Liquid Temperature Range: 40 to 90 degrees F.
4. Outdoor installation.
5. Seismic Loads:

a. Seismic Factors: Sds = 0.93, Sd1 = 0.50.
b. Site Class F.
c. Importance Factor: 1.0.
d. Clear water storage with a pH ranging from 6 to 10 standard units (s.u.).

C. Restraint System:

1. Metal components to be galvanized clips, edge softeners, and tension ring with stainless steel or galvanized cables and clamps.
2. Seismic system to be designed to meet the proper seismic zone. Calculations and drawings shall be stamped by a professional engineer registered in the State of Washington.

D. Tanks shall be manufactured by Poly Processing Company, Snyder Industries, or approved equivalent.

2.08 MISCELLANEOUS FITTINGS AND ACCESSORIES

A. Pipe Flexible Couplings: All flexible couplings used for connections of pipe shall be Romac ductile iron couplings or an Owner-approved equal. All buried flexible couplings shall be furnished with stainless steel bolts and nuts.

2.09 MISCELLANEOUS MATERIAL

A. Utility marking tape and 4x4-wooden monuments shall be provided and installed by the Contractor, per the Drawings.

PART 3 – EXECUTION

3.01 LAYOUT

A. Construction staking shall be per Section 015100 – Field Engineering.

3.02 TRENCH EXCAVATION AND BACKFILL

A. Perform trench excavation, bedding, and backfill in accordance with Section 312000 – Earth Moving.

3.03 PIPING INSTALLATION

A. All pipe shall be installed in conformance with manufacturer's recommended procedures for the particular pipe being installed. In addition, comply with the installation requirements of the Uniform Plumbing Code.

B. Do not install any piping when the temperature drops below freezing nor until trenches have been thoroughly and properly dewatered.

C. Pipe shall be firmly and properly bedded and then partially backfilled between pipe joints and valves.

D. Pipe ends shall be neatly and squarely cut, all burrs removed, and reamed inside to provide a tight joint and clean, smooth flow line.

E. The Contractor shall be responsible for determining appropriate and correct radii of curves in the lines and providing whatever combination of pipe lengths and/or standard and special couplings are necessary for proper completion of the work. No pipe shall be installed under tension.

F. Threaded joints shall be made up with approved joint compound applied smoothly and evenly per manufacturer's directions. All joints shall be made up tight with tongs and wrenches without the use of handle extensions.

G. Once a joint has been tightened, it shall not be backed off unless threads are recleaned and new compound applied. Any joints that leak shall be cleaned and remade with new material. Caulking or thread cement to make joints right will not be accepted by the Owner.

H. Unions shall be installed in all threaded joint piping to facilitate removal of valves, meters, etc., for maintenance/repair in accordance with accepted trade practice and also in accordance with the Plans.

I. Temporarily cap the ends of specified piping runs as called for on the Drawings and mark the termination location with a 2x4 post painted and installed, as shown on the Drawings.

3.04 UTILITY CROSSINGS

A. Water lines and utility lines shall be separated by a 10-foot lateral separation or by a combination of 5-foot lateral separation and 1.5-foot vertical separation.

B. Where crossings are required with domestic water and utility lines, no joint shall be laid closer to the crossing than one-half the length of a standard length of pipe, and where practical at the crossing, there shall be a 36-inch vertical separation. Where a 36-inch separation between the lines cannot be maintained, the drain line shall be inserted into a 20-foot minimum length of PVC pipe, which will act as a protective “conduit” and keep the exposed drain line joints 10 feet away from the crossed line. The drain line shall be cut as necessary to place a joint at the ends of the conduit, not inside. Where the necessary length of conduit is more than 20 feet, the Contractor shall glue “bridging” pieces to the sewer pipe to prevent sag in the line.

3.05 TANK DELIVERY, STORAGE, AND HANDLING

A. The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. AVOID sharp objects on trailers.

B. All fittings shall be installed and, if necessary, removed for shipping and shipped separately unless otherwise noted by the Contractor.

C. Upon arrival at the destination, inspect the tank(s) and accessories for damage in transit. If damage has occurred, manufacturer shall be notified immediately.

3.06 SYSTEM TESTING AND INSPECTION

A. The following tests shall be performed by the Contractor, in the presence of the Owner, and also the County Inspector, should he require it.

B. The Contractor shall provide not less than 7 days’ advance notice to the Owner of the scheduled test date so as to allow the Owner to make appropriate arrangements and scheduling.

C. Pressure Pipe (tight lines):

1. All sections of pressure tight lines shall be hydrostatically tested for leaks at a pressure of 125 psi for a period of 2 hours. Lines may be filled with water to expel all air, and high-pressure

air injected through a one-way valve to bring pressure up to 125 psi. The Contractor shall provide and install a pressure gauge reading in 1-psi increments. The Contractor shall also plug and/or provide all temporary materials necessary to isolate test lines from the rest of the system.

2. Pressure loss in excess of 1 psi during the 2-hour test period will be cause for rejection and reperformance of the test. The Contractor shall make any/all repairs and shall bleed the system of suspected entrapped air and then reconduct the pressure test to the Owner's satisfaction. The test shall be repeated as many times as deemed necessary by the Owner, at no additional cost.

D. Tank Testing:

1. Material Testing:

   a. Perform gel and low temperature impact tests in accordance with ASTM D1998 on condition samples cut from each polyethylene chemical storage tank.
   b. Degree of Crosslinking. Use Method C of ASTM D1998, Section11.4 to determine the ortho-xylene insoluble fraction of crosslinked polyethylene gel test. Samples shall test at no less than 60 percent.

2. Tank Testing:

   a. Dimensions: Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D1998. Fitting placement tolerance shall be plus or minus 1/2-inch vertical and plus or minus 1 degree radial. Visual: Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, and delamination.
   b. Hydrostatic Test: Following fabrication, the tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1/2 an hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

END OF SECTION

SECTION 333100 – SANITARY UTILITY SEWERAGE PIPING – FOR SCHEDULE B ONLY

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes both gravity and pressurized sanitary sewage collection system pipe installation and MBR system piping (including chemical feed, drain, odorous air, permeate, and process air piping).

1.02 SUBMITTALS

A. Submittals shall be per Section 013300 – Submittal Procedures.

B. Product Data: For the following:

1. Piping materials.
2. Precast concrete manholes and structures.
3. Cleanouts and accessories.

PART 2 – PRODUCTS

2.01 PIPES AND FITTINGS

A. Buried and exposed gravity sewer pipe and fittings shall be according to the following:

1. PVC Pipe, ASTM D3034, SDR 35, solvent-cemented.
2. Gravity sewer pipe systems include the following: SS = Sanitary Sewer, D = Drain, and OA = Odorous Air.

B. Buried and Exposed Pressure Sewer Pipe and Fittings:

1. Pressure piping and fittings (SSFM) 3 inches and under shall be AWWA C901, IPS SDR 11, PE 3408 HDPE per ASTM D3350. Joining system shall be by butt-fusion and electrofusion techniques. Pipe shall be specially marked (green stripe or similar) for use in sewage products.
2. Exposed MBR tank and skid related liquid process piping (PE, CHF) shall be as specified in 400500.
3. MBR tank and skid-related Process Air (PA) piping shall be ASTM 312 Schedule 40S stainless steel, ANSI B1.20.1 threaded connection, with ASTM A403 fittings for piping 2 inches and smaller. Process air (PA) piping 3 inches and larger shall be ASTM A778 stainless steel, butt weld or flanged connections, couplings where specified, with ASTM A774 fittings.

a. General: All stainless-steel piping systems shall meet the material requirements below:

1) Piping Materials: Type 304L.

a) Minimum wall thickness: Schedule 10 for 3-inch and larger and Schedule 40 for 3-inch and smaller.

4. Pressure Pipe Systems include the following: SSFM = Force Main, PA = Process Air, PE = Permeate, CAR=Carbon Supplement, and CLS=Chlorine Solution.

2.02 CLEANOUTS

A. Gray-Iron Cleanouts:

1. ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

   a. Light Duty: In earth or grass foot-traffic areas.
   b. Medium Duty: In paved foot-traffic areas.
   c. Heavy Duty: In vehicle-traffic service areas.
   d. Extra Heavy Duty: In roads.
   e. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.03 MANHOLES

A. Precast concrete manholes shall conform to WSDOT 9-05.50(2). Manhole rings and covers shall conform to WSDOT 9-05.15(1).

B. Interior finishes for the influent manhole and bypass manhole shall conform to Section 099000.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Excavating, trenching, and backfilling are specified in Section 312000 – Earth Moving.

B. Piping Installation:

1. Install all pressure piping in accordance with the manufacturer's recommended procedures for the type of pipe being installed.
2. For installation of HDPE pipe and fittings, the fusion operation shall be performed by an individual who has a certificate showing successful completion of an HDPE pipe fusion training course in fusing polyethylene pipe in the manner recommended by the pipe supplier.
3. The interior beads of all butt-fusion joints shall be removed per the manufacturer's recommended procedures. Prior to the removal of beads from the full-length pipe sections, the

installer shall demonstrate the performance of the "bead removal" machine for the Owner on a short section of pipe that will allow the Owner to visually inspect the finished joint. Fabricated fittings shall be of the same size and SDR as the adjoining pipe.

4. Lay all pipes true to line and grade and do not bridge between joints.
5. Firmly bed all piping in compacted sand bedding along its entire length. Place bedding under, around and over all pipe so as to avoid distortion or crushing of the pipe. Compact all bedding using mechanical tampers or vibrators.
6. Remove all rock, boulders, cobbles, roots, and other debris from trenches prior to laying pipe. Trench bottoms shall be kept free of frost, frozen earth, or standing water at the time of pipe installation.
7. When laying pipe is in progress, the ends of piping shall be kept closed with approved temporary plugs to prevent entrance of dirt or debris. Mark the location of the ends with a 2 by 4 post painted and installed, as shown on the Drawings.
8. Perform pressure testing per Part 3.02 of this section.

3.02 SYSTEM TESTING AND INSPECTION

A. The following tests shall be performed by the Contractor, in the presence of the Owner, and also the County Inspector, should he require it.

B. The Contractor shall provide not less than 7 days' advance notice to the Owner of the scheduled test date so as to allow the Owner to make appropriate arrangements and scheduling.

C. Pressure Pipe (tight lines):

1. All sections of pressure tight lines shall be hydrostatically tested for leaks at a pressure of 125 psi for a period of 2 hours. Lines may be filled with water to expel all air, and high-pressure air injected through a one-way valve to bring pressure up to 125 psi. The Contractor shall provide and install a pressure gauge reading in 1-psi increments. The Contractor shall also plug and/or provide all temporary materials necessary to isolate test lines from the rest of the system.
2. Pressure loss in excess of 1 psi during the 2-hour test period will be cause for rejection and reperformance of the test. The Contractor shall make any/all repairs and shall bleed the system of suspected entrapped air and then reconduct the pressure test to the Owner's satisfaction. The test shall be repeated as many times as deemed necessary by the Owner, at no additional cost.

D. Gravity Pipe: Cleaning and testing shall be according to WSDOT 7-17.3(2).

E. Rapid Infiltration Basins: Contractor shall provide Owner time and opportunity to test each rapid infiltration basin after placement of the Pea Gravel and before placement of the Filter Sand. It is expected that each drain will take approximately 3 to 4 hours to test. Contractor will be expected to provide a minimum of 6,000 gallons of water at a rate of 50 gallons per minute for each test. Performance of each rapid infiltration basin will be considered suitable if the water level stabilizes at a depth below the surface of the Pea Gravel for at least 60 minutes at a flow rate of 50 gallons per minute.

END OF SECTION 333100

SECTION 333217 – PACKAGED NON-POTABLE WATER PUMPING STATIONS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SERVICE

A. The variable speed packaged pumping station will be used to pressurize and transfer treated and stored plant effluent to be used as pressurized wash and utility water at the wastewater treatment plant.

1.02 DEFINITIONS

A. Terminology pertaining to pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards.

1.03 SUBMITTALS

A. Shop Drawings:

1. Make, model, weight, and horsepower of each equipment assembly.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
4. Detailed drawings showing the equipment dimensions, size, and locations of connections and weights of associated equipment.
5. Power and control wiring diagrams, including terminals and numbers.
6. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
7. Factory-finish system.
8. Affidavit that the tank manufacturer is ASME certified.
9. Anchor bolt sizes.

B. Quality Control Submittals:

1. Affidavit that tanks are ASME certified.
2. Seismic anchorage and bracing calculations.
3. Factory Functional Test Reports.
4. Special shipping, storage and protection, and handling instructions.
5. Manufacturer’s printed installation instructions.
6. Field test data.
7. Manufacturer’s Certificate of Proper Installation.

8. Suggested spare parts list to maintain the equipment in service for a period of 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
9. List special tools, materials, and supplies furnished with equipment for use prior to and during start-up and for future maintenance.
10. Operation and Maintenance Manuals.
11. Manufacturer's warranties.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Contractor shall furnish all labor, materials, equipment, and incidentals required to provide pumping systems as specified herein. One manufacturer shall supply the pump to ensure suitability and assurance of experience in matching equipment together and to ensure single-source responsibility for equipment.

B. Manufacturers and Products:

1. Grundos Hydro MPC-EC (CUE) 2CR 5-9 3x208V 60Hz
2. Or Engineer-approved equal.

2.02 PERFORMANCE CRITERIA

A. Guaranteed Performance of Booster Pump Station Package

1. Pumping Condition at Full Speed:

a. Capacity: 55 gpm.
b. Total Head: 160 ft.

B. Pumps shall operate without cavitation or undue vibration under all conditions and shall not exceed the vibration limits provided in the most current revision of the Hydraulic Institute Standards.

2.03 PACKAGE CONSTRUCTION

A. General:

1. System shall consist of a prefabricated and tested variable speed packaged pumping station to maintain constant water delivery pressure.

B. Pumps:

1. Shall be of the in-line vertical multi-stage design.
2. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.

3. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
4. NPT suction and discharge.
5. Pump Construction:

a. Suction/discharge base, pump head, motor stool:	Cast iron (Class 30)
b. Impellers, diffuser chambers, outer sleeve:	304 Stainless Steel
c. Shaft	316 or 431 Stainless Steel
d. Impeller wear rings:	304 Stainless Steel
e. Shaft journals and chamber bearings:	Silicon Carbide
f. O-rings:	EPDM

6. The shaft seal shall be a balanced o-ring cartridge type with the following features:

a. Collar, Drivers, Spring:	316 Stainless Steel
b. Shaft Sleeve, Gland Plate:	316 Stainless Steel
c. Stationary Ring:	Silicon Carbide
d. Rotating Ring:	Silicon Carbide
e. O-rings:	EPDM

   f. The Silicon Carbide shall be imbedded with graphite.

7. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling and motor. The entire cartridge shaft seal shall be removable as a one piece component.

C. System Construction:

1. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valves shall be full port ball valves.
2. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the valve shall not exceed 5 psi at the pump design capacity.
3. Minimum diaphragm tank connection size of 3/4-inch shall be provided on the discharge manifold.
4. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). Systems with positive inlet gauge pressure shall have a factory installed pressure transducer on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 Vdc.
5. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2/1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
6. Systems with a flooded suction inlet or suction lift configuration shall have a factory installed water shortage protection device on the suction manifold.
7. The base frame shall be constructed of corrosion resistant 304 stainless steel. Rubber vibration dampers shall be fitted between each pump and base frame to minimize vibration.

8. Depending on the system size and configuration, the control panel shall be mounted in one of the following ways:

    a. On a 304 stainless steel fabricated control cabinet stand attached to the system skid.
    b. On a 304 stainless steel fabricated skid, separate from the main system skid.
    c. On its own base (floor mounted with plinth).

D. Pressure Tanks:

1. Provide (2) two bladder tanks.
2. Connecting piping to discharge manifold.
3. Pressure relief valve.
4. Interior and exterior of each tank including attached steel fittings shall be factory coated in accordance with the manufacturer's recommendations. Coatings shall be FDA approved for potable water contact. Interior coating shall be Tnemec Series 20, or approved equal.

E. Motor:

1. Totally Enclosed Fan Cooled (TEFC).
2. 1.15 service factor.
3. 3 hp.
4. 3,500 rpm.
5. Copper wound for operation on 208 V, 3-phase, 60 Hz.
6. Class F non-hydroscopic insulation rated for 40 degrees C. ambient temperature.

F. NPW System Control Panel:

1. For each station, a duplex pump control panel shall be provided as per specification drawings and shall have as a minimum, main disconnect, digital level control system with submersible level transducer.
2. Components shall be provided as listed below:

    a. Enclosure shall be UL Type 4X stainless steel, with pad-lockable 3 point latch. A swing out inner door shall be provided.
    b. A GFCI convenience receptacle shall be provided. Receptacle shall be industrial grade, 120V 20A.
    c. Main disconnect switch shall be UL98 listed and sized to handle full load amps of the panel, with pad-lockable door interlocking handle.
    d. VFD for each pump
    e. Circuit Breaker with pad-lockable door mounted disconnect handle.
    f. Shall be Schneider Electric/Square D ATV21 type or approved equal.
    g. Control power transformer with primary fuse protection.
    h. An HOA selector switch, RUN indicator, and OUT-OF-SERVICE indicator shall be provided for each pump. All pilot devices shall be UL Type 4X rated, 22mm type manufactured by Square D or equal. The indicators shall be long life LED type.
    i. An alarm horn shall be provided and mounted on the side of the panel. Horn shall be Federal Signal model 350 or equal with a minimum sound level of 100 db. A silence pushbutton shall be located on the inner door.
    j. An alarm light shall be mounted on the top of the panel, and shall be red polycarbonate and UL Type 4X rated.

k. Control relays shall be provided as shown on plan drawings and shall be blade type, with indicator lights. Relays shall be IDEC or approved equal.
l. Analog 4-20mA loops shall be provided with fuse protection.

3. Wire Ends: All wire ends shall be finished with crimped ferrules to prevent strands from splaying.
4. UL Listing: The panel shall be manufactured in by a UL508A registered shop and provided with a UL 508A label. A plastic laminated copy of the wiring diagram shall be attached to the inside of the panel door with waterproof adhesive.
5. Pressure Controller: The pressure booster control system shall include a digital pressure controller (DPC).

    a. The DPC shall, as a minimum, consist of a microprocessor with I/O and a color touch screen operator interface panel. The DPC shall be an integrated system and factory programmed to start, stop and sequence the pumps based on the relationship between the user accessible set points on the interface panel and the analog input from the pressure transducer.
    b. The DPC shall be an industrial type controller designed for harsh environments and a standard catalog item of a manufacturer with at least five years' experience in manufacturing micrologic pressure controllers. The DPC shall be rated for a minimum of 0-50 C operating temperature.
    c. The digital pressure controller shall be mounted on the control panel door and shall include:

        1) 3.5-Inch 320 x 240 pixel TFT touch screen
        2) 5 key sealed membrane keypad
        3) 4.5M application memory
        4) 312K data table memory
        5) 8GB micro SD card
        6) (1) RS232 programming port
        7) (1) 4-20ma or 0-10V analog inputs
        8) (22) 24VDC digital inputs
        9) (12) 5A relay contact outputs rated for up to 230VAC
        10) (2) 10 KHz high-speed inputs

    d. The DPC shall have pull-apart terminals so that the controller can be easily replaced without disconnecting or disturbing any wiring from the unit.

6. Digital Input and Outputs: Inputs shall be provided for each pump to include pump starter auxiliary contact to confirm pump operation when called and HOA Auto position to confirm the pump is available. Outputs shall be provided for each pump run command, out-of-service indicator for each pump, alarm horn and general fault contact.
7. Program Features:

    a. Configuration: The DPC shall have the following minimum configuration capabilities, all accessible by simply enabling them by touching a button in a user friendly setup wizard:

        1) Simplex, duplex, triplex or quadraplex operation – system shall automatically adjust all screens and functions for the number of pumps in the system.
        2) Constant speed or variable speed pumps.

3) 0-10V or 4-20ma pressure sensor input.
4) User scalable pressure sensor range and units.

b. Monitoring and Set Points: The pressure controller shall be designed with easy to navigate screens that will allow user access to the following functions and data:

1) Pressure display – in PSI
2) Number of pumps called
3) Pump status (Running, Stopped, Called, Failed, Out-of-service) for each pump
4) HOA selector (in controller to allow remote control of the pumps) for each pump
5) Run hour meter for each pump – minimum 100,000.00 hours (hundredths Resolution)
6) Number of starts counter for each pump
7) Alternation status
8) Alternation mode selector (Automatic, time clock, or manual)
9) Lead pump start and target set point
10) Lag pump start and stop set point
11) High and low discharge pressure alarm set point
12) High and low suction pressure alarm set point
13) Lead pump start delay and minimum run timer
14) Lag pump(s) start and stop delay timer

c. Alarm Configuration: The DPC shall have alarm configuration screens for each of the following alarm conditions:

1) High suction pressure
2) Low suction pressure
3) High discharge pressure
4) Low discharge pressure
5) Pump failure
6) Transducer failure

d. Each alarm condition shall have touch buttons that enable or disable each of the above alarm conditions individually to:

1) Enable/disable alarm condition
2) Shutdown pumps
3) Manual or Auto reset
4) Turn on the horn output
5) Turn on the alarm light output
6) Flash the alarm light
7) Turn on the general fault contact
8) Send email and/or text message
9) Adjust time delay

e. All enabled alarms shall be recorded in the DPC alarm history log and in an alarm handler that provide data regarding time of alarm, active or not, and number of same faults since last time cleared.

8. Password Protection: All set points shall be password protected with two levels of passwords.

9. Fault Data Logging: Fault logging shall be provided with a screen that gives access to the past 1,000 fault conditions, complete with date and time stamp. The system data log shall log any alarm condition that is enabled. A separate fault log shall be provided for each VFD that will log the last 250 VFD fault conditions.
10. Trend Graph and History: The DPC shall have a trend graph that automatically saves suction pressure, system pressure, motor speed and number of pumps running data at one second interval to a file on an SD card.

    a. A new file shall be automatically created at the beginning of each month. A minimum of 64 months of data shall be stored and can be retrieved by the DPC for on screen display in real time, or history mode.
    b. A Windows based software utility shall be available, at no additional charge, which can copy the file to a PC and display the data on the PC screen in graphical format (trend chart).
    c. This trend data shall serve the purpose of providing data regarding peak flow periods, system efficiency, and pump run times and duration.

11. Pump Run Data Logging:

    a. The DPC shall log every pump run event. The log shall record the start time, stop time and run duration, complete with date stamp, every time the pump runs. The log shall record a minimum of 10 years of data based on a frequency of 30 seconds between events.

PART 3 – EXECUTION

3.01 VARIABLE FREQUENCY DRIVE

A. Manual Operation:

1. When the hard wired H-O-A is place into the HAND position, the Pump Vision will be bypassed and the pump will run at a user preset speed. The preset speed is entered on the Pump Status screen and saved into the VFD. The VFD is not dependent upon the Pump Vision in any way for manual operation.
2. When the hard wired H-O-A is place into the AUTO position, the mode of operation is selected by touching the HAND, OFF or AUTO buttons on the Pump Status screen.
3. When the “soft” HOA is set to HAND, the pump will run and the VFD speed can be increased or decreased using the INC or DEC buttons on the Pump Control screen.
4. This “soft” H-O-A is provided in the Pump Vision to enable remote operation of the pumps, either through the Remote Access system, DDE program, through (Optional) the Web Server system, or by other SCADA systems
5. VARIABLE FREQUENCY DRIVE

B. Automatic Operation:

1. The pumps are available for automatic run when the AUTO selector switch input is enabled and the “soft” H-O-A is in the AUTO mode.

    a. The analog pressure signal is converted to PSI and that value is compared to the start and stop set points that are entered into the system by the user.

b. On falling pressure, when the pressure is less than or equal to the lead pump start set point, the lead pump will start after the start delay timer elapses and will maintain the pressure at the "Target" set point

C. Speed Control—PID Mode:

1. Once started, the lead pump VFD will immediately ramp up to the minimum run set point at the rate programmed into the VFD acceleration function. The speed of the drive will be modulated automatically by the PLC to maintain the target pressure set point.

    a. When the drive reaches minimum speed, the sample cycle timer begins timing. When the sample cycle timer elapses, a change will be made to the VFD speed proportional to the system pressure deviation from the target pressure set point. The speed can increase up to the maximum speed set point and decrease to the minimum speed set point. The speed changes occur at the interval set in the sample timer. The proportion of the change can be adjusted in the PID setup screen and is entered as a ratio of PSI: % Speed. If a 1.0:1 ratio is set, the VFD speed will change 1% for each 1 PSI of deviation. The amount of change is limited by the trim set point. This function is useful in controlling a "runaway" speed condition. A typical setting for the trim may be 6.0%, which would allow the VFD speed to change by that amount with each sample timer cycle.

D. Lag Pump Start:

1. When the speed of the VFD(s) running meets or exceeds the lag pump start set point, the lag pump start delay timer begins timing.

    a. When the timer elapses, the lag pump will start and ramp up to match the speed of the lead pump at the rate programmed into the VFD acceleration function.
    b. While running, the lead pump and lag pump will modulate at the same speed. In triplex or quadraplex systems, each lag pump starts in the same manner.

E. Lag Pump Stop:

1. When the speed of the VFD(s) running is at or below the lag pump stop set point, the last lag pump that started will stop.

    a. In triplex or quadraplex systems, each lag pump stops in the same manner, with a time delay between stops.

F. Sensorless No-Flow Lead Pump Stop:

1. The controller shall determine that there is a no flow condition without the use of an external sensor. When the lead pump has run for the minimum time, the pressure is above the start set point, and the controller determines that there is no flow, the lead pump will shut down.

G. Testing:

1. Each pump shall be factory performance tested as a unit prior to shipment. The performance test shall consist of five (5) points over the operating range of the pump. One point will be the specified primary design point of the pump. The performance tests will meet the acceptance

criteria of the Hydraulic Institute. Verified test data will include head vs. capacity, motor output (HP), RPM and pump efficiency.

2. Job-site programming shall be entered into the controller prior to shipment (details of installation requirements shall be communicated to the pump system manufacturer). A verified Controller performance test report shall be made available from the system manufacturer.
3. The system shall undergo a hydrostatic test of 250 psig for a minimum of 15 minutes prior to shipment.

H. Warranty

1. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.

END OF SECTION 333217

SECTION 333300 – SANITARY SEWERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work includes constructing sanitary sewer mains, side sewers, and manholes.

1.2 STANDARD SPECIFICATIONS

A. All work to be performed and materials to be used shall be in accordance with the current edition of the Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.

B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.

C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections apply to this Section.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data, standard drawings, and catalog cuts for the following:

1. Pipe and pipe fittings

2. Manhole structures and appurtenances

3. All miscellaneous components and appurtenances

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Gravity sewer: Gravity sewer pipe and fittings shall be solid wall PVC conforming to Section 9-05.12(1) of the WSDOT Standard Specifications. All pipe and fittings shall be legibly and permanently marked with type and class.

B. Pressure sewer: Pressure sewer pipe shall be HDPE SDR 11.

2.2 VALVES

2.3 Valves shall be schedule 80 PVC ball valves. Valves shall be rated for a minimum of 200 psi working pressure. Valve boxes shall be installed on all underground valves.

2.4 CLEANOUTS

A. Sewer cleanouts to conform to detail shown on plans.

2.5 MANHOLES

A. Manholes shall be precast concrete structures conforming to Section 9-05.50(2) of the WSDOT Standard Specifications.

B. Manhole gaskets, metal castings, and appurtenances shall conform to the standard details in the Plans and Section 7-05.2 of the WSDOT Standard Specifications.

2.6 MANHOLE RING AND COVER

2.7 Castings for manhole rings shall be gray iron or ductile iron and covers shall be ductile iron.

2.8 All covers shall be interchangeable within the dimensions shown on the plans. All mating surfaces shall be machine finished to ensure a non-rocking fit. The inside vertical recessed face of the ring and the vertical outside edge of the cover shall be machined or manufactured to the following tolerances:

1. Ring ± 3/32 inch

2. Cover ± 3/32 inch

B. All manhole rings and covers shall be identified by the name or symbol of the producing foundry and country of casting origin. This identification shall be in a plainly visible location when the ring and cover are installed. Ductile iron shall be identified by the following, “duc” or “di”. The producing foundry and material identification shall be adjacent to each other and shall be minimum ½-inch to maximum 1-inch high letters, recessed to be flush with the adjacent surfaces.

2.9 MANHOLE FOUNDATION MATERIALS

A. Foundation material for manholes shall be a minimum of 6-inches of compacted gravel backfill for pipe zone bedding.

PART 3 - EXECUTION

3.1 PIPE AND FITTINGS

A. Sanitary Sewers shall be constructed in accordance with Section 7-08.3 of the WSDOT Standard Specifications.

B. Valves shall be installed with valve box. Valves within traffic areas or dedicated pathways shall have traffic-rated valve box.

C. Plugs and stubs for future sewer pipes shall be one full stick of sewer pipe secured in place with a gasketed joint at the manhole and installed at the line and grade as shown on the plans. The installed pipe shall have a temporary cap installed that can be removed in the future.

D. Detectable Marking tape shall be installed over all sewer lines including service lines. The tape shall be placed approximately 1-1.5 feet below the ground surface and shall extend the full pipe length.

E. Direct Bury, U.S.E. 14-gauge green coated copper tracer wire shall be installed with all sewer lines. Tracer wire shall be wrapped around the pipe or taped to the pipe at maximum intervals of 10-feet.

3.2 VALVES

A. Valves shall be constructed in accordance with Section 7-12.3 of the WSDOT Standard Specifications.

3.3 CLEANOUTS

A. All sewer cleanouts shall be constructed in accordance with Section 7-19.3 of the WSDOT Standard Specifications.

3.4 MANHOLES

A. Manholes shall be constructed in accordance with Section 7-05.3 of the WSDOT Standard Specifications.

3.5 CLEANING AND TESTING

A. Sewers and appurtenances shall be cleaned and tested in accordance with Section 7-17.3(2) of the WSDOT Standard Specifications.

END OF SECTION

SECTION 333500 – SANITARY UTILITY VALVES, GATES, AND APPURTENANCES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section includes the supply and installation of gates, valves, motor operated valves, flexible couplings and related equipment, as shown on the drawings and specified herein.

B. A gate schedule is provided in 2.08, below, for the convenience of the Contractor. The Contractor shall verify all gates with the drawings, for type, size, and application.

1.02 QUALITY ASSURANCE

A. Standards: The materials and work performed in this section shall conform to the applicable standards of:

1. The American National Standards Institute (ANSI).
2. The American Society for Testing and Materials (ASTM).
3. American Water Works Association Inc. (AWWA).
4. The American Society of Mechanical Engineers, Boiler, and Pressure Vessel Code (ASME).
5. Plumbing and Drainage Institute (PDI).

B. Where no method of tests for materials is specified, the latest applicable test specified by ASTM shall be followed.

1.03 SUBMITTALS

A. In accordance with the requirements of Section 013300 – Submittal Procedures, submit the following data:

1. Materials and equipment list, giving manufacturer's technical data, O&M Manuals, Warranty information, and catalog cuts, with all gaskets and all other applicable items.
2. A complete list of all materials and equipment proposed to be furnished and installed with all applicable dimensions for specific applications.

1.04 PRODUCT HANDLING

A. Protect materials before during and after installation and protect the installations of all other trades.

B. Provide and use proper equipment, tools, and facilities for the safe and proper handling of valves, gates, and appurtenances to avoid damage.

C. In the event of damage, make all repairs to satisfaction of Engineer or make replacement of all damaged items.

D. After delivery to the site, all materials shall be carefully unloaded, protected against breakage, corrosion, accumulation of foreign matter disintegration and injury. The Contractor shall be responsible for all lost or damaged materials.

PART 2 – PRODUCTS

2.01 GATE VALVES

A. Gate valves 2-1/2 inches and under with screwed ends shall be 200-pound WOG with bronze body and trim, union bonnet, rising stem and solid wedge disc. Figure No. 47-U as manufactured by Clow or equal.

B. Gate Valves, 3 Inches and Larger: Shall conform to AWWA C500-80 for metal-seated gate valves, non-rising stem with iron body, bronze mounted, ductile iron gate, stainless steel or bronze stem. Valve ends shall be ANSI 125-pound flanged or Victaulic, unless otherwise required for connection. Valves shall be rated for a minimum of 150 psi and shall open counterclockwise. Gate valves with flanged ends shall be 200-pound WOG with iron body, bronze trim, resilient seat, or resilient wedge gate valves, by Clow, or equal.

C. Gate valves for buried service shall be AWWA resilient seat or resilient wedge gate valves with non-rising stem, mechanical joint ends with setscrews, O-ring seals, 2-inch square nut, and suitable C.I. valve box. Valves shall be by Clow or equal.

2.02 KNIFE GATE VALVES

A. Knife gate valves (instead of gate valves) shall be used in all mixed liquor, drains and unscreened sewage applications. All knife gate valves shall be supplied by a single manufacturer. Exposed valves shall be wafer-type, rising stem, bonnet-less knife gate valve and buried or submerged shall have a bonnet. Provide neoprene O-ring seats for tight shutoff, with seat such that if O-ring is dislodged, valve will still seat. Design seat such that if O-ring is dislodged, valve will still seat. Body shall be tapped to match ANSI B16.5, 150-pound flanges.

B. Exposed valves shall be wafer-type, rising stem, bonnet-less knife gate valve and buried or submerged shall have a bonnet. Valves shall be designed for 150 psi working pressure. Body shall be tapped to match ANSI B16.5, 150-pound flanges.

C. Packing shall be Teflon V-ring set type to give drip-tight service and long life. Valve body, flanges, stiffeners, and top works shall be carbon steel. Gate, seat, and stem shall be Type 304 stainless steel. Stem nut shall be acid-resistant bronze.

D. Gate Valves, 2-1/2 Inches and Smaller: Shall be 125 psi, wedge disk, all brass or bronze vales with screwed or solder ends as required.

E. Valves shall be handwheel operated. Valves greater than 5 feet above the floor shall be mounted horizontally and valves with operators 6 feet and greater above the floor shall be mounted horizontally and shall have chain operators with chains extending to 3 feet above floor, except for the two valves in the Pipe way that have access from the top. Chain hangers shall be placed to allow chain to be hung out of the way during non-use. Valves if mounted in the piping as shown, if operator is 5 feet or greater above the floor mounted vertically, shall be mounted horizontally.

2.03 PLUG VALVES

A. Unless otherwise shown on the Plans, plug valves shall be eccentric plug type with full pipe diameter opening, resilient facings bonded to the metal core of the plug and ANSI 125-pound flange or Victaulic ends. Contact between the plug face and the seat face shall be made only when the valve is fully closed. Valves shall have nickel alloy seats and shall have permanently lubricated stainless steel upper and lower bearing bushings. The stem seal or packing shall be designed to be replaced without removing the bonnet.

B. Valves shall have unrestricted straight-through flow without bonnet cavities to catch dirt and clog the line or action and shall be designed for not less than l25 psi working pressure. Buried valves shall have ends for connection and service and special seals suitable for submerged service. Valves shall be Victaulic, Keystone/Drum-Owen, DeZurick, or equal.

C. Three Way Plug Valves (Valves shall be Victaulic, Keystone/Drum-Owen, DeZurick or equal) (Note: See 2.18 for 3 way valves for Sprayfield):

1. Combinations: As shown on the plans.
2. Stops: Required for open/closed positions in accordance with flow pattern combination. Valves with 360-degree plug rotation without stops to limit plug travel are not acceptable.

D. Plug Valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, chain-wheels, etc., as required, or indicated on the Plans. Valves, 6 inches or less, may have lever or t-wrench operators. Valves larger than 6 inches shall have gear operators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position, and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts and washers shall be zinc plated. Type and position of operators shall be approved by the Engineer for each valve. Chain hangers shall be mounted near all valves with chain wheel operators to allow hanging the chains out of operating areas. Chain wheel and chain operators shall be provided for all valves with the operator 6 feet or greater above the floor.

E. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.

2.04 PVC AND CPVC VALVES

A. Ball valves (liquid applications) in PVC and CPVC piping shall be of the same material, Type I, Grade l PVC or CPVC, ASTM D-l784, with true union connections and Buna-N or Viton seals. The valves shall have Teflon seats and full port opening, same size as pipe.

B. Ball valves on air lines shall be bronze body with stainless steel shaft and disc with Buna N seats.

C. PVC Ball Check Valves. PVC ball check valves shall be suitable for 150-pound service with PVC body, Viton seats, and union-type end connections. PVC ball check valves for chemical application shall be Chemtrol BC Series as manufactured by Cabot Corporation.

2.05 SWING CHECK VALVES

A. The valve shall have a cast iron body and disc, bronze seat, rubber seat ring, and 303 stainless steel shaft. The external lever shall have an adjustable weight. Swing check valves shall be Mueller, Kennedy, Victaulic, or equal.

B. Where called for on the Drawings, including electrical or instrumentation drawings, valves shall be equipped with position sensor switches. Switches shall be mounted on approved stainless steel brackets located to not interfere with valve or adjacent equipment operation. Switches shall be micro-limit switches DPST of proximity switches. Switch actuation shall be for “non-closed” position indication.

2.06 BUTTERFLY VALVES

A. Butterfly valves shall comply with physical and performance requirements of APWA C-504, Class 150B. All valves shall have Buna N seats, cast iron body, stainless steel shaft, ductile iron or stainless-steel disc and stainless-steel disc edge, and shall be wafer-type, flange type, or Victaulic, as required for the service shown on the Drawings. Valves shall be furnished with manual operators with valve position indicators and multiple “lock-stops” on handles, unless otherwise called out.

2.07 MUD VALVES

A. Mud valves shall be flanged frame, non-rising stem, Waterman Model MV-11 or equal. Valve bodies, covers, and yokes shall be constructed of high strength cast iron. Valve seat shall be bronze to bronze. Valve stem and lift nut shall be bronze. Flange drilling shall be 125-pound ANSI. Valves shall be furnished complete with non-rising extension stem and indicating floor stand, or wall bracket, or operating nut, depending on location, as shown on the Drawings.

2.08 WEIR GATE SCHEDULE

A. Weir gate schedule is provided for the convenience of the Contractor and may not be inclusive. Contractor shall verify all gate dimensions from the drawings. Gate

Gate	Frame (stop or slide) or Size (sluice) Type	Width[1]	Height[1]	Remarks
Downward acting weir gate; travel 1′-6″ above top of weir wall opening				
Sludge Holding Basin	Weir-wall mounted	3′-0″	2′-0″	Handwheel and nut – Normally Closed
Post-Anoxic Zone	Weir-wall mounted	3′-0″	2′-0″	Handwheel and nut
Pre-Aeration Zone	Weir-wall mounted	3′-0″	2′-0″	Handwheel and nut

Notes for Gate Schedule:

1. Weir gate frames shall be Flange Back for thimble or Wall Mounting and Embedded Frames for channel gates measured with the dimensions given for the opening of the gate (channel width and depth, top to invert or weir box opening width and top of concrete to top of box). All weir gate frames shall be provided with a Neoprene rubber flush bottom seal, ASTM D2000 and J-type seals on sides, winged UHMW or flat seals will not be considered. Downward acting weir gate shall have J-type seals on sides and bottom.

2. All weir gates shall have handwheel for manual operation of gate and nut to fit portable electric operator drive.

2.09 ALUMINUM OR STAINLESS-STEEL STOP GATES

A. Provide aluminum stop gates and frames, as manufactured by Fontaine, USA or equal. All stop gate frames shall be provided with a Neoprene rubber flush bottom seal, ASTM D2000. Vertical guides shall be furnished with ultra-high molecular weight (UHMWPE to ASTM-D-4020-96) seats, which contact the slide face with J-type seals to provide additional water tightness. Stop gates shall be fabricated of 1/4 inch or manufacturer recommended design, aluminum as shown and shall be reinforced as necessary to assure long life under the specified operating conditions.

B. Guide frames shall be extruded aluminum shapes or composites, Alloy 6061-T6, of size and types shown and called out on schedule, with factory-welded corners. All surfaces in contact with concrete shall have one shop coat of unthinned bitumastic paint, Koppers 50 or 1/2-inch EPDM gasket material between gate and concrete. All other surfaces shall be mill finish.

2.10 STAINLESS STEEL DOWNWARD ACTING WEIR GATES

A. Weir gates shall be provided as shown on the schedule, above. The gates shall be self-contained or non-self-contained, with separate stem guides and operators, in accordance with the requirements of these Specifications and as called out on the Drawings. Weir gates shall be 304 stainless steel (SS). Weir gates shall be hand-wheel and gear operated, with provision of a square nut or other means of attaching and supporting a portable, electric gate operator for use on all weir gates. Specific gate design and configuration shall be as shown on plans.

B. The gate frame shall be a rigid, welded unit, composed of the guide rails, and cross bars, with a clear opening the same size as the waterway, unless otherwise specified. They shall be flange back, spigot back, or embedded type as directed on the plans and gate schedule.

C. The guides shall be of extruded or fabricated 304 SS incorporating a single slot design. The primary slot will accept the plate of the slide (disc) and the secondary slot will be sufficiently wide to accept the reinforcing ribs of the disc. The guides shall be designed for maximum rigidity, having a weight of not less than three pounds, per foot. The guides will be of sufficient length to support at least two-thirds (2/3) the height of the slide, when the gate is fully open.

D. The slide cover shall be plate reinforced with structural 304 SS shapes welded to the plate. The slide cover shall not deflect more than 1/720 of the span of the gate under maximum head. Reinforcing ribs shall extend to the guides so that the seating surface of the guide is reinforced. The stem connection shall be either the clevis type, with structural members welded to the slide and a bolt to act as pivot pin, or a threaded and bolted (or keyed) thrust nut supported in welded nut pocket. The pocket and yoke of the gate shall be capable of taking at least twice the rated thrust output of the operator at 40 pounds pull.

E. The stems shall be Type 304 SS of suitable length and ample strength for the intended service. The stem diameter shall be capable of withstanding twice the rated output of the operator at 40-pound pull, 1-inch minimum, and shall be supported so the L/r ratio for the unsupported stem length shall not exceed 200.

F. Gates shall be furnished with a flush bottom seal arrangement. A resilient neoprene seal with a minimum width of exposed face of 3/4 inch shall be securely attached to the frame along the invert and shall extend to the depth of the primary slot.

G. Gates shall be provided with Self-Adjusting, UHMWPE Sealing System with Sealing on two sides for Slide and Channel Gates and Sealing on Two Sides and Frame Mounted Top for Sluice Gates. “J” bulb seals will only be used when the Seating or Unseating heads are below 15 feet. PSI and will seal along the sides, and across the invert for (weir gates) or top (standard upward opening) of the gate. Seals shall be mounted either on the frame so the seals do not protrude into the specified opening of the gate. When seals are required completely around opening, a slide-mounted seal shall be provided to seal against the invert member.

H. Gates which have a width exceeding twice the slide height shall be furnished with tandem interconnected operators with a single input crank.

I. The fabricated 304 SS weir gates shall be Fontaine, USA or equal.

2.11 TELESCOPING VALVES

A. The Contractor shall provide telescoping valve assemblies where shown on the drawings, and as detailed on the drawings. The valves shall be of rising stem type and shall provide at least 36 inch or the amount of travel shown on the Plans. The valves shall consist of an operating stand assembly, a stainless steel lifting stem, a seamless stainless steel tube and a tube guide collar with neoprene gasket seals.

B. The Offset pedestal, floor stand, mounting bracket shall be 304 stainless steel and the handwheel shall be aluminum or cast iron. The operator shall be able to maintain the position of the valve at

any desired position within the operating range. Valve operating stands shall be equipped with 2:1 geared operators, Golden Harvest GH-900, Waterman, or equal.

C. Where called for a 12-inch-diameter seamless stainless steel weir cone shall be securely attached to the lip of the valve, as shown, and sealed against leakage at the seam. All ferrous surfaces, with the exception of any stainless steel, shall be hot dip galvanized. All nut and bolt assemblies shall be 316 stainless steel.

2.12 EXTENSION RISER STEMS

A. Extension riser stems shall be Mueller Figure 1 or 2, Kennedy or equal. Stem diameters shall be 1-inch minimum, as required for application. Guides shall be spaced such that the slenderness ratio of the stem body does not exceed 200. Provide one adjustable stem guide, minimum, for each riser. See Detail 2.1 on GP3 for stem support.

2.13 RUBBER EXPANSION JOINTS

A. Expansion joints for use at intake and discharge of pumps shall be standard spool type with single arch and high strength nylon fabric and elastomer, reinforced as required for the intended application. The flanges shall be integral with the body and utilize stainless steel retaining rings, drilled for 125-pound flange. Tapered expansion joints shall be concentric. Expansion joints shall be Red Valve, Metraflex, or equal.

2.14 VALVE BOXES

A. Valve boxes shall be two-piece sliding type, cast iron with 5-l/4-inch shaft, and shall be Mueller, Clow, or equal. Length shall be as appropriate for the installation, or as approved. Extension stems, if required, shall be the manufacturer's standard type for use with the valve box. Lids shall be designed for full H-20 wheel loads when located in a traveled way.

B. Where valves are buried greater than 6 feet below the ground surface (top of 2-inch operating nut greater than 4 feet below ground surface), extended stems shall be provided and installed for operating nut to be 3 feet below top of valve box.

2.15 AIR RELEASE VALVES

A. Sewage Air and Vacuum Valve:

1. Sewage air and vacuum valves shall allow unrestricted venting or re-entry of air through it during filling or draining of force mains or other pipelines, to prevent vacuum or air bubble build-up. The valves shall incorporate two stainless steel floats directly connected by a stainless steel float guide to maintain an air gap between the bottom float and the top shut-off float. The air gap shall retard waste solids from fouling or clogging the top shutoff float. The internal baffle shall be fitted with a guide bushing and act to protect the shut-off float from direct airflow. The baffle shall retain the 45-degree Durometer Buna N seat in place, without distortion, for tight shutoff.

2. All internals shall be easily removed through the top cover of the valve without removing the valve from the line. The complete valve shall withstand 500 psi test.
3. Air/vac valve shall be equipped with 2-inch NPT inlet and 1-inch NPT outlet back into wet well for Effluent Outfall Header and 1/2-inch NPT inlet and outlet for WAS header. Valve shall be equipped with inlet shutoff valve, blow off valves, quick disconnect couplings, and a minimum of 10 ft of hose for flushing.
4. Valve body, cover, and baffle shall be cast iron. Upper float, lower float, stem, and guide bushing shall be stainless steel. Valve seat shall be Buna N. Valve shall be APCO Series 401 or equal.

B. Permeate Air/Vacuum Relief Valve:

1. Air/vacuum valves shall be designed to allow large quantities of air to escape out the orifice when the pump starts and to close water tight when the liquid enters the valve. The Air/Vacuum Valves shall also permit large quantities of air to enter thru the orifice when the pump stops to break the vacuum. The discharge orifice area shall be equal or greater than the inlet of the valve.
2. The valve shall consist of a body, cover, baffle, float, and seat. The seat shall be compression molded Buna-N, fastened to the valve cover without distortion for tight shut-off and easy removal or replacement if necessary. The float shall be stainless steel designed to withstand a minimum of 1000 psi (static). The float shall be center guided for positive shut-off into the seat.
3. All materials of construction shall be certified in writing to conform to A.S.T.M. specifications as follows:

a.	Body, cover	Cast Iron	ASTM A126 Gr.B
b.	Baffle	Delrin	ASTM D4181
c.	Float	Stainless Steel	ASTM A240 T304
d.	Seat	Buna-N	
e.	Exterior Paint	Universal Primer	FDA Approved for Potable Water Contact

4. Valve to be APCO Series 140 Air/Vacuum Valves per Bulletin 601, as manufactured by Valve & Primer Corporation, Schaumburg, Illinois, U.S.A., or approved equivalent.

C. Air release valves shall allow escape of small quantities of air while under pressure. Air/Vacuum valves shall allow large quantities of air to enter or escape. The valves shall be for service of 150 psi. The body and cover shall be cast iron, float and stem shall be stainless steel and the seat shall be Buna-N.

2.16 PRESSURE GAUGES FOR PUMPS

A. Pressure gauge shall be provided for each pump discharge (including submersible pumps between the check and isolation valves). Each pressure gauge shall be silicone or glycerin filled, have isolation valve, diaphragm seal to separate pumped liquid from gauge, annular seal where possible and shown, or as called out on drawing (annular seal connection shall be Red Valve Series 40 or equal) upstream of isolation valve, and minimum 2.5-inch face. Gauge shall read in psi with range of 0 to 50 psig. Provide and install compound type gauges where indicated on the Drawings.

2.17 3-WAY PLUG VALVE (IF USED)

A. 3-way plug valve shall be in accordance with 2.4 C, above and the following:

1. Size: 12-inch with a maximum shutoff pressure differential of 50 psi.
2. Type: 3-way tapered plug valve, Combination 1.
3. Rating: 125 psi.
4. Body: Cast Iron ASTM A126, Class B.
5. End Connections: ANSI Class 150 flanged.
6. Plug Facing: Ni-Resist plug.
7. Packing: Acrylonitrile – Butadiene.
8. Operators:

    a. Electric Motor Actuators shall be 240 volts, single phase.
    b. Local actuator – Position 1, Position 2, Auto. In Auto, the valve will be controlled from the PLC by two form C contact outputs
    c. Submit control circuit wiring shown in the Drawings.

B. Manufacturers and Products shall be Dezurik Model PTW, 12, F1, CI, 6, S-, 1-, M, or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install all materials in strict accordance with the manufacturer's recommendations as approved by the Engineer.

B. Before installation, carefully clean valves of all foreign material. Unless otherwise indicated, install valves with the stem vertical. Mount horizontal valves in such a manner that adequate clearance is provided for operation.

C. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned. After cleaning, insert the gasket and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen the nuts, reseat or replace the gasket, retighten the nuts, and retest the joint. Joints must be watertight at test pressures before acceptance.

3.02 TESTS

A. Upon completion of this portion of the work, and prior to its acceptance by the Owner, make all required tests and secure all required approvals from agencies having jurisdiction.

B. Testing: Valves and related materials will be tested at the same time that the adjacent pipeline is tested. Joints shall show no visible leakage under test. Repair joints that show signs of leakage prior to final acceptance. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The Contractor will be held responsible for any damage caused by the testing.

END OF SECTION

SECTION 334000 - STORMWATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Work described in this Section includes installing the stormwater conveyance piping and appurtenances to serve the park uses. Stormwater utility work in this section includes, but is not limited to, the following.
   1. Construction of gravity storm sewer pipes catch basins, roof drains, culverts, flow dispersion trench and cleanouts.
   2. Trench excavation, pipe bedding, and gravel backfill.

1.2 REFERENCES

A. Reference Standards – Current edition at date of bid:
   1. Washington State Department of Transportation (WSDOT) / American Public Works Association (APWA)
      a. Standard Specifications for Road, Bridge, and Municipal Construction.
      b. Standard Plans for Road, Bridge, and Municipal Construction

B. Washington State Department of Ecology's Stormwater Management Manual for Western Washington

1.3 SUBMITTALS

A. Submit manufacturer's literature and data for all pipe, fittings, castings, catch basins, area drains, grates, and other manufactured products.

1.4 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:
   1. Temporary Erosion and Sedimentation Control – 015713
   2. Earth Moving – 312000
   3. Appendix A Geotechnical Report

PART 2 - PRODUCTS

2.1 Materials

A. Solid Wall PVC Storm Sewer Pipe shall meet the requirements of section 7-04 and 9-05.1(5) (PVC Drain Pipe) of the WSDOT Standard Specifications (WSDOTSS).

B. Catch basins shall meet the requirements of section 7-05 and 9-05.50(3) of the WSDOT Standard Specifications.

C. Corrugated Polyethylene Culvert Pipe shall meet the requirements of WSDOTSS 9-05.19. Flared End Sections shall comply with WSDOTSS 7-02.3(2).

D. Flow Dispersion Trench shall consist of the following materials:
1. Washed rock shall meet the requirements of section 9-03.12(5) Gravel Backfill for Drywells of the WSDOT Standard Specifications
2. Geotextile shall be non-woven meeting the requirements of section 9-33 of the WSDOT Standard Specifications, Class A geotextile for underground drainage with low survivability (Table 2).
3. Perforated pipe and cleanouts shall meet the requirements of section 9-05.2(6), or 9-05.2(7) type SP with Class 2 perforations, of the WSDOT Standard Specifications.
4. Wood for Flow Dispersion Trench shall be Hem Fir, S4S, WCLB Para. 118a Construction, unless otherwise indicated, grade marked, and the following requirements: Comply with ASL PS 20 and applicable grading rules of respective grading and inspecting agency for species and product indicated. Manufacture to sizes and patterns using kiln dried lumber. Wood shall be pressure treated with ACQ-D to 0.40 lbs/sf.
5. Bolts, Nuts, and Washers: ASTM A325, galvanized to ASTM A153.

E. Gravel Backfill for Pipe Zone Bedding shall meet the requirements of WSDOTSS 9-03.12(3).

F. Trench Backfill material shall meet WSDOTSS 9-03.19 Bank Run Gravel for Trench Backfill. Common Borrow A may be used Trench Backfill provided the material is processed through a 2-1/2” screen.

PART 3 - EXECUTION

3.1 PREPARATION

A. All temporary erosion and sediment control measures shall be in place prior to land disturbance.

3.2 TRENCHING AND EXCAVATION

A. Trenching and excavation for the stormwater conveyance components shall be done in accordance with sections 7-05.3 and 7-08.3 of the WSDOT Standard Specifications. Salvage all

boulders per Section 31 20 00 Earth Moving. Excavated material may be used as Common Borrow A if the material meets the sieve requirements of Common Borrow A as determined by the Owner.

3.3 PIPE INSTALLATION

A. Installation of the stormwater conveyance components shall be done in accordance with sections 7-08.3 of the WSDOT Standard Specifications.

3.4 MANHOLES, INLETS, CATCH BASINS AND DRYWELLS

A. Manholes, Inlets, Catch Basins and Drywells shall be installed in compliance with WSDOTSS 7-05 Manholes, Inlets, Catch Basins and Drywells.

3.5 FLOW DISPERSION TRENCH

A. Install Flow Dispersion Trench level as shown and described in Plans. The top of the Flow Dispersion Trench shall be Gravel Backfill for Drywells; no topsoil, mulch or any other material shall be placed over the Flow Dispersion Trench.

END OF SECTION

SECTION 338000 – RV UTILITY PEDESTAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Shall be tested and certified to be in compliance with ANSI/UL 231 entitled "power outlets." If a laboratory other than U.L is used that laboratory must certify, in writing, that the power outlet has been tested and meets all of the requirements of ANSI/UL 231, including 746C polymeric materials, and that the unit will pass the 94VO-5V flame test.

B. Shall be certified to meet all sections of NFPA 7-551-70 of NEC

C. Shall meet 406.8 (B)(2)(a) of the national electric code NFPA 70, i.e. "A receptacle installed in a wet location shall be installed in a weatherproof enclosure, the integrity of which is not affected when the attachment plug cap is inserted."

1.2 REFERENCES

A. National Fire Protection Association (NFPA) National Electrical Code (NEC)

1.3 SUBMITTALS

A. Submit manufacturer's literature and data for all equipment.

1.4 RELATED WORK

A. Coordinate related work specified in other parts of the Project Specifications, including, but not limited to the following:
   1. Section 260500 – Common Work Results for Electrical Systems
   2. Section 260526 – Grounding and Bonding for Electrical Systems
   3. Section 033000 – Cast-In-Place Concrete – Architecture

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers – Power Pedestal / Distribution Equipment:

A. Dock Boxes Unlimited Inc. 149 Warwick Court, Williamsburg, VA 23185 Toll Free: 1-800-559-4269

2.2 Power Pedestal – General specification

A. Main Housing
   1. The housing shall be constructed of 14 gauge, stainless steel and shall be coated with UV-resistant polyurethane resin over a powder coating. It shall be UL listed as a type 3R weatherproof enclosure.

B. Lighting Assembly / Housing:
   1. The lighting top housing shall be constructed of 14 gauge, stainless steel and shall be coated with UV-resistant polyurethane resin over a powder coating. It shall be UL listed as a type 3R weatherproof enclosure.
   2. STANDARD – Each pedestal shall be equipped with a non-metered LED light, that is controlled by an electromechanical photocell and protected by a 20 amp, single pole breaker.
   3. OPTION – Each pedestal shall be equipped with a non-metered light. The lighting assembly shall include one 14-watt compact fluorescent light, that is controlled by an electro mechanical photocell and protected by a 20 amp, single pole breaker.

C. Wiring:
   1. The power pedestal shall be completely pre-wired at the factory to the load side of a utility meter socket.
   2. All load copper wiring shall be of high stranding and tin plated to resist corrosion.

D. Grounding:
   1. All exposed metallic parts must have an integral ground that is a part of the equipment grounding system

E. Receptacles:
   1. All receptacles shall be mounted behind a lockable weather[roof, hinged door that is under tension to ensure proper closing pressure when the receptacle is or is not in use.
   2. All receptacles shall be mounted at least 24” above level surface.
   3. All receptacles under 60 amps shall be of the corrosion resistant type conforming to NEMA TT-30 and/or NEMA 14-50.
   4. 20 Amp, 110 Volt, straight blade receptacles shall be GFI protected.
   5. 30 Amp, 125 Volt, receptacles shall be 2 pole, 3 wire (NEMA TT-30).
   6. 50 Amp, 125/250 Volt, receptacles shall be 3 pole, 4 wire (NEMA 14-50).

F. Circuit Breakers:
   1. All breakers for receptacles shall be of the thermal magnetic type, 10,000 A.I.C., and shall be UL listed.
   2. Circuit breakers shall be located under lockable, weatherproof door.
   3. Circuit breakers for the 20 Amp, 110 Volt, straight blade receptacles shall be single pole, 20 Amp.
   4. Circuit Breakers for the 30 Amp, 125 Volt, Receptacles shall be single pole, 30 Amp.
   5. Circuit breakers for the 50 Amp, 125/250 Volt, receptacles shall be two pole, 50 Amp.
   6. Additional circuit breakers are available to power auxiliary items such as lighting, buildings, or sheds.

G. Hose/Cable Bracket:
   1. Each pedestal shall have aluminum brackets capable of holding a 50’ length of 5/8” water hose or 50’ of 50 Amp, four-conductor boat S.O cord.

H. Meter Socket:
1. Each pedestal shall be equipped with a 200A meter socket built into the pedestal.
2. The utility shall land all service conductors on the meter socket vvia an isolated raceway inside the pedestal.

I. Communications (optional):
1. Each pedestal shall be equipped with two outlets for each slip. Each outlet shall contain a combination of RJ45 (internet) receptacles, RJ11 (telephone) receptacles, or male coax (cable TV) connectors under an injection-molded heavy resin, weather protective cover.
2. Each communication assembly shall include an internal isolation box for the separation of high and low voltage equipment.

J. Water:
1. Each pedestal shall be equipped with one ¾" ball valve with a ¾" female NPT fitting.
2. The water assembly shall have an isolation box, which separates the water connections from the electrical access area.

K. Power Pedestals for A.D.A Sites (Designated as Handicap Accessible):
1. Power pedestals installed on designated handicap accessible sites shall compy with the guidelines of the Americans with Disabilities Act of 1990.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cement concrete type A pad shall be installed and cured for at least 1 week prior to installation of RV Utility Pedestal.

B. Utility conduit stubs to be installed and in place prior to installation of RV Utility Pedestal.

3.2 RV Utility Pedestal Installation

A. RV Utility Pedestal shall be surface mounted to Cement Concrete Type A as directed by manufacturers guidelines.

END OF SECTION

SECTION 400500 – PROCESS PIPING (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. This section specifies systems of process piping and general requirements for piping systems. Detailed specifications for the components listed on the Piping System Specification Sheets are found in other sections of Divisions 33 and 40. This section shall be used in conjunction with those sections.

B. Definitions:

1. Pressure terms used in Section 400500 – Process Piping, and elsewhere in Division 40 are defined as follows:

a. Maximum: The greatest continuous pressure at which the piping system operates.
b. Test: The hydrostatic pressure used to determine system acceptance.

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the documents referenced below. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	**Title**
AASHTO M36/M36M	Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains
ANSI A13.1	Scheme for the Identification of Piping Systems
ANSI B1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.12	Cast Iron Threaded Drainage Fittings
ANSI B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

Reference	Title
ASTM A126	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A536	Ductile Iron Castings
ASTM B88	Seamless Copper Water Tube
ASTM C76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C443-REV A	Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM D1248	Polyethylene Plastics Molding and Extrusion Materials
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2466	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3261	Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM F441	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM A929	Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
AWWA C111	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
AWWA C150	Thickness Design of Ductile-Iron Pipe
MIL-STD-810C	Environmental Test Methods
UPC	Uniform Plumbing Code

B. Fittings and Coupling Compatibility:

1. To ensure uniformity and compatibility of piping components, fittings and couplings for grooved end piping systems shall be furnished by the same manufacturers.

PART 2 – PRODUCTS

2.01 PIPING MATERIALS

A. Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, linings and coatings, shall be selected from those listed on the piping system specification sheets. Piping materials shall conform to detailed specifications for each type of pipe and piping appurtenance specified in other sections of Division 40.

2.02 PIPING IDENTIFICATION

A. Plastic Coding Markers:

1. Plastic markers for coding pipe shall conform to ANSI A13.1 and shall be as manufactured by W. H. Brady Company, Seton Name Plate Corporation, Marking Services Inc., or equal. Markers shall be the mechanically attached type that are easily removable; they shall not be the adhesive applied type. Markers shall consist of pressure sensitive legends applied to plastic backing which is strapped or otherwise mechanically attached to the pipe. Legend and backing shall be resistant to petroleum based oils and grease and shall meet criteria for humidity, solar radiation, rain, salt, fog and leakage fungus, as specified by MIL-STD-810C. Markers shall withstand a continuous operating temperature range of -40 degrees F to 180 degrees F. Plastic coding markers shall not be the individual letter type but shall be manufactured and applied in one continuous length of plastic.
2. Markers bearing the legends on the background colors specified in the PIPESPEC shall be provided in the following letter heights:

Outside Pipe Diameter,[a] Inches	Letter Height, Inches
Less than 1-1/2	1/2
1-1/2 through 3	1-1/8
Greater than 3	2-1/4

[a] Outside pipe diameter shall include insulation and jacketing.

3. In addition, pipe markers shall include uni- and bi-directional arrows in the same sizes as the legend. Legends and arrows shall be white on blue or red backgrounds and black on other specified backgrounds.

B. Plastic Tracer Tape:

1. Tracer tape shall be 6 inches wide, colored the same as the background colors as specified in Table A, Paragraph 400500-3.06, “Piping Systems,” and made of inert plastic material suitable for direct burial. Tape shall be capable of stretching to twice its original length and shall be as manufactured by Allen Systems, W. H. Brady Co., Seton Name Plate Corporation, Marking Services Inc., or equal.
2. A message shall be printed on the tape. The message shall read “CAUTION WASTEWATER PIPE BURIED BELOW” with bold letters approximately 2 inches high. The message shall be printed at maximum intervals of 2 feet.

C. Magnetic Tracer Tape:

1. Polyethylene magnetic tracer tape shall be as manufactured by Allen Systems, W. H. Brady Co., Seton Name Plate Corporation, Marking Services Inc., or equal. Tape shall be acid and alkali-resistant, 3 inches wide, 0.005-inch thick, and have 1,500 psi strength and 140 percent elongation value. The tape shall be colored the same as the background colors as specified in Paragraph 400500-3.06 and shall be inscribed with the word "CAUTION--PIPE BURIED BELOW".

D. Detector Wire:

1. Detector wire shall be insulated No. 14 copper location wire.

2.03 VALVES

A. See Specification Section 333500 – Sanitary **Utility Valves, Gates, and Appurtenances.**

2.04 PRODUCT DATA

A. Product data on piping materials shall be provided in accordance with Section 013300 – Submittal Procedures, where specified.

B. Piping layout drawings shall be transmitted to the Engineer a minimum of 2 weeks prior to construction. Drawings shall be original layouts by the Contractor; photocopies of Contract Drawings are not acceptable.

2.05 CLEANOUTS

A. Gray-Iron Cleanouts:

1. ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

a. Light Duty: In earth or grass foot-traffic areas.
b. Medium Duty: In paved foot-traffic areas.
c. Heavy Duty: In vehicle-traffic service areas.
d. Extra Heavy Duty: In roads.
e. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Location:

1. Piping shall be provided as specified except for adjustments to avoid architectural and structural features and shall be coordinated with electrical construction.

B. Piping Sizes:

1. Where the size of piping is not specified, the Contractor shall provide piping of the sizes required by the UPC. Unless specified otherwise, small piping (less than 1 inch in diameter) required for services not described by the UPC shall be 1/2 inch.

C. Pipe Support, Anchorage, and Seismic Bracing:

1. General: Piping shall be supported by anchor brackets, guides, saddles, or hangers. Acceptable types of supports, guides, saddles, hangers, and structure attachments for general pipe support, expansion/contraction and for seismic bracing, as well as anchorage details, are shown on the Drawings. Minimum spacing shall be as specified for supports and for seismic bracing. Where a specific type of support or anchorage is indicated on the Drawings, then only that type shall be used there. Piping shall be vertically supported by anchor brackets, guides, saddles or hangers and shall be seismically braced where indicated to resist lateral load. Supports shall be provided on each run at each change of direction. Pipe supports shall be hot-dip or mechanically galvanized. Unless otherwise specified, existing pipes and supports shall not be used to support new piping.
2. Piping Connections to Machines: Piping at machine connections shall be aligned in all planes to permit insertion of bolts at bolted connections or coupling screwed connections without using jacks, come-a-longs or other mechanical means to align field piping with the connections at the machines. Bolts shall not be forced into mating flange bolt holes and shall be capable being withdrawn using finger pressure alone. The use of 'dutchmen' mitered sections or similar specials to achieve the required alignment with machine connections is strictly prohibited.

D. Anchorage for Buried Piping:

1. All plugs, caps, tees and bends in buried pressure piping systems shall be anchored by means of reaction backing or restrained joints as specified.

E. Bedding and Backfill:

1. Bedding and backfill for buried piping shall be as specified in Section 310000 - Earthwork.

F. Equipment Connection Fittings:

1. Where shown, equipment connection fittings as specified in Section 400506 - Piping Connections, shall be provided between field piping systems and equipment inlet and outlet connections.

G. Flexibility:

1. Unless otherwise specified, piping passing from concrete to earth shall be provided with two pipe couplings or flexible joints as specified in Section 400506.

3.02 PIPING IDENTIFICATION

A. Pipe Coding:

1. After application of the specified coating and insulation systems, exposed piping, interior and exterior, and piping in ceiling spaces, pipe trenches, pipe chases and valve boxes shall be identified with plastic markers as specified in Paragraph 400500 2.02A, Piping Systems." Legend markers and directional arrows shall be located at each side of walls, floors and ceilings, at one side of each piece of equipment, at piping intersections, and at approximately 50-foot centers.

B. Plastic Tracer Tape:

1. A single line of tape as specified in Paragraph 400500-2.02B, Piping Systems," shall be provided 2.5 feet above the centerline of buried plastic pipe. For pipelines buried 8 feet or greater below finished grade, Contractor shall provide a second line of tape 12 inches below finished grade, above and parallel to each buried pipe. Tape shall be spread flat with message side up before backfilling.

C. Magnetic Tracer Tape:

1. Polyethylene magnetic tracer tape shall be buried 12 to 18 inches below ground and shall be above and parallel to buried nonferrous, plastic and reinforced thermosetting resin pipe lines. For pipelines buried 8 feet or greater below final grade, the Contractor shall provide a second line of tape 2.5 feet above and parallel to the buried pipe.

D. Detector Wire:

1. The detector wire shall be continuous along all no-ferrous pipelines and placed adjacent to the pipe as it is being laid. Tag ends shall be secured at the end of the pipe runs to either a post or in a valve box.

3.03 VALVE IDENTIFICATION

A. Stainless steel tags bearing the specified valve number stamped in 1/4-inch high letters shall be installed on valve flanges in a position visible from floor level. Flangeless valves 8 inches in diameter and larger shall have tags attached to the valve body by self-tapping corrosion resistant metal screws. Flangeless valves 6 inches in diameter and smaller shall have tags attached to the valve stem by stainless steel wire. Wire shall be 0.063-inch minimum.

3.04 TESTING

A. General:

1. Upon completion of piping, but prior to application of insulation on exposed piping, the Contractor shall test the piping systems. Pressures, media, and test durations shall be as specified in the PIPESPEC. Equipment which may be damaged by the specified test conditions shall be isolated. Testing shall be performed using calibrated test gauges and calibrated volumetric measuring equipment to determine leakage rates. Each test gauge shall be selected so that the specified test pressure falls within the upper half of the gauge's range. Unless otherwise specified, the Contractor shall notify the Engineer 24 hours prior to each test.
2. Unless otherwise specified, testing, as specified herein, shall include existing piping systems which connect with new pipe systems. Existing pipe shall be tested to the nearest existing valve. Any piping which fails the test shall be repaired. Repair of existing piping will be considered and paid for as extra work.
3. Testing procedures shall follow the following WSDOT specification sections:

    a. Sanitary Sewer: Section 7-17.

B. Not Used.

C. Liquid Systems:

1. Leakage shall be zero at the specified test pressure throughout the specified duration for the following systems: exposed piping, buried insulated piping, and buried or exposed piping carrying liquid chemicals. Unless otherwise specified, leakage from other buried liquid piping systems shall be less than 0.02 gallon per hour per inch diameter per 100 feet of buried piping.

D. Drains:

1. Drain systems, other than pumped drain systems, shall be tested in accordance with UPC.

3.05 CLEANING AND FLUSHING

A. General:

1. Piping systems shall be cleaned following completion of testing and prior to connection to operating, control, regulating or instrumentation equipment. The Contractor may, at his option, clean and test sections of buried or exposed piping systems. Use of this procedure, however, will not waive the requirement for a full pressure test of the completed system. Unless specified otherwise, piping 24 inches in diameter and smaller shall first be cleaned by pulling a tightly fitting cleaning ball or swab through the system. Piping larger than 24 inches in diameter may be cleaned manually or with a cleaning ball or swab.

B. Temporary Screens:

1. Upon completion of the cleaning, the Contractor shall connect the piping systems to related process equipment. Temporary screens, provided with locator tabs which remain visible from the outside when the screens are in place, shall be inserted in pipelines at the suction of pumps and compressors in accordance with the following table:

Equipment suction or piping size, inches	Maximum screen opening, inches
0 –1	1/16
1-1/4 – 3	1/4
3-1/2 – 6	1/2
Over 6	1

2. The Contractor shall maintain the screens during testing, initial start-up, and initial operating phases of the commissioning process. In special cases, screens may be removed as required for performance tests. The Contractor shall remove the temporary screens and make the final piping connections after the screens have remained clean for at least 24 consecutive hours of operation. Systems handling solids are exempted.

C. Not Used.

D. Liquid Systems:

1. After completion of cleaning, liquid systems, unless otherwise specified, shall be flushed with clean water. With temporary screens in place, the liquid shall be circulated through the piping system using connected equipment for a minimum period of 15 minutes and until no debris is collected on the screens.

PIPING SCHEDULE FOLLOWS

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

Symbol	Service	Size (In.)[a]	Material	Installation	Working Pressure (psi)	Test Medium	Test (psi)	Test (min)	Remarks
ALK	Alkalinity Supplement	ALL	TY/PVC	IN/EXP	30	H_2O	100	60	
CAR	Carbon Supplement	ALL	PVC	IN/EXP	30	H_2O	100	60	
CLS	Chlorine Solution	4 & smaller	PVC	ALL	40	H_2O	100	60	Heat trace and insulate if exposed.
D	Drain	3 & smaller	PVC	ALL	20	per UPC	per UPC	–	Buried under structure
D	Drain	4 & larger	DIP	BUR	20	per UPC	per UPC	–	Buried under structure Test In accordance w/ UPC[b] for Drains
EFF	Effluent	ALL	PVC	ALL	50	H_2O	130	60	Heat trace and insulate if exposed.
FD	Floor Drain	3	PVC	BUR	20	per UPC	per UPC		
FF	Feed Forward	3 & larger	PVC	ALL	15	H_2O	45	60	Heat trace and insulate if exposed.
FM	Force Main	3 & larger	HDPE	ALL	70	H_2O	120	60	
NPW	Non-Potable Water	2 & larger	PVC	BUR	90	H_2O	150	60	
OA	Odorous Air	ALL	CPVC	ALL	–	Air	50	60	
PA	Process Air	ALL	SST	EXP	15	Air	50	60	
PA	Process Air	ALL	DIP	BUR	15	Air	50	60	
PE	Permeate	ALL	PVC	EXP	50	H_2O	130	60	Heat trace and insulate if exposed.
PE	Permeate	ALL	DIP	BUR	50	H_2O	130	60	
RAS	Return Activated Sludge	ALL	PVC	ALL	2	H2O	10	60	Heat trace and insulate if exposed.
SD	Storm Sewer	ALL	DIP	ALL	Gravity	air	WSDOT 7-17.3(2)F	WSDOT 7-17.3(2)F	
SS	Sanitary Sewer	4 & smaller	PVC	ALL	Gravity	air	WSDOT 7-17.3(2)F	WSDOT 7-17.3(2)F	
SSFM	Sanitary Sewer Force Main	4 & smaller	PVC	ALL	50	H_2O	100	60	

Symbol	Service	Size (In.)[a]	Material	Installation	Working Pressure (psi)	Test Medium	Test (psi)	Test (min)	Remarks
V	Vent, Plumbing	ALL	PVC	ALL	–	air	per UPC	–	Material, installation, and testing per UPC for Vents
W	Potable Water	3 & smaller	PVC	ALL	70	H_2O	150	60	

NOTES:

[a] Unless noted, pipe schedule applies to all sizes for a particular service. All pipe sizes within pipe ranks may not be used. Reference Drawings for sizes used.

[b] UPC = Uniform Plumbing Code.

Size
"<" Greater Than
"<" Less Than
"≥" Greater Than or Equal To
"≤" Less Than or Equal To
"All" All Sizes

Material
"C900" C900 PVC
"CPVC" Chlorinated Polyvinyl Chloride
"DIP" Ductile Iron
"HDPE" High Density Polyethylene
"PVC" Polyvinyl Chloride
"SST" Stainless Steel
"TY" Tygon Tubing

Installation
"BUR" Buried
"EXP" Exposed (interior or exterior)
"SUB" Submerged
"All" All Installations
IN/EXP Interior & exposed

Joint Type
"BF" Butt Fusion
"BW" Butt Welded
"FL" Flanged
"GR" Grooved
"HU" Hub and Spigot
"MJ" Mechanical Joint
"SW" Socket Welded
"THD" Threaded
"W" Welded

END OF SECTION 400500

SECTION 400506 – PIPING CONNECTIONS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section specifies the following methods of connecting metallic piping: flanges, threading, mechanical couplings, equipment connection fittings, dielectric unions, and welding.

1.02 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	**Title**
ANSI Bl.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI Bl.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B18.2.1	Square and Hex Bolts and Screws Inch Series
ANSI B18.2.2	Square and Hex Nuts (Inch Series)
ANSI B31.1	Power Piping
ANSI B31.3	Chemical Plant and Petroleum Refinery Piping
ASME Section IX	Boiler and Pressure Vessel Code; Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators Qualifications
ASTM B98	Copper-Silicon Alloy Rod, Bar and Shapes
ASTM F37	Standard Test Methods for Sealability of Gasket Materials
ASTM F104	Standard Classification System for Nonmetallic Gasket Materials
ASTM F152	Standard Test Methods for Tension Testing of Nonmetallic Gasket Materials

Reference	Title
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Service-Size 4 in. through 144 in.
AWWA C219	Bolted, Sleeve-Type Couplings for Plain-End Pipe
AWWA C550	Protective Epoxy Coatings for Valves and Hydrants
AWWA C606	Grooved and Shouldered Joints
AWWA M11	Steel Pipe – A Guide for Design and Installation
NSF 61	Drinking Water System Components – Health Effects

1.03 SUBMITTALS

A. Procedures: In accordance with Section 013300.

B. Shop drawings and product data.

C. Manufacturer's handling, delivery, storage, and installation instructions.

PART 2 – PRODUCTS

2.01 FLANGE ASSEMBLIES

A. Flanges:

1. General: Flanges shall either be flat flanges or convoluted ring flanges as specified in the following paragraphs.
2. Flat Flanges: Cast iron flanges shall be faced in accordance with ANSI B16.1. Where companion flanges are used, the flanges on pipe shall be refaced to be flush with the companion flange face. Class 150 and Class 300 forged steel flanges shall be raised face conforming to ANSI B16.5. Lightweight slip-on flanges shall be plain face conforming to AWWA C207, Class B and ANSI B16.5. Unless otherwise specified, steel flanges shall be ANSI B16.5, Class 150 or AWWA C207, Class D. Class E AWWA flanges shall be provided where test pressure exceeds 175 psi. Plain faced flanges shall not be bolted to raised face flanges.
3. Convoluted Ring Flanges: Convoluted ring flanges shall be ductile iron, forged steel or cast stainless steel, designed to bear on hubs welded to the pipe and shall be as manufactured by Improved Piping Products. The Engineer knows of no equal. The flange joints shall be rated for not less than 150% of the test pressures listed in Section 400500 – Process Piping and shall conform to the requirements of ANSI B 16.5 and AWWA C207. The flange manufacturer shall be prepared to demonstrate, by certified pressure test that the flanges will meet these requirements.

B. Gaskets:

1. Gasket material shall be as specified in Paragraph 400506-2.03.
2. Gaskets for plain faced flanges shall be the full-face type. Thickness shall be 1/16 inch for pipe 10 inches and less in diameter and 1/8 inch for pipe 12 inches and larger in diameter. Unless otherwise specified, gaskets for raised face flanges shall match the raised face and shall be 1/16-inch thick for pipe 3-1/2 inches and less in diameter and 1/8 inch thick for pipe 4 inches and larger.

C. Bolts:

1. Flange assembly bolts shall be ANSI B18.2.1 standard square or hexagon head bolts with ANSI B18.2.2 standard hexagon nuts. Threads shall be ANSI Bl.1, standard coarse thread series; bolts shall be Class 2A, nuts shall be Class 2B. Bolt length shall conform to ANSI B16.5.
2. Unless otherwise specified, bolts shall be carbon steel machined bolts with hot pressed hexagon nuts. Bolts for submerged service shall be made of Type 316 stainless steel in conformance with ASTM F593, marking F593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04 or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.

2.02 MECHANICAL COUPLINGS

A. Sleeve-Type Couplings:

1. Unless otherwise specified, sleeve-type mechanical pipe couplings shall be Smith-Blair Type 411, Dresser Style 38, or equal, with the stop removed from the middle ring. Reducing couplings shall be Smith-Blair Type 415, Dresser Style 62, or equal. Sleeve-type flanged coupling adapters shall be Smith-Blair Type 913, Dresser Style 128, or equal. Insulating couplings shall be Smith-Blair Type 416, Dresser Style 39, or equal.
2. Bolts for submerged service shall be made of Type 316 stainless steel in conformance with ASTM F593, marking F593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04, or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high- strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.
3. Gaskets shall be as specified in Paragraph 400506-2.03 and AWWA C111.

B. Plain End Couplings:

1. Plain end pipe couplings for pipe sizes 6 inches and smaller shall be Gustin-Bacon 200, Victaulic Style 99, or equal for Schedule 80 pipe and Gustin-Bacon 205, Victaulic Style 90, or equal for lighter weight pipe. Plain end couplings for pipe sizes 8 inches and larger shall be Gustin-Bacon 200, Victaulic Style 99, or equal. Unless otherwise specified, bolts and nuts shall comply with AWWA C606.
2. Gaskets shall be as specified in Paragraph 400506-2.03 and AWWA C606.

C. Grooved End Couplings:

1. Grooved end flexible-type couplings shall be Gustin-Bacon 100, Victaulic Style 77, or equal. Grooved end rigid-type couplings shall be Gustin-Bacon 120 Rigi-Grip, Victaulic Style 07 Zero-Flex, or equal. Flexible-type couplings shall be used for all piping greater than 12 inches in diameter; for pipe 12 inches in diameter and less in rack-mounted tunnel piping applications; and for grooved joints adjacent to pump or blower suction and discharge where grooved couplings are used for noise and vibration control. All other applications for piping 12 inches in diameter and less shall utilize rigid-type couplings. Grooved end flanged coupling adapters shall be either Gustin-Bacon 154, Victaulic Style 741, or equal. Snap- joint grooved end couplings shall be Gustin-Bacon 115, Victaulic Style 78, or equal. Cut grooves are not permitted on fabricated or lightwall pipe.
2. Unless otherwise specified, bolts and nuts shall comply with AWWA C606. Bolts for submerged service shall be Type 316 stainless steel in conformance with ASTM F593, marking F593F. Nuts for submerged service shall be made of copper-silicon alloy bronze conforming to ASTM B98, alloy C65100, designation H04 or alloy C65500, designation H04. Bolts and nuts for buried service shall be made of noncorrosive high-strength, low- alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating. Where washers are required, they shall be of the same material as the associated bolts.
3. Gaskets shall be as specified in Paragraph 400506-2.03 and AWWA C 606.

D. Equipment Connection Fittings:

1. Equipment connection fittings shall provide both lateral and angular misalignment adjustment between equipment connection flanges and the connection to field piping systems by providing individually adjustable flexible joints at each connection. In addition, equipment connection fittings shall provide full pressure thrust restraint between the field piping connection and equipment connection flanges.
2. Equipment connection fittings shall consist of two flanged coupling adapters, a plain end section of pipe and thrust restraint rods and associated fittings designed to transmit thrust without transmitting shear to the thrust restraint rods and without compromising provisions for accommodating angular and parallel misalignment. Materials and features shall conform to the requirements established in this paragraph. Standard “dismantling joints” incorporate only one flanged coupling adapter and are not acceptable substitutes. Equipment connection fittings shall be Viking Johnson, Romac, or equal, modified as specified to provide the required features.
3. Equipment connection fittings shall each consist of a single sleeve of plain end piping conforming to the requirements of the specified piping system of sufficient length to span the gap between the connection at the equipment and the connection at the field piping with gasketed flange adapters at each end. Thrust restraint shall be provided by means of all threaded rod spanning between flanges and male rod nuts and female washers that are rounded to provide a ball-joint type self-aligning feature. All threaded restraint rod shall project through flange and mating flange coupling adapter bolt holes or through holes in restraint lug plates that extend above the flanges and are secured to the flanges with a minimum of two flange bolts. Where the all threaded rods project through flange bolt holes, ball joint type nut and washer combinations and lock washers shall be provided at each face, each end. Where restraint lug plates are employed, ball joint type nuts and washers shall be provided only on the outside faces of the plates and the nuts shall have a self-locking feature that prevents nut movement due to vibration or other operational or environmental causes. Double nutting with non-locking nuts shall not be an acceptable method of providing the self-locking feature. Thrust rod diameter and material shall be selected to provide sufficient freedom of movement through all bolt holes to allow unrestricted maximum adjustment of equipment connection fittings to accommodate piping misalignment without transmitting any shear to the thrust rods and also

to permit full development of thrust restraint at all thrust rod tension take-ups. Design of equipment connection fittings shall conform to AWWA C219.

4. Thrust rods, restraint lug plates, nuts, washers and lock washers shall be Type 316 stainless steel, all selected to develop full rated piping system pressure thrust forces. Dry film molybdenum di-sulfide anti-galling compound shall be factory applied to ends of thrust rods, covering all threads subject to nut travel and tightening. Gaskets shall be as specified in Paragraph 400506-2.03. Flange gaskets shall be full face type. Follower gaskets shall be compression wedge type.
5. Sleeves shall be carbon steel or as specified for the specific piping system. Pressure rating of flange adapters shall equal or exceed the pressure rating of mating flanges. All metal portions of equipment connection fittings, with the exception of 316 stainless steel components, shall be coated and lined with fusion bonded epoxy conforming to AWWA C550 and NSF 61.

2.03 GASKETS

A. Gaskets designated in Section 400500 – Process Piping shall be as follows:

1. EPDM: ethylene-propylene-diene-terpolymer.
2. Neoprene: neoprene.
3. Nitrile: nitrile (Buna N).
4. Compressed gasketing consisting of organic fibers (Kevlar) and neoprene binder; ASTM F104 (F712400), 2500 psi (ASTM F152), 0.2 ML/HR LEAKAGE FUEL A (ASTM F37).
5. Compressed gasketing consisting of organic fibers (Kevlar) and SBR binder; ASTM F104 (F712400), 2500 PSI (ASTM F152), 0.1 ml/hr leakage Fuel A (ASTM F37).
6. Gylon gasketing, Garlock Style 3500, 2000 psi (ASTM F152), 0.22 ml/hr Fuel A (ASTM F37).
7. Gylon gasketing, Garlock Style 3510, 2000 psi (ASTM F152), 0.04 ml/hr Fuel A (ASTM F37).
8. Gylon gasketing, Garlock Style 3504, 2000 psi (ASTM F152), 0.12 ml/hr Fuel A (ASTM F37).
9. TFE: noncreeping tetrafluoroethylene (TFE) with insert filler.
10. PTFE bonded EPDM: PTFE bonded to EPDM in full-face gasket having concentric-convex molded rings; Garlock Stress Saver 370 or equal.
11. Viton: viton.

2.04 THREAD

A. Pipe thread dimensions and size limits shall conform to ANSI Bl.20.1.

2.05 COATINGS

A. Unless otherwise specified, flange assemblies and mechanical type couplings for buried installation shall be field coated as specified in Section 099000 – Painting and Coating.

2.06 PRODUCT DATA

A. In accordance with Section 013300 – Submittal Procedures, the Contractor shall provide for each welder, a welder qualification certificate indicating the welder is certified for pipe welding in

accordance with ASME Boiler and Pressure Vessel, Section IX. Each welder's certificate shall be provided to the Engineer prior to that welder working on the job.

PART 3 – EXECUTION

3.01 PIPE CUTTING, THREADING AND JOINTING

A. Pipe cutting, threading and jointing shall conform to the requirements of ANSI B31.1.

3.02 PIPE WELDING

A. Pipe shall be welded by ASME-certified welders using shielded metal arc, gas shielded arc or submerged arc welding methods. Welds shall be made in accordance with the requirements of ANSI B31.1 for piping Systems 8, 26, and 28 specified in Section 400500 – Process Piping. Welds shall be made in accordance with the requirements of ANSI B31.3 for piping System 20 specified in Section 400500 – Process Piping.

B. Welds for piping systems not specified above shall be made in accordance with AWWA C206.

3.03 TAKEDOWN COUPLINGS

A. Takedown couplings shall be screw unions, flanged or grooved end mechanical coupling type joints and shall be provided as specified. Flanged or grooved end joints shall be employed on pipelines 2-1/2 inches in diameter and larger. Where piping passes through walls, takedown couplings shall be provided within 3 feet of the wall, unless specified otherwise.

B. A union or flanged connection shall be provided within 2 feet of each threaded end valve.

3.04 FLEXIBILITY

A. Unless otherwise specified, piping passing from concrete to earth shall be provided with two pipe couplings or flexible joints as specified on the buried pipe within 2 feet of the structure for 2-inch through 6-inch diameter pipe; within 3 feet of the structure for 8-inch through 24-inch diameter pipe; and within one and one-half pipe diameters of the structure for larger pipe. Where required for resistance to pressure, mechanical couplings shall be restrained in accordance with Chapter 13 of AWWA M11, including Tables 13-4, 13-5 and 13-5A, and Figure 13-20.

3.05 DIELECTRIC CONNECTIONS

A. Where a copper pipe is connected to steel or cast iron pipe, an insulating section of rubber or plastic pipe shall be provided. The insulating section shall have a minimum length of 12 pipe diameters. Dielectric unions as specified in Paragraph 400506-2.05 may be used instead of the specified insulating sections. Where copper pipe is supported from hangers, it shall be insulated from the hangers, or copper-plated hangers shall be used.

3.06 EQUIPMENT CONNECTION FITTINGS

A. Where shown, equipment connection fittings shall be provided between field piping systems and equipment inlet and outlet connections.

END OF SECTION 400506

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SECTION 400531 – THERMOPLASTIC PIPE (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. This section specifies polyvinylchloride, chlorinated polyvinylchloride, polyethylene, and polypropylene pipe and fittings. High density polyethylene (HDPE) piping for gravity and pressure pipelines is specified in Section 400533 – High Density Polyethylene Pipe. Also refer to 400500 – Process Piping.

B. Pipe Designations:

1. For use in the Piping System Specification Sheets (PIPESPEC) in Section 400500 – Process Piping and in this section, the following plastic pipe designations are defined:

Designation	Definition
CPVC	Chlorinated polyvinylchloride
PE	Polyethylene
PP	Polypropylene
PVC	Polyvinylchloride

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM D1248	Polyethylene Plastics Molding and Extrusion Materials
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2464	Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
ASTM D2657	Heat-Joining Polyolefin Pipe and Fittings
ASTM D2665	Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D4101	Propylene Plastic Injection and Extrusion Materials
ASTM F402	Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings
ASTM F437	Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F439	Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F441	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F493	Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

PART 2 – PRODUCTS

2.01 PVC PIPE

A. Pressure Pipe:

1. PVC material for pipe and fittings shall conform to ASTM D1784, Class 12454-B. Pipe and fittings shall either be in accordance with ASTM D1785 or shall conform to ASTM D2241 for standard dimension ratios: 160 psi pipe—SDR 26; 200 psi pipe—SDR 21; 250 psi—SDR 17. Pressure rating for pipe shall be in excess of test pressure specified in Section 400500. Neoprene gaskets with push-on joints shall conform to ASTM F477.

2. Schedule 80 PVC socket type fittings shall conform to ASTM D2467. Schedule 40 PVC fittings shall conform to ASTM D2466. PVC solvent weld cement for socket connections shall meet the requirements of ASTM D2564. Schedule 80 PVC threaded fittings shall conform to ASTM D2464. Fittings for gasketed pipe shall be ductile iron or steel push-on IPS-sized pressure fittings rated for use with the specified class of PVC pipe.

B. Non-pressure Pipe:

1. Gravity Sewer Pipe: PVC material for sewer pipe and fittings shall conform to Class 12454-B, as defined in ASTM D1784. Pipe and fittings shall meet the requirements of ASTM D3034 for SDR 35. Neoprene gaskets with push-on joints shall conform to ASTM F477.
2. Effluent Disposal Pipe: PVC material for pipe and fittings shall conform to ASTM D1784, Class 12454-B. Pipe and fittings shall either be in accordance with ASTM D1785. Schedule 80 PVC fittings shall conform to ASTM D2466. PVC solvent weld cement for socket connections shall meet the requirements of ASTM D2564.

2.02 CPVC PIPE EXPOSED TO SUNLIGHT

A. Materials: Shall be manufactured from CPVC Schedule 80 (unless indicated otherwise): conforming to ASTM D1784 and ASTM D1785. CPVC shall be Type VI, Grade I with cell classification 23447.

B. Fittings: Shall be fabricated from the same pipe materials above.

2.03 PRODUCT DATA

A. The following information shall be provided in accordance with Section 013300 – Submittal Procedures:

1. Manufacturer’s certificates of compliance with the specified standards and Contractor’s layout drawings.

PART 3 – EXECUTION

3.01 INSTALLATION

A. PVC pipe 3 inches in diameter and smaller shall be joined by means of socket fittings and solvent welding in conformance with ASTM F402. Solvent-cemented joints shall be made in strict compliance with the manufacturer’s/supplier’s instructions and recommended procedures. Unless otherwise specified, PVC pipe 4 inches in diameter and greater shall be joined by means of gasketed push-on joints and steel or ductile iron push-on or mechanical joint fittings.

B. Connections to different types of pipe shall be by means of flanges, specified adapters or transition fittings. Where sleeve type couplings are used, both shall be uniformly torqued in accordance with pipe manufacturer’s recommendation. Foreign material shall be removed from the pipe interior prior to assembly.

3.02 TESTING

A. Testing of plastic piping shall be as specified in Section 400500 – Process Piping.

END OF SECTION 400531

SECTION 400533 – HIGH DENSITY POLYETHYLENE PIPE (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. This section specifies high density polyethylene (HDPE) pipe, fittings, and appurtenances for piping 3/4 inches to 3 inches in nominal diameter. The designation HDPE is used in the Piping System Specification in Section 400500, "Process Piping" and in this section.

B. Characteristics:

1. The piping system shall conform with the following:

   a. Dimension ratio (DR) – As indicated in Section 400500, "Process Piping."
   b. Pressure Class in accordance with AWWA C901 – As indicated in Section 400500, "Process Piping."

1.02 QUALITY ASSURANCE

A. References:

1. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

References	**Title**
ANSI/AWWA C901	Polyethylene (PE) Pressure Pipe and Tubing, 3/4-inch through 3-inch, for Water Service
ASTM D2160	Solids Wall High Density Polyethylene (HDPE) Conduit Based on Conduit Based on Controlled Outside Diameter (OD)

References	**Title**
ASTM D2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2657	Heat Joining Polyolefin Pipe and Fittings
ASTM D3350	Polyethylene Plastics Pipe and Fittings Material
PPI TR 31	Underground Installation of Polyolefin Piping

B. Inspection and Testing:

1. All HDPE materials, pipe and fittings shall be inspected and tested in accordance with the requirements of AWWA C901.

C. Affidavit of Compliance:

1. The manufacturer shall furnish an affidavit of compliance conforming to the requirements of AWWA C901, Section 5.1, affirming that the piping components comply with the requirements of AWWA C901 and this section. The affidavit shall be signed under penalty of perjury by an officer of the pipe manufacturer's company.

1.03 SUBMITTALS

A. The following submittals shall be provided in accordance with Section 013300 - Submittal Procedures:

1. Detail drawings which show the type and location of all fittings, joints, and connections to structures and manholes.
2. Proof of training and contact information for successful projects of each HDPE pipe fitter/ joiner according to Paragraph 3.02B.

PART 2 – PRODUCTS

2.01 GENERAL

A. HDPE materials, pipe and fittings shall be manufactured, inspected, sampled and tested in accordance with the requirements of AWWA C901 and this section. In case of conflict between the requirements of this section and AWWA C901, the requirements of this section shall prevail.

2.02 MATERIALS

A. HDPE piping components shall be manufactured from materials that meet or exceed the requirements of the Plastic Piping Institute designation PE4710 and that conform to the requirements of ASTM D3350 for a cell classification of PE 445574C.

B. Bolts and nuts for buried mechanical joining components such as flanges shall be made of noncorrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/ AWWA C111/A21, regardless of any protective coating.

2.03 PIPE

A. Pipe shall have the nominal dimensions shown with an IPS outside diameter basis and the dimensions and tolerances specified in AWWA C901. DR rating and pressure class shall be as specified in Section 400500, "Process Piping."

2.04 FITTINGS

A. Fittings shall conform to the applicable requirements of AWWA C901 for the joining methods specified in herein.

2.05 PIPE MARKINGS

A. Pipe marking shall conform to the requirements of AWWA C901.

2.06 PRODUCT DATA

A. The following product data shall be provided in accordance with Section 013300, "Submittal Procedures:"

1. Affidavit of Compliance specified herein.
2. A report containing a copy of all manufacturer's test results for all tests specified herein.

PART 3 – EXECUTION

3.01 PIPE HANDLING AND STORAGE

A. The Contractor shall use care in handling and storage of the pipe. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations.

1. The handling of the pipe shall be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.

B. Sections of pipe with cuts, gouges, or scratches on the outside diameter (OD) surface that exceed 10 percent of the wall thickness of the pipe shall be removed completely and the ends of the pipeline rejoined. The inside diameter (ID) surface shall be free of cuts, gouges, and/or scratches.

3.02 INSTALLATION

A. General:

1. Unless otherwise specified, the piping system shall be installed in accordance with ASTM D2321, AWWA C901 and the manufacturer's recommendations.

B. Joining:

1. Pipe and fittings shall be joined into continuous lengths on the job site above ground. Unless otherwise specified, joining shall by the butt-fusion method performed in accordance with the pipe manufacturer's recommendations and ASTM D2657. Socket fusion, extrusion welding and hot gas welding shall not be used.
2. The pipe supplier shall be consulted to obtain machinery and expertise for the joining by butt-fusion of HDPE pipe and fittings. No pipe or fittings shall be joined by fusion by any of the Contractor's personnel unless they are adequately trained and qualified in the techniques involved. If Contractor's personnel are used, Contractor shall provide proof of training and a minimum of 5 successful projects for each qualified person; Contractor shall include contact information for the successful projects. Butt fusion joining shall yield a joint strength equal to or greater than the tensile strength of the pipe.
3. Flanged joining, or other mechanical joining methods specified, may be used to make connections to differing piping materials, to equipment, valves and other appurtenances, and where specified.

C. Trench Excavation:

1. Trenches shall be excavated to ensure that sides will be stable under all working conditions. Trench walls or supports shall comply with all local and national standards for safety.

D. Location and Alignment:

1. Pipe and fittings shall be placed in the trench with the invert conforming to the elevations, slopes, and alignments shown.

E. Bedding and Backfill:

1. Materials used for bedding and backfill shall be as specified in these Specifications and as shown in the Drawings.

3.03 TESTING

A. General:

1. Testing of piping shall be as specified in Section 400500, "Process Piping," and this section. In case of conflict, the requirements of this section shall prevail.

B. Hydrostatic Pressure Testing:

1. HDPE piping systems shall be fully pressure tested prior to placing the line into service. Water shall be the test medium for hydrostatically testing the pipe. Test procedures shall be as specified in Section 400500, "Process Piping," and the following. In case of conflict, the following procedures shall apply.
2. At a minimum, Contractor shall hydrostatically test every 1,000-foot HDPE pipe segment of installed pipe. Contractor shall hydrostatically test the entire pipeline after completed installation.
3. After all free air is removed from the test section, the pressure in the pipe or pipe segment shall be raised at a steady rate to the required pressure. The pressure in the section shall be measured

at the lowest point of the test section. Test pressure shall be as specified in Section 400500, "Process Piping." The initial pressure shall be applied and allowed to stand without makeup pressure for 2–3 hours to allow for diametric expansion or pipe stretching to stabilize. After the equilibrium period, the test section shall be returned to the required test pressure and held for 3 hours. Amounts of makeup water allowable for expansion during the pressure test shall be as listed in the Plastic Pipe Institute Technical Report TR 31-88. No leaks in excess of those allowed by TR 31-88 or pressure drops shall be observed during the segment tests or final test period.

END OF SECTION

Section 404100 – Process Piping and Equipment Heat Tracing (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process piping and equipment heat tracing as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Comply with the following requirements:

1. NFPA 70 National Electrical Code (NEC).
2. Local codes and ordinances.

PART 2 – PRODUCTS

2.01 HEAT TRACE SYSTEMS

A. Provide thermostatically controlled heat trace systems as shown on the Drawings.

B. Control each heat trace system through a weatherproof thermostat.

C. Requirements for heat trace systems are as follows:

1. Design each heat trace system to automatically maintain 45-degree F liquid temperature when outdoor ambient conditions range from -25 to 45 degrees F and 20 MPH winds.
2. Base heat trace system design on the following:

    a. Thermal conductivity of piping materials.
    b. K value of insulation.
    c. Heat output exceeding heat loss by a 1.5 safety factor at the specified performance requirement.

3. Self-regulating heat trace cable constructed, designed, and rated as follows:

    a. 16 AWG copper bus wires.

b. Semi-conductive polymer core with electrical resistance variable with temperature.
c. Flame retardant, electrically insulating jacket.
d. Tinned copper braid.
e. Water and chemical resistant, flame retarding thermoplastic rubber insulation overjacket.
f. Operates on 120 V or 240 V, 60 Hz ac power source as shown on the Drawings.
g. Maximum 150 degree F maintained temperature.

4. Provide NEMA 4X power termination boxes, ambient sensing thermostats, splicing kits, end seal kits and other accessories as required.

D. Acceptable Manufacturers:

1. Chromalox.
2. Delta-Therm.
3. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install and field test heat trace system prior to installation of insulation.

3.02 FIELD QUALITY CONTROL

A. Conduct field tests as follows:

1. Continuity check.
2. Short circuit check.

END OF SECTION

SECTION 409020 – PROCESS CONTROL SYSTEM FOR WASTEWATER TREATMENT PLANT (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process control system for wastewater treatment plant (WWTP) as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Work under this section includes the following:

1. Providing the following:

    a. Control Panels (CPs) not supplied by equipment manufacturers.
    b. Instrumentation.

2. Interconnecting the control panels through an industrial network.
3. Contractor shall integrate the various equipment manufacturers' supplied control panels with the SCADA Computer(s) and other control panels. Coordination with Owner's designated SCADA programmer will be required.
4. Providing calibration, commissioning, and start-up of the entire WWTP control and monitoring system.
5. Providing on-site training to the wastewater operator(s).

C. Work not included under this section:

1. The procurement of SCADA computers, software, or firewalls that interface with external networks. Procurement of these items will be performed by the Owner.
2. The programming of SCADA computers and configuration of firewalls. This work will be performed by parties designated by the Owner.

1.02 SUBMITTALS

A. Submit a test protocol document which is to be used to record test results demonstrating the instrumentation and control system operates as designed, a minimum of 2 weeks prior to installation testing (commissioning). Documentation includes but is not limited to the following:

1. Detailed test procedure.
2. Checklists.
3. Blank forms and data to be recorded.
4. Test equipment to be used and calculated tolerance limits.

B. Submit completed test protocol document after installation testing has been completed certifying system functions as specified.

1.03 QUALITY ASSURANCE

A. Provide the services of System Integrator who has the expertise to integrate the approved hardware and software with components from various manufacturers to present the Owner with a total system solution for the control and monitoring of the Wastewater Treatment Facilities.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 PROCESS CONTROL PANELS AND HARDWARE

A. Provide custom control panel in compliance with Section 409513 – Process Control Panels and Hardware as follows:

Enclosure	NEMA	Mounting	Height	Width	Depth
CP-1	12	Free-Stand	90″	48″	24″

1. Sizes indicated above are approximate. Supplier to determine actual size based on components and devices to be installed inside control panel. Coordinate final control panel sizes with Engineer to determine mounting space requirements if sizes supplied will differ from those indicated above.

2.02 PROCESS INSTRUMENTATION

A. Provide process instrumentation in compliance with Sections 409113.23 - Gas Analysis Process Measurement Devices, 409123.33 - Flow Process Measurement Devices, and 409123.36 - Level Process Measurement Devices.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install control panel, instruments, and equipment at location shown on the Drawings.

3.02 START-UP AND TESTING

A. Provide calibration of all equipment and signals prior to start-up and testing.

B. Notify Owner and Engineer a minimum of 2 days prior to on-site start-up.

C. Perform start-up and testing in accordance with Section 014524.

D. In the presence of the Owner and Engineer, perform commissioning of the system after the Contractor has tested the equipment and its appurtenances for proper operating condition, start-up has been performed, and Contractor feels system is ready to be placed into operation. Commissioning includes the following:

1. Testing of operational control of entire system, which includes:

    a. System interlocks and controls.
    b. Equipment status.
    c. Alarm functions.
    d. Password and security functions.

2. Emergency shutdown and restarting of the system.
3. Provide report after testing has been completed certifying system functions as specified.

E. Operational Test after Commissioning:

1. The control and monitoring system is to operate without failure prior to Substantial Completion.
2. Engineer and Contractor will agree to the start date for the 14-day operational test.
3. Any failure in the system will require correction by the Contractor. If the failure causes shutdown of the system for more than 12 hours, the failure will be considered as a major and a new starting date for the 14-day operational test will be determined.

    a. Submit a major malfunction report which will include details concerning the nature of the malfunction and the resulting repair action required and taken.

END OF SECTION

SECTION 409113.23 – GAS ANALYSIS PROCESS MEASUREMENT DEVICES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide gas analysis process measurement devices as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of, including the manufacturer's detailed specifications.

B. Submit operation and maintenance (O&M) manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Design gas detectors for continuous detection of combustible or toxic gases in ambient air.

B. Provide Gas Analysis Process Measurement Devices (indicate gas detector type) as follows:

Tag	Loop No.	Service	Power Supply	Measuring Range (ppm)	Output (mAdc)
AIT	100	Odor Control H_2S Gas Monitor	120 Vac	0 to 200	4/20

2.02 WET H_2S GAS DETECTORS

A. General:

1. Provide gas monitor for the detection of hydrogen sulfide (H_2S) gas concentration in wet 100 percent moisture saturated atmosphere.
2. Provide H_2S gas detectors with following requirements:

3. Design: Microprocessor based with non-volatile memory, self-instructing menu, and digital circuitry.

B. Sensor:

1. Measurement: Electrochemical, polarographic with a membrane to isolate the electrodes from the gas stream and allow gas to diffuse into the sensor resulting in a reaction between the electrodes.
2. Mounting: Duct insertion remote from transmitter.
3. Cable: Manufacturer supplied with 25-foot length.

C. Transmitter:

1. User Interface: Nonintrusive via external pushbutton or magnet.
2. Display: Integral with transmitter, displays gas concentration, sensor integrity, and fault diagnostics.
3. Output: Isolated 4 to 20 mAdc.
4. Input Voltage: 120 Vac.
5. Enclosure: NEMA 4X.

D. Air-Purge System:

1. Control: Automatic control via discrete contact from transmitter.
2. Powered from transmitter.
3. Enclosure: NEMA 4X.

E. Acceptable Manufacturer:

1. Analytical Technology, Inc. (ATI) – Series Q45S.
2. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's recommendations.

3.02 CALIBRATION

A. Calibrate and program equipment to meet system requirements.

3.03 START-UP AND TESTING

A. Comply with the manufacturer's recommended testing procedures.

END OF SECTION

SECTION 409123.33 – FLOW PROCESS MEASUREMENT DEVICES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide flow process measurement devices as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

B. Submit operation and maintenance (O&M) manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 QUALITY ASSURANCE

A. All flow process measurement device of the same type to be provided by one manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide flow process measurement devices (indicate flow meter type) as follows:

Tag	Service	Power Supply	Range (gpm)	Output	
				No. 1	No. 2
FIT/FE-105	Influent Flow Meter	120 Vac	0.0 to 120.0	4/20 mAdc	Pulse
FIT/FE-102	MBR Feed Flow Meter	120 Vac	0.0 to 25.0	4/20 mAdc	Pulse

Note: Verify meter size with mechanical drawings.

2.02 PALMER-BOWLUS FLUME OPEN CHANNEL FLOW METERS

A. Open Channel Ultrasonic Flow Meter:

1. Coordinate ultrasonic flow meter with packaged flow metering manhole in Section 333500 – Sanitary Utility Valves, Gates, and Appurtenances.
2. Provide non-contact ultrasonic microprocessor-based flow meters with following requirements:

a. Transmitter:

1) Power Supply: 120 Vac.
2) Output: 4 to 20 mAdc configured for flow rate.
3) Display: Alphanumeric LCD, displaying level, flow rate and totalized flow.
4) Adjustment: Field programmable by keypad entry. Provide hand-held programmer if required for field programming.
5) Operating Temperature: -20 to 120 degrees F when mounted in heated enclosure.
6) Enclosure: NEMA 4X.

b. Transducer:

1) Beam Angle: Maximum 12 degrees.
2) Range: As required for application.
3) Design: Single head with continuous cable without splices to extend to transmitter.
4) Approval: FM, Class I, II, Division I, Groups A, B, C, D, E, F, and G.
5) Operating Temperature: -20 to 120 degrees F.

c. Provide the following accessories:

1) NEMA 4X Instrument Enclosure in compliance with Section 409515 – Process Control Panel Enclosures when mounted outside as shown on the Drawings.
2) Mounting hardware for transducer and transmitter for mounting in location shown on the Drawings.

d. Acceptable Manufacturers:

1) Milltronics, Inc., HydroRanger 200 with Echomax Transducer.
2) Endress+Hauser, Prosonic, S FMU 90 with FDU 9x Transducer.
3) Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's recommendations.

B. Install identification tags to comply with Section 260553 – Identification of Electrical Systems, and as follows:

1. Provide metal tags to field instruments.

C. Identify all wires at both ends with wire markers to comply with Section 260519 – Low-Voltage Electric Power Conductors and Cables. Show these numbering on the as-build drawings.

D. Ground the shield of instrumentation controls cable at one end only (control panel). Insulate the shield at the other end from the ground.

E. Touch-up and clean enclosures after the start-up.

3.02 CALIBRATION

A. Calibrate and program equipment to meet system requirements.

B. Provide calibration of all equipment and signals prior to start-up and testing.

3.03 START-UP AND TESTING

A. Start-up and testing are the responsibility of equipment supplier.

B. Comply with the manufacturer's recommended testing procedures.

END OF SECTION

SECTION 409123.36 – LEVEL PROCESS MEASUREMENT DEVICES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide level process measurement devices as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

B. Submit operation and maintenance (O&M) manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide Level Process Measurement Devices (indicate level transmitter type) as follows:

Tag	Service	Power Supply or Loop Powered	Range (feet)	Output (mAdc)
LE-10	Influent Pump Station Wet Well Level	24 Vdc	0′0″ to 20′0″	4/20
LE-20	MBR Feed Pump Station Wet Well Level	24 Vdc	0′0″ to 20′0″	4/20
LE-40	Non-Potable Water Storage Tank Level	24 Vdc	0′0″ to 20′0″	4/20

2.02 HYDROSTATIC LEVEL TRANSMITTER

A. Design hydrostatic level transmitter to sense and measure the head-pressure imposed on its bottom diaphragm by the height of liquid above it, then process and convert this signal electronically to analog signal proportional to level.

B. Provide hydrostatic level transmitter with following requirements:

1. Head-pressure sensing type suitable for continuous submergence.
2. Range: As required for application.
3. Operating Data:

    a. Operating Temperature Range: -40 to 248 degrees F.
    b. Compensated Temperature Range: 32 to 122 degrees F.
    c. Overpressure: 300 precent of range.

4. Power: Loop powered.
5. Output: 4 to 20 mAdc.
6. Accuracy: Plus or minus 0.25 percent of FS.
7. Construction: 316 stainless steel housing with Viton or stainless-steel diaphragm, stainless steel bolts and nuts.
8. Electrical Connection: Shielded cable suitable for continuous submergence with polyethylene jacket.
9. Provide the following accessories as required:

    a. Cable support system.
    b. Surge protection.
    c. NEMA 4X cable box for with following requirements:

        1) Cable glands located at the base of enclosure.
        2) Desiccant drying cartridge.
        3) Vent tube filter or micro filter located at base of enclosure (GORE-TEX).

10. Approvals: FM approved IS for Class I, Division 1, Groups A-G.
11. Acceptable Manufacturers:

    a. Blue Ribbon Bird Cage.
    b. Wika – Model LS-10 with stainless steel level guard.
    c. Sigma Controls – Model 6100 with stand-off.
    d. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's recommendations.

B. Install identification tags to comply with Section 260553 – Identification of Electrical Systems, and as follows:

1. Provide metal tags to field instruments.

C. Identify all wires at both ends with wire markers to comply with Section 260519 – Low-Voltage Electric Power Conductors and Cables. Show numbering on the as-built drawings.

D. Ground the shield of instrumentation controls cable at one end only (control panel). Insulate the shield at the other end from the ground.

E. Touch-up and clean enclosures after the start-up.

3.02 CALIBRATION

A. Calibrate and program equipment to meet system requirements.

B. Provide calibration of all equipment and signals prior to start-up and testing.

3.03 START-UP AND TESTING

A. Start-up and testing are the responsibility of equipment supplier.

B. Comply with the manufacturer's recommended testing procedures.

END OF SECTION

SECTION 409443 – PROGRAMMABLE LOGIC PROCESS CONTROLLERS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide programmable logic process controllers as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

B. Submit operation and maintenance (O&M) manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Maintain area free of dirt and dust during and after installation of products.

1.04 QUALITY ASSURANCE

A. Provide all equipment by one manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Design programmable logic controller (PLC) to accept input contact and analog signals, perform the functions specified, and output contact and analog signals to control and/or indicate the specified processes.

B. Provide rack-mounted style PLC consisting of I/O racks, power supplies, CPUs, memory units, network communication modules and I/O modules.

1. Provide a modular type system with the necessary number and type of inputs and outputs.

a. Noise immunity to meet NEMA Standard ICS2-230.
b. Rack-mounted module removable without disconnecting the wiring harness from its terminals.

2. Provide expansion racks and power supplies at each location as required.
3. Provide rack interconnect cables as required noting location of keyed plugs.

C. Provide DIN rail mounted style PLC consisting of CPUs, power supplies, memory units, network communication modules and I/O modules.

1. Provide a modular type system with the necessary number and type of inputs and outputs.
2. Provide expansion modules and power supplies at each location as required.
3. Provide expansion module interconnect cables as required.

2.02 DIN RAIL MOUNTED PLC

A. Common Hardware Ratings:

1. Operating Temperature Range: 0 to +55 degrees C.
2. Storage Temperature Range: -40 to +85 degrees C.
3. Humidity Range: 5 to 95 percent noncondensing.
4. Noise Immunity in compliance to NEMA Standard ICS 2-230.
5. Operation Vibration Rating: 5.0 G at 10 to 500 Hz, 0.030-inch peak-to-peak.
6. Isolation Level: 1500 V between backplane and I/O.
7. Dielectric Withstand Rating: 1500 Vac in compliance with UL 508, CSA C22.2 No. 142.

B. Processor Unit:

1. Program Memory: 2 MB RAM, minimum.
2. Capable of controlling up to 16 I/O modules.
3. Online programming including runtime editing.
4. Standard RAM memory back-up provided.
5. LED indicators for: SD Card Status, RUN, OK, Forced I/O, Network Port Status, Ethernet Link Status.
6. Communication Ports:

a. One USB port
b. Two Ethernet ports that supports dual IP addresses

7. Real-time clock.
8. Key switch positions for Remote, Program, and Run.

C. Discrete Input Modules:

1. Operating Voltage: 79 to 132 Vac.
2. Sixteen non-isolated inputs or eight isolated inputs as required.
3. Removable terminal block.
4. LEDs to indicate the status of each I/O point.

D. Analog Input Modules:

1. Four input channels per module.
2. Ratings:

   a. Current Rating: 0 to 20 mAdc, 4 to 20 mAdc.
   b. Voltage Rating: Plus/Minus 10 Vdc, 0 to 10 Vdc, 0 to 5 Vdc, 1 to 5 Vdc.

3. Terminal Impedance:

   a. Current Rating: 250 ohms.
   b. Voltage Rating: 220 K ohms.

4. LEDs to indicate the status of each I/O point.

E. Relay Output Modules (Isolated):

1. Voltage Rating: 5 to 265 Vac.
2. Eight individually isolated relay outputs.
3. Continuous Current Rating per Point: 2.5 A ac not to exceed 1440 VA for the module.
4. Continuous Current Rating per Module: 16 A ac, 2.5 A/common.
5. LEDs to indicate the status of each I/O point.
6. Optical isolation between digital and field circuits.

F. Analog Output Modules:

1. Two output channels per module, single-ended.
2. Ratings:

   a. Current Rating: 0 to 20 mA, 4 to 20 mA.
   b. Voltage rating of plus/minus 10 Vdc, 0 to 10 Vdc, 0 to 5 Vdc, 1 to 5 Vdc.

3. LEDs to indicate the status of each I/O point.

G. Provide taps and cables as required for connecting PLC to related devices.

H. Acceptable Manufacturers:

1. Allen-Bradley: CompactLogix.
2. No substitutes.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install PLC in accordance with manufacturer's recommendations.

B. Install component identification and wire tags on all wiring.

3.02 CLEANING

A. Clean units as recommended by manufacturer.

END OF SECTION

SECTION 409513 – PROCESS CONTROL PANELS AND HARDWARE (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process control panels and hardware as shown on the Drawings, as specified herein and as needed for a complete and proper installation.

B. Work under this section includes:

1. Providing pre-wired and programmed process control panels.
2. Start-up and testing of the process control panels.
3. Providing on-site training to the operations staff.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the control panels, components, PLC power supply loading calculation for each rack, UPS runtime calculation, sequence of operation description, and manufacturer's detailed specifications (cut sheets or data sheets).

1. Each control panel supplier to submit documentation for all supplied control panels and components in one submittal package.

B. Submit control system drawings, including drawing index, bill of materials, control system configuration overview, panel dimensions and layouts, programmable logic controller (PLC) rack layouts, control wiring schematics, instrument loop diagrams, and panel/field interconnecting diagram.

1. Submit the initial drawings on 11-inch by 17-inch sheets with the shop drawings.
2. After the control and monitoring system is fully operational and all modifications have been made, submit the final as-built drawings as follows:

a. Four printed copies on 11-inch by 17-inch sheets.
b. Four electronic copies on CD-ROM compatible with AutoCAD.

C. Submit a factory or shop operational test report for each panel verifying hardware and functional requirements not less than 10 days prior to shipment of the panels.

D. Submit the operation and maintenance manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

E. Submit electronic copies of final device configurations after Substantial Completion as follows:

1. Four CD-ROMS for each system prior to final completion. Documentation for multiple control panels can be provided on one CD. Provide the following documentation:

a. All passwords and any other required information to configure any system component.

1.03 QUALITY ASSURANCE

A. Assemble and wire all panels in factory or shop.

1. Provide color-coded wiring in accordance with applicable codes and laws to facilitate maintenance and repair of control panel. Post color-coding schedule inside the control panel.
2. Provide minimum 16 AWG control wires and provide spiral wrap, tie wrap, fasteners, and wire duct as required.
3. Label all wiring at each end with numbers corresponding to the wiring schematics. Show numbering on the as-built drawings. Use tubular heat shrink-type or self-laminating vinyl wire markers printed using thermal printer.
4. Label all terminal blocks with numbers corresponding to the wire numbers.
5. Segregate wiring of different voltage levels.
6. Provide nameplates for enclosure, instruments, devices, and components. Descriptions on the nameplate to agree with the descriptions on the as-built drawings.

B. Provide enclosures, devices, components, etc., which have been listed and labeled by Underwriter's Laboratories.

C. Perform a factory or shop operational test on each panel.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Facilitate coordination between all process control panel suppliers to ensure seamless integration into the plant SCADA system where applicable. Provide the same make and model of all instruments, equipment, and components which serve the same function within all process control panels.

B. Provide PLC-based control panels to control and monitor the process equipment as specified in other sections and as shown on the Drawings with the following requirements:

1. Controller (processor) with adequate memory.
2. Power supplies with adequate load capacity.
3. Analog and discrete input/output modules to control and monitor all applicable signals required for proper operation.
4. Communication modules to interface with the SCADA network and field devices.

2.02 ENCLOSURES, DEVICES, COMPONENTS

A. Comply with applicable sections in Divisions 26 and 40 for all equipment supplied under this section.

B. Provide CP-1 pre-wired controls housed in an enclosure consisting of but not limited to the following as applicable and as shown on the Drawings:

1. DIN rail mounted PLC to comply with Section 409443 – Programmable Logic Process Controllers.
2. Power supply systems to comply with Section 409588 – Power Supply Systems as follows:

    a. Uninterruptible power supply (UPS).
    b. DC power supplies.

3. Expandable industrial alarm dialer to comply with Section 409712 – Process Control Alarm Dialers.
4. Fused terminal blocks for power supply to field instruments.
5. Surge protection to comply with Section 409580 – Process Control Surge Protectors to protect the following:

    a. Analog and discrete signals from field instruments.
    b. Main power feed to panel.

6. Intrinsic safety barriers to comply with Section 409574 – Process Control Signal Conditioners Converters.
7. Signal conditioner (isolator) to comply with Section 409574.
8. Unmanaged Ethernet switch to comply with Section 409543 – Process Control Hardware Interfaces.
9. Firewall appliance (to be procured by Owner).
10. Industrial Control relays designed for the application, Omron, Phoenix Contract or approved equal.
11. Thermal management system to maintain components at rated temperature.
12. Corrosion inhibitors.
13. Terminal Blocks for Field Wiring: Finger-safe, DIN rail mounted, with separation plates, end barriers, and end anchors as required.
14. Panel mounted NEMA 12 Graceport with GFCI receptacle and Ethernet (RJ45).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install process control panels in accordance with manufacturer's recommendation and as follows:

1. Terminate all wiring between field devices and all related panels.
2. Ground the shield of instrumentation controls cable at one end only. Insulate the shield at the other end from the ground.

B. Install nameplates and identification tags to comply with Section 260553 – Identification of Electrical Systems and as follows: Label the enclosures, devices, and components.

C. Touch-up and clean enclosures after the start-up.

3.02 START-UP AND TESTING

A. Start-up and testing are the responsibility of the process control panel supplier.

B. Provide start-up and testing of process control panels in conjunction with the equipment it controls and as specified in other sections of these Specifications.

END OF SECTION

SECTION 409515 – PROCESS CONTROL PANEL ENCLOSURES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process control panel enclosures as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. Provide all enclosures by one manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

1.05 SEISMIC ANCHORAGE AND STRUCTURAL DATA

A. Mechanical instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 130541 – Seismic Restraint Requirements for Nonstructural Components.

PART 2 – PRODUCTS

2.01 GENERAL

A. Design process control panel enclosures to house electrical and electronic controls, instruments, lights, switches, and components as specified and/or as shown on the Drawings.

B. Acceptable Manufacturers:

1. Hoffman.
2. Or equal.

2.02 NEMA 12 FREE-STAND ENCLOSURES

A. Provide NEMA 12 free-stand enclosures with the following requirements:

1. Constructed of 16-gauge or 14-gauge steel (depending on size) with seams that have been continuously welded and ground smooth without holes or knockouts on any side.
2. Body flange trough to exclude liquids and contaminants.
3. Gasketed and continuously hinged doors with three-point locking, quarter-turn padlockable handle.
4. Hidden hinges for clean, aesthetic appearance.
5. ANSI 61 gray polyester powder paint finish inside and out over phosphatized surface.
6. Back panel for mounting of devices and components, finished in white enamel.
7. Door and body stiffeners are required in enclosures over 30 inches wide and/or high.
8. Swing-out panels for mounting of special devices where specified or required.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install the enclosures and panels in accordance with manufacturer's recommendations.

B. Install on concrete pad as shown on the Drawings, and secure with steel bolts.

END OF SECTION

SECTION 409543 – PROCESS CONTROL HARDWARE INTERFACES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process control hardware interfaces as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

B. Submit operation and maintenance (O&M) manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 UNMANAGED ETHERNET SWITCHES

A. Provide unmanaged Ethernet switches with the following requirements:

1. Interfaces:

    a. Comply with IEEE 802.3.
    b. Eight 10/100 Base-TX, RJ45 ports.

        1) Shielded.
        2) Full duplex.
        3) Support auto negotiation and auto polarity.

    c. Provision for connection of one 100BaseFX, multi-mode ST connector.
    d. One pluggable terminal block.

2. Alarm Contact:

    a. Indicates switch/communication link failure.
    b. Rated at 24 Vdc, 1 A.

3. Power Supply: Redundant, 24 Vdc, nominal, with integral overload and transient protection.
4. Operating Temperature: 0 to 55 degrees C.
5. Acceptable Manufacturers:

    a. MOXA, EDS-308 Series.
    b. Phoenix Contact FL Switch 1000
    c. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install the devices in accordance with manufacturer's recommendations.

B. Configure the devices in accordance with manufacturer's instructions, and as shown on the Drawings.

3.02 START-UP AND TESTING

A. Comply with the manufacturer's recommended testing procedures.

END OF SECTION

SECTION 409574 – PROCESS CONTROL SIGNAL CONDITIONERS CONVERTERS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process control signal conditioners/converters as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

B. Submit operation and maintenance (O&M) manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 INTRINSIC SAFETY BARRIERS

A. Provide intrinsic safety barriers (ISB) with following requirements:

1. Application: Discrete contact input or discrete contact output as required.
2. Rated Voltage: +100 to 126 Vac.
3. Voltage to Intrinsically Safe Apparatus: 10.6 V at 20 mA.
4. Short circuit proof.
5. Safety Data: FM.
6. DIN rail mounting.
7. Acceptable Manufacturers:

    a. Pepperl+Fuchs – KFA5-SR2-Ex2.W
    b. STAHL – Series 9002.
    c. Or equal.

2.02 SIGNAL CONDITIONER (ISOLATOR)

A. Provide a single output isolator with the following requirements:

1. Input: 4 to 20 mAdc.
2. Output: Isolated 4 to 20 mAdc.
3. Power Supply: 120 Vac, 60 Hz or loop powered.
4. Mounting: Plug-in DIN rail socket.

B. Provide a dual output isolator with the following requirements:

1. Input: One 4 to 20 mAdc.
2. Output: Two isolated 4 to 20 mAdc.
3. Power Supply: 120 Vac, 60 Hertz or loop powered.
4. Mounting: Plug-in DIN rail socket.

C. Acceptable Manufacturers:

1. PR Electronics
2. Turck
3. Acromag
4. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install process control signal conditioners/converters in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 409580 – PROCESS CONTROL SURGE PROTECTORS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process control surge protectors as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 QUALITY ASSURANCE

A. All equipment to be provided by one manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Design surge protector to protect the electrical/electronics equipment from lightning, line transients, and other damaging voltage spikes, and attenuate power line disturbances such as voltage surge, spike, impulses or transient, to a safe, nondestructive level which matches the needs of the electrical/electronics equipment.

B. Acceptable Manufacturers:

1. MCG Electronics, Inc.:

    a. Model 416 for ac power lines surge protector.
    b. Model DLP-3.9 for I/O ports data line surge protector.
    c. Or equal.

2.02 AC POWER LINES SURGE PROTECTORS

A. Provide an ac power lines surge protector with the following requirements:

1. Rated Voltage: 120 Vac 60 Hz.
2. Rated Current: 25 A.
3. Response: 1 nanosec.
4. Surge Voltage: 12,000 A.
5. Clamp Voltage: 212 V.
6. Suppression Voltage: 420 V impulse, 250 V ringwave.
7. Surge Energy: 400 joules.
8. Filter: Attenuates conducted RFI.

2.03 DATA LINES SURGE PROTECTORS

A. Provide I/O ports data lines surge protector with the following requirements:

1. Clamp Voltage (10/1000 micro): +20 V.
2. Clamp Threshold (1 mA): +25 V peak.
3. Response Time: 1 nanosecond.
4. Data Rate: 20 Kilobits/second.
5. Connectors (line/load): DB9 or as required.

B. Provide surge protector for Ethernet Data Networks with the following requirements:

1. Clamp Voltage: 119 Vpk (L-G), 56 Vpk (L-L).
2. Maximum DC Operating Voltage: 19.8 Vdc (L-G), 5.6 Vdc (L-L).
3. Maximum Surge Current: 1 kA.
4. Maximum Capacitance A-B Lines: 20 pF (L-L).
5. Agency Approval: UL 497B, CE.
6. Acceptable Manufacturers:

    a. Leviton, Cat No. 3861-ETH.
    b. Phoenix Contact DataTrab PT Series.
    c. SixNet, SP-ETH Series.
    d. Or equal.

2.04 CURRENT LOOP SURGE PROTECTORS

A. Provide surge protector for current loop with the following requirements:

1. Indoor Application (mounted in the control panel):

    a. Surge Life: >100 operations with 200 A, 10 x 1000 usec.
    b. DC Leakage Current at Rated L-G Voltage: >10 uA.
    c. Signal Attenuation: 3 db with 6000 ohms termination.
    d. Response Time: 50 pico-seconds.
    e. Operating Temperature: -40 to 60 degrees C.

f. Peak Signal Voltage L-L: 28 V.
g. Maximum Data Rate L-G: 4 MHz.
h. Peak Clamping Voltage: 55 V L-L and L-G.
i. Load Current: 150 mA.
j. Capacitance 1800 pF. L-L and L-G.
k. Series Resistance: 22 ohms.
l. Mounting: DIN Rail.
m. Acceptable Manufacturers:

1) Bourns, Model 1820-28-A3.
2) Phoenix Contact PlugTrab PT Series.
3) Or equal.

2. Outdoor Application:

a. Maximum Signal Voltage: 30 Vpk.
b. DC Clamping Voltage: 36 V L-L.
c. Capacitance, 1 MHz Maximum: 2000 pF.
d. Inductance, per Line Maximum: 1 uH.
e. DC Leakage, 24 Vdc Maximum: 1 uA.
f. Impulse Clamping Voltage: 50 V L-L
g. Operating Temperature: 40 to 100 degrees C.
h. Maximum Load Current: 150 mA.
i. Component Response Time: 1 ns.
j. Surge Life: 20 times (L-L)-G 20 kA 8/20 us.
k. Housing: Schedule 40 stainless steel pipe nipple with 1/2-14 NPT connection.
l. Acceptable Manufacturers:

1) Bourns, Model 1669-02 or 1669-06.
2) Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install surge protectors in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 409588 – POWER SUPPLY SYSTEMS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide power supply systems as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

B. Submit operation and maintenance (O&M) manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 UNINTERRUPTIBLE POWER SUPPLY

A. Design uninterruptible power supply (UPS) to supply the total power requirement of the system plus 25 percent for future expansion. Provide no-break transfer line to inverter and return.

B. Provide UPS unit with the following requirements:

1. Input: 120 Vac 60 Hz, single-phase.
2. Output: Voltage 120 Vac 60 Hz, single-phase, true sine wave.
3. Battery Time: 30 minutes minimum running time at full load or 60 minutes minimum at half load.
4. Battery: Sealed, lead acid 5-year-maintenance free.
5. Input/Output Configuration:

    a. Input: 6-foot line cord with 20 A, three-prong grounded plug (5-20P).
    b. Output: Minimum 2-duplex, 15 A receptacles.

6. Safety: UL listed.

7. Acceptable Manufacturers:

    a. American Power Conversion (APC), Smart UPS.
    b. Sola/Hevy-Duty S4K Series.
    c. Allen Bradley 1609 Series.
    d. Or equal.

C. Provide control panel UPS with relay interface card with dry contact relay outputs to monitor the following UPS status:

1. Battery On.
2. Battery Low.
3. Communication Loss.
4. Overloaded.
5. Fault.
6. Replace Battery.

2.02 DC POWER SUPPLY

A. Design dc power supply to convert alternating current to direct current and supply the total power requirement of the system plus 25 percent for future expansion.

B. Provide dc power supply with the following requirements:

1. Input: 120 Vac, 60 Hz.
2. Output: dc voltage as required.
3. Housing: Enclosed housing, DIN mounted.
4. NEC Class 2.
5. Suitable for use as redundant power supply when connected to redundancy module (for 24 Vdc power supplies).
6. Output contact to indicate power supply fault.
7. Acceptable Manufacturers:

    a. Sola/Hevi-Duty SDN “P” Series.
    b. Allen Bradley Bulletin 1606-XL.
    c. Or equal.

C. Provide Redundant DC power supply module with the following requirements:

1. Nominal voltage: 24 Vdc.
2. Housing: Enclosed housing, DIN mounted.
3. Allows two 24 Vdc power supplies to be connected to module using isolated inputs.
4. NEC Class 2.
5. Output contact to indicate module fault.
6. Acceptable Manufacturers:

    a. Sola/Hevi-Duty SDN RED Series.
    b. Allen Bradley Bulletin 1606-XLRED.
    c. Or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install power supply systems in accordance with manufacturer's recommendations.

END OF SECTION

NISQUALLY STATE PARK
PHASE 3A
MAINTENANCE BUILDING AND WASTEWATER TREATMENT FACILITY

SECTION 409712 – PROCESS CONTROL ALARM DIALERS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process control alarm dialers as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

B. Submit operation and maintenance (O&M) manuals in compliance with pertinent provisions of Section 017700 – Closeout Procedures.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 EXPANDABLE INDUSTRIAL ALARM DIALERS

A. Provide expandable industrial alarm dialers with the following requirements:

1. Four dry-contact input channels, expandable to a minimum of 32 inputs.
2. Ethernet interface capable of communicating to programmable logic controller via Allen-Bradley Ethernet/IP protocol.
3. Integral ac power failure and low battery alarm notification.
4. Utilizes standard 2-wire telephone line.
5. Capable of dialing up to 16 phone numbers, up to 32 digits each.
6. Capable of dialing out to a numeric pager.
7. Allows a minimum of two phone lists.
8. Programmed either locally using integral keypad or remotely using standard touch-tone telephone.
9. Includes the following user programmable functions:

    a. Alarm recognition time.
    b. Call delay time.
    c. Inter-call delay time.
    d. Message repetition.
    e. Unique voice-recorded message for each input channel.

10. Non-volatile memory storage for all programmed parameters.
11. Allows user to obtain status report of all monitored channels remotely by calling in using any standard telephone.
12. Power Requirement: 120 Vac, 60 Hz.
13. NEMA ~~4X~~ 1 enclosure.
14. Battery backup for at least 12 hours.
15. FCC approved RJ-11 plug-in modular connector for telephone line.
16. Operating Range: 20 to 130 degrees F.
17. Integral surge protection on all inputs including power, phone line, and alarm signal.
18. Internal speaker telephone.
19. Acceptable Manufacturers:

    a. RACO, Verbatim Gateway Model Number 325VPLC-4C-32ET.
    b. No Substitutes.

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PART 3 – EXECUTION

3.01 INSTALLATION

A. Install the process control alarm dialers in accordance with manufacturer's recommendations.

B. Program the alarm dialer with the appropriate messages, time delays, ID number, telephone numbers, etc. as directed by the Owner.

END OF SECTION

SECTION 409796 – PROCESS SWITCHES (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. Provide process switches as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 013300 – Submittal Procedures, including the manufacturer's detailed specifications.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 016000 – Product Requirements.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide Process Switches (indicate switch type) to comply with Section 409796 as follows:

Tag	Service	Output
LSL-11	Influent Pump Station Wet Well Low Level Float	Dry Contact
LSH-12	Influent Pump Station Wet Well Lead Pump Float	Dry Contact
LSH-13	Influent Pump Station Wet Well Lag Pump Float	Dry Contact
LSH-14	Influent Pump Station Wet Well High Level Float	Dry Contact
LSL-21	MBR Feed Pump Station Wet Well Low Level Float	Dry Contact
LSH-22	MBR Feed Pump Station Wet Well Lead Pump Float	Dry Contact
LSH-23	MBR Feed Pump Station Wet Well Lag Pump Float	Dry Contact
LSH-24	MBR Feed Pump Station Wet Well High Level Float	Dry Contact
LSL-31	Plant Drain Pump Station MH Low Level Float	Dry Contact
LSH-32	Plant Drain Pump Station MH High Level Float	Dry Contact

2.02 FLOAT SWITCHES

A. Provide float switches with following requirements:

1. Float Casing Material: Polypropylene.
2. Switch: Mechanical switch in float casing, SPDT N.C., minimum 10 A contacts rated 120 Vac.
3. Cable: CPE jacketed.
4. Actuation Point: Maximum angle of 20 degree above, 10 degree below horizontal, or 1 inch above/below horizontal.
5. Approval: UL recognized component.
6. Acceptable Manufacturer:

    a. Conery Mfg. Inc., Model 2901 Series.
    b. Flygt, Model ENM-10.
    c. Or equal.

7. Provide a stainless-steel cable or chain with 10-pound cast iron weight for float switch support, or cord weight (zinc plated cast iron – 1.22 lbs.) or internal weighted bulb as required.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install the process instrumentation devices in accordance with manufacturer's recommendation.

B. Install identification tags to comply with Section 260553 – Identification of Electrical Systems and as follows:

1. Provide metal tags to field instruments.

C. Identify all wires at both ends with wire markers to comply with Section 260519 – Low-Voltage Electric Power Conductors and Cables. Show these numbering on the as-build drawings.

D. Ground the shield of instrumentation controls cable at one end only (control panel). Insulate the shield at the other end from the ground.

E. Touch-up and clean enclosures after the start-up.

3.02 CALIBRATION

A. Calibrate and program equipment to meet system requirements.

B. Provide calibration of all equipment and signals prior to start-up and testing.

3.03 START-UP AND TESTING

A. Comply with the manufacturer's recommended testing procedures.

B. Start-up and testing are the responsibility of Contractor.

END OF SECTION

SECTION 412200 – CRANES AND HOISTS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. This section specifies, portable davit hoists, bridge cranes, and accessories for the maintenance hoists to be installed on this project.
2. Furnish units complete with all appurtenances which are required for proper and safe operation.
3. Fabricate, assemble, erect, and place all specified equipment in proper operating condition in full conformity with Drawings, Specifications, and manufacturer's recommendations.
4. Provide load tests and certification for the rated loads.

1.02 DESIGN STANDARDS

A. The hoists/cranes shall be the manufacturer's normal design for the services specified. Standard replacement parts shall be readily available. The design, materials, and fabrication of the cranes shall comply with the latest Codes and Standards referred to herein.

B. Construction and Manufacture:

1. Equipment furnished under this section shall comply in all respects with the requirements of the following standards:

a. Monorail System: Specifications for Underhung Cranes and Monorail Systems, ANSI MH27.1 and ANSI B30.11.
b. Hoist: ANSI B30.11, Hoist Manufacturers' Institute.
c. Trolley: ANSI MH27.1.

d. Wire Rope Hoist Service Class: ANSI HST 4M.
e. Chain Hoist Service Class: ANSI HST 1M.
f. Hook: ANSI 30.10.
g. Stress and Safety Factors: ANSI MH27.1 and ANSI B30.11. Properly select materials of construction for stresses to which subjected.
h. Safety of Operation, Accessibility, Interchangeability, and Durability of Parts: ANSI B30.
i. CMAA: Crane Manufacturer's Association of America: CMAA Specifications Nos. 70 and 74.
j. HMI: Hoist Manufacturer's Institute.
k. NEMA: National Electric Manufacturer's Association.
l. NEC: National Electric Code.
m. OSHA and/or WISHA Standards.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 013300 – Submittal Procedures.

B. Shop Drawings and Equipment Data:

1. Manufacturer's catalog data and certification confirming rated capacities.
2. Complete catalog information, descriptive literature, materials of construction, and specifications on hoist, wheels, gears and bearing, trolley drive system, hook, brakes, and accessories.
3. Dimensional drawings and details for bridge cranes, and hoists.
4. Painting/coatings.

C. Operations and Maintenance:

1. Equipment function, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, adjustment, and checking instructions.
3. Operating instructions for start-up, routine and normal operation, regulation and control, shutdown, and emergency conditions.
4. Lubrication and maintenance instructions.
5. Guide to "troubleshooting."

6. Parts list and predicted life of parts subject to wear.
7. Outline, cross-sections, assembly drawings, and engineering data.
8. Test data and performance curves, where applicable.
9. As-built drawings.

D. Operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

1.04 PROTECTION

A. Protect all equipment during shipment, handling, and storage.

B. Painted Surfaces:

1. Protect against impact, abrasion, discoloration, and other damage.
2. After installation, repaint or touch up all painted surfaces that are scratched or damaged, prior to final acceptance.

1.05 QUALITY ASSURANCE

A. Certification:

1. Manufacturer's certification that equipment is capable of lifting the specified capacity with an acceptable industry safety factor.
2. On-site load test to 125 percent of rated load in accordance with OSHA/WISHA requirements.

B. Factory test all drives and hoists.

C. Unit Responsibility: The Contractor shall assign unit responsibility to a single manufacturer, namely, the manufacturer responsible for the complete crane/hoist system. Unit responsibility shall include the crane, hoist, trolley, and appurtenances.

1.06 WARRANTIES

A. Provide a 1-year equipment warranty as specified in the General Conditions.

PART 2 – PRODUCTS

2.01 EQUIPMENT ROOM BRIDGE CRANE

A. Equipment Name: MBR Equipment Hoist and Rail.

B. Type: Dual girder under-running manual bridge rail with manual chain hoist.

C. Crane Duty Class: Class C Moderate Service.

D. Rated Capacity (minimum):

1. Bridge Rail: 1/2 ton (1,000 pounds).
2. Hoist: 1/2 tons (1,000 pounds).

E. Speeds, Full Load (approximate): Not Applicable.

F. Dimensions:

1. Bridge Rail Span: Per Drawings.
2. Bridge Rail Runway: Per Drawings.
3. Maximum Lift: 12 feet 6 inches.

G. Other Features and Accessories:

1. Bumpers attached to bridge and to trolleys for both directions of travel.
2. Swivel hook with safety latches and enclosed lower pulley blocks.

3. Rated capacity of the crane and hoist clearly marked on the bridge beams.

H. Hoists and Manual Trolleys:

1. Low headroom chain hoists, with manual trolleys, to fit the bridge track. Hoist shall provide 12-foot lift with 10-foot hand chain drop. Hoist shall be provided with capacity limiter. Chain provided shall be stainless steel with chain container.
2. Cast Iron Wheels: Heat-treated and equipped with sealed, lifetime lubricated precision ball bearings for long life.

I. Painting:

1. Hoist and Trolley: Factory painted per manufacturer's standards.
2. Crane Bridge and End Trucks: Factory painted per manufacturer's standards.
3. Monorail and Crane Beams: Shop painted in accordance with Section 099000 – Painting and Coating.

2.02 BRIDGE CRANE MATERIALS

A. Chain: Steel.

B. Trolley: Steel, ASTM A36.

C. Wheels: Cast Iron or Steel.

D. Hooks: Forged Steel.

E. Girders and Support: Steel

2.03 PORTABLE DAVIT HOISTS

A. Provide portable davit crane of galvanized finish construction.

B. Provide zinc-plated spur gear hand winch with crane.

C. Provide and install powder coat finish socket bases at location indicated on drawings.

D. Provide 1/4-inch by 36-foot 304 stainless steel wire rope with stainless steel eye hook connection to equipment and free end of cable held on wire rope keepers as shown on the drawings.

E. Provide grip eye assemblies with davit crane to assist in lifting of chained connections by hoist equipment. Provide a grip eye for each size of pump chain used at site.

2.04 MANUFACTURERS

A. Girder, Bridge Rail , Hand Trucks and Trolley System:

1. System shall be of types described above as manufactured by:

a. Gorbel.
b. Or Equal.

B. Chain Hoists:

1. Chain hoist shall be of types described above as manufactured by:

a. Coffing.
b. Or Equal.

C. Portable Davit Hoists:

1. Portable hoists shall be of types described above as manufactured by:

a. Thern, Model 5110.
b. Or Equal.

PART 3 – EXECUTION

3.01 INSTALLATION AND INSPECTION

A. Inspect structure and crane rail beam erection for conformance with reviewed shop drawings and Contract Documents prior to installation of equipment. Correct or replace nonconforming work prior to proceeding with installation.

B. Cranes and hoists shall be installed in conformance with manufacturer's instructions and inspected by a manufacturer's representative. Provide all necessary accessories to make monorail complete, usable, and capable of meeting the operating requirements specified in the Operating Requirements. Test, adjust, and clean equipment for acceptance by the Engineer.

3.02 TESTING

A. Crane and hoist equipment shall be operated through a complete lift and lowering cycle and through a complete travel of the trolley and/or bridge to determine that the equipment shall perform smoothly and safely. All tests shall be carried out with the hoist loaded at 125 percent of capacity. The Contractor shall provide the test weight loads. Contractor shall provide certification of load test to the Engineer signed by a Crane Professional. Any defects shall be corrected by the Contractor without any expense to the Owner.

3.03 USE BY CONTRACTOR

A. Hoist used by the Contractor shall be repaired, repainted, and otherwise refurbished to like-new condition prior to its acceptance. The Contractor assumes all responsibility for operation and maintenance until the hoist has been accepted.

3.04 TRAINING AND ORIENTATION

A. Contractor shall arrange and conduct a training and orientation for facility maintenance personnel and staff users. One session of 2 hours shall be conducted and shall cover operation, maintenance, and safety features of the hoisting equipment; questions and answers; and hands-on demonstration.

3.05 CLEANUP

A. Upon completion of work, area shall be cleaned and restored to original condition, acceptable to the Owner.

END OF SECTION

SECTION 432500 – INFLUENT PUMP STATION (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SUMMARY

A. This section covers pumps, motors, sump, and appurtenances for Influent Pump Station. The duplex submersible pumping station shall be designed for handling raw unscreened sewage and wastewater containing solids, wipes and other fibrous materials without clogging. Pumps shall be designed for heavy duty service.

B. Furnish each Pump complete with base elbow, submersible motor, power cable, guide rails, and accessories.

C. The pump manufacturer shall warrant all equipment provided under this section, whether or not it is manufactured by the pump manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the pump supplier shall service the pumps and motors.

1.02 REFERENCES

A. ANSI/ASME B16.3, “Malleable Iron Threaded Fittings.”

B. ASME/ANSI B16.39, “Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300.”

C. ASTM A153, “Zinc Coated (Hot-Dip) on Iron and Steel Hardware.”

D. ASTM A283/A283M, “Low and Intermediate Tensile Strength Carbon Steel Plates.”

E. ASTM C443, “Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.”

F. ASTM D4101, “Propylene Plastic Injection and Extrusion Materials.”

G. HI SCRRP, “Centrifugal, Rotary, and Reciprocating Pumps.”

H. NEMA ICS 1, “Industrial Control and Systems.”

I. NEMA ICS 2, “Industrial Control Devices, Controllers, and Assemblies.”

J. NEMA ICS 6, “Enclosures for Industrial Control and Systems.”

K. NEMA MG 1, “Motors and Generators.”

L. NFPA 70, National Electrical Code.

M. NFPA 820, “Standard for Fire Protection in Wastewater Treatment and Collection Facilities.”

N. UL 508, “Standard for Industrial Control Equipment.”

1.03 SUBMITTALS

D. In accordance with Section 013300 – Submittal Procedures.

E. Submit manufacturer's literature and specifications for package lift station, including literature describing pumps, motors, equipment chamber, control panel, and level control. Provide the following specific data:

1. Manufacturer, model, weight, and horsepower.
2. Catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Manufacturer's published warranty documents.
4. Pump performance curves demonstrating compliance with performance requirements. Indicate all specified duty points and recommended limits of operation graphically on pump performance curve. Include curves for efficiency, brake horsepower, and net positive suction head required, each plotted against flow in gallons per minute (gpm).
5. Impeller type, size, and identification.
6. Motor Submittal Data:
7. Completed Motor Data Form.
8. Guaranteed minimum efficiency at rated load at rated voltage.
9. Guaranteed minimum power factor at rated load at rated voltage.
10. Expected efficiency at 1/2, 3/4, and full load at rated voltage.
11. Expected power factor at 1/2, 3/4, and full load at rated voltage.
12. Motor no-load current at rated voltage.
13. Full-load current at rated voltage.
14. Full-load current at 110 percent voltage.
15. Starting current at rated voltage.
16. Full-load speed.
17. Certified copy of test report for identical motor tested in accordance with NEMA and IEEE 841.
18. Cable Assembly Data:
19. Insulation and conductor materials of each cable assembly.
20. Outer diameter dimensions of each cable assembly.
21. Complete dimensional drawings of equipment, including pumps, motors, piping connections, details of construction, and weights.
22. Guide system and discharge elbow base dimensions and materials.
23. Copies of drawings with requested wet well dimensions to be specified by the pump manufacturer.
24. Factory finishing system.
25. Mechanical seal information.
26. Weight of each pump.
27. Size and template for anchor bolts for discharge elbows.
28. Bearing life calculations.
29. Seismic anchorage and bolting calculations.
30. Certificate of compliance with ISO 9001 Quality System.

F. Drawings on lift station, including outline dimensions, support details, cross sections, and control wire diagram.

G. Junction box data, including wiring diagrams, elementary diagrams, internal layout, material list, and descriptions of components.

H. Prior to factory testing:

1. Complete installation instructions.
2. Procedure for factory testing.

I. Prior to shipment to jobsite:

1. Operations and Maintenance Manuals.
2. Field testing procedure.
3. Certified factory test results.

J. Closeout Submittals:

1. Manufacturer's Certificate of Proper Installation.
2. Certified field test results.

1.04 QUALITY ASSURANCE

A. Excavating, backfilling, and compacting around lift stations shall comply with Section 311200 – Earth Moving.

B. Pump station wet well is classified as Class I, Division 1, Group D Environment as defined in NFPA 70. Pumps float switches, and other equipment in this environment shall comply with NFPA requirements for this classification, unless otherwise noted in this technical specification.

C. The pumps shall be submersible, centrifugal, explosion-proof sewage pumps meeting classification for NEC Class I, Division 1, Group C, D Hazardous locations.

D. Package sewage pump station assembled by vendor with minimum 3 years of company experience with similar installations.

E. Unit Responsibility: In order to ensure coordination, all pumps, motors, power cable, base elbows, and accessories shall be supplied by one pump manufacturer.

F. All pumping equipment furnished under this section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated as such to the satisfaction of the Owner.

G. To ensure a consistent high standard of quality, the manufacturer of this pumping equipment shall comply with the requirements of the ISO 9001 Quality System, and such compliance shall be verified by an independent certification agency approved by the International Organization for Standardization. Documentation shall be submitted for approval showing compliance with this requirement, and the equipment will not be released for shipment until approved.

1.05 SPARE PARTS

A. The following spare parts shall be provided for each size of pump:

1. One complete set of O-rings and gaskets.

2. One upper and one lower mechanical seal for each pump supplied.
3. One set of special tools.

B. Package to prevent damage during handling and storage.

C. Label with project number, equipment number, part name and number, and description.

1.06 WARRANTY

A. The submersible sewage pumps and associated equipment shall be warranted for a period of not less than 3 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

1.07 PROTECTION

A. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling, and storage.

B. Protect equipment from exposure to elements and keep all items thoroughly dry at all times.

C. Store motors, electrical equipment, and other equipment with moving parts in weathertight warehouses at a maintained temperature of 60 degrees F minimum.

D. Painted Surfaces: Protect against impact, abrasion, discoloration, and other damage.

E. Protect electrical equipment, controls, and insulation against moisture or water damage.

1.08 CRITICAL SPEED AND VIBRATION

A. Each complete pump assembly shall have no critical or resonant frequencies or multiples of resonant frequencies within 30 percent above and 30 percent below the range of pump speeds and blade pass frequencies required to meet the Performance Requirements. Complete assemblies shall be free of objectionable or destructive vibration throughout the specified operating range.

B. Vibration levels shall comply with the most recent edition of the Hydraulic Institute Standards.

C. Verify that equipment is mutually compatible and free of resonance over the complete operating range.

PART 2 – PRODUCTS

2.01 INFLUENT PUMP STATION CRITERIA

A. Contractor shall furnish all labor, materials, equipment, and incidentals required to provide pumping systems as specified herein. One manufacturer shall supply the pump to ensure suitability

and assurance of experience in matching equipment together and to ensure single-source responsibility for equipment.

B. System shall consist of two submersible sewage pumps (one duty/on standby) and motors, electrical and controls junction box, basin assembly, internal discharge piping, check valve, shut-off valve, quick-disconnect slide rail system, lift chain, level control switches, stainless steel level-control bracket, discharge plumbing with hydraulically-sealed discharge flange, pump mounting plates with bottom rail supports, pedestal mount and cord sealing plate for panel, or NEMA 4 junction box. System shall be installed in a precast concrete wet well where noted on the Drawings.

2.02 MANUFACTURERS AND PRODUCTS

A. Influent Pump Station Pumps:

1. Flygt Model NP 3069 SH 3 – Adaptive 276, ABS (Sulzer) Contrablock Impeller Pump or approved equal.

2.03 PERFORMANCE REQUIREMENTS

A. Influent Pump Station Pumps Guaranteed Performance:

1. Pumping Capacity at Full Speed:

   a. Capacity: 120 gpm.
   b. Total Head: 29 feet.
   c. Approximate Motor Speed: 3345 rpm.

2. Minimum Shut-Off Head: 47 feet.
3. Minimum Noncompressible Solids Passage: 2.0 inches.
4. Minimum Motor Horsepower2.7
5. Minimum Inlet Diameter: 3.1 inches.
6. Minimum Discharge Diameter: 3 inches.
7. Maximum Value for NPSHr: 13.1 feet.

B. Pumps shall operate without cavitation or undue vibration under all conditions.

C. Provide pump and motor units which are listed for explosion proof Class I, Division 1, Group D hazardous location in air and submersible in water and sewage.

2.04 PUMP

A. General:

1. A single-passage, clog-free pump, utilizing a non-clog impeller. The overall pump design shall combine high efficiency, standard NPSH, a large solid passage, and the ability to handle rags and other fibrous material without clogging.
2. Sealing: All matting surfaces in pump casing and in motor housing shall be machined and fitted with nitrile or Viton O-rings for watertight seal.

B. Impeller:

1. Impeller shall be of the balanced non-clogging type matched to its constant velocity equalizing pressure volute and be made of close-grained cast iron conforming to ASTM A48 CL30. It shall be of one-piece construction, single suction, enclosed two-vane, radial flow design with well-rounded leading vanes and then tapered toward the trailing edge for a circular flow pattern to prevent the accumulation of solids and stringy material.
2. Impeller shall be dynamically balanced and secured to the shaft by means of a bolt, washer, and key. Static and dynamic balancing operations shall not deform or weaken the impeller. The arrangement shall be such that the impeller cannot be loosened from torque in either forward or reverse rotation.
3. Wiper vanes on the back impeller shroud are not allowed.
4. Impeller shall be trimmed to specifically meet the conditions of operation.

C. Volute:

1. Volute is to be cast with extra thick walls made of close-grained cast iron conforming to ASTM A48, Class 30. It is to be one-piece, constant velocity equalizing pressure with smooth fluid passages large enough to pass any size solid that can pass through the impeller.
2. The volute shall be centerline discharge.
3. A renewable separate fronthead piece shall be bolted directly to the suction opening of the volute.
4. A sliding bracket assembly shall be a part of the pumping unit constructed so that when lowered to the discharge base/elbow, the knifing action of the vertical metal-to-metal seal provides a self-cleaning, non-clogging, non-sparking UL Listed explosion-proof assembly.

D. Wear Rings:

1. Wear rings shall be provided on both the impeller and fronthead so that clearances can be maintained throughout the life of the rings and minimize recirculation.
2. Impeller wear rings shall be of the axial- or face-type.
3. Fronthead wear rings shall be of the axial- or face-type.
4. Wear rings shall be attached to the impeller and fronthead using an interference fit and Loctite.
5. Wear rings shall be stainless steel, with the impeller wear ring approximately 50 Brinell softer than the fronthead wear ring.
6. Wear ring clearance adjustment shall be attained through impeller adjustment shims.

E. Pump Shaft:

1. The pump shaft shall be machined for straight fit at the impeller and a flange coupling for connection to the motor shaft shall be provided. A renewable straight shaft sleeve of 416 stainless steel, positive adhesive sealed to prevent leakage between the shaft and sleeve.
2. Sufficient diameter to carry the maximum loads imposed and to prevent vibration and fatigue.
3. Accurately machined along its entire length to proportions suitable for use in variable speed pumping applications.
4. Sufficient strength and stiffness to operate without distortion or vibration throughout the range of service specified.
5. Critical speeds of rotating assembly shall be in conformance with CRITICAL SPEED AND VIBRATION.

6. Capable of withstanding two times the expected peak motor torque from zero to maximum speed.
7. Dynamically balanced at maximum speed to 0.5 ounce inches per 10 pounds of shaft weight per end.

F. Materials of Construction:

1. Influent Pump Station. Pumps:

a. Pump housing: ASTM A-48, Class 35B.
b. Cooling jacket: Stainless steel AISI 316.
c. Impeller and insert ring: A 532 ALLOY III A (25% chrome).
d. Stator housing: ASTM A-48, Class 35B.
e. Shaft: ASTM A479 S43100-T.
f. Shaft seal Pump side: Corrosion resistant Tungsten carbide WCCR.
g. Shaft seal Motor side: Carbon–Aluminum Oxide.
h. Screws and Nuts: Stainless Steel, A4, AISI 316L, 316, 316Ti.
i. O-rings: Nitrile (NBR) or Viton (FKM) rubber.

2.05 MOTOR

A. Designed, built, and tested in accordance with the latest revision of the following standards. In the case of conflict between the requirements of this section and those of the standards, the requirements of this section shall prevail.

1. NEC.
2. NEMA MG-1.
3. ANSI/IEEE 112.
4. UL 1004.
5. UL 674.

B. Provide submersible, FM approved, explosion-proof, air or oil-filled motor suitable for continuous operation on 208 volts, 3-phase, 60 Hertz A.C.

C. Design motor to be non-overloading throughout the pump capacity-head curve for constant speed pumps.

D. Minimum Full Load Efficiency:

1. Influent Pump Station Pumps: 71 percent.

E. Minimum Full Load Power Factor:

1. Influent Pump Station. Pump: 0.78.

F. Minimum Service Factor: 1.15.

G. Minimum Allowable Starts Per Hour:

1. Influent Pump Station. Pump: 20.

H. Thrust Bearings: Designed to take the full axial load of the impeller.

I. Dissipate excess heat directly from the exposed stator housing to surrounding pump liquid for adequate motor cooling at any continuous power output up to and including rated power in ambient of 40 degrees C.

J. Stator Windings and Leads: Insulated with moisture-resistant Class F (minimum) insulation for operation at temperatures up to 155 degrees C (minimum).

K. Protection Devices:

1. Each pump controller shall use a Flygt MiniCAS/FUS module for mounting in Owner's electrical enclosure. Module shall simultaneously supervise pump motor stator temperature and pump seal leakage detector. Relay shall operate on 120 Vac, 24 Vac, or 24 Vdc. Module shall use only two wires to monitor all sensors. Include a mating socket, designed for back panel mounting, with each relay.

a. Motor Over-temperature:

1) Provide temperature detector(s) embedded in motor per manufacturer's standard.
2) Module shall have at a minimum of one NC and one NO contact rated for operation on 120 Vac and shall have provisions for a contact input to automatically or remotely reset the over-temperature trip.

b. Motor Moisture Detection:

1) Provide a conductivity probe in the motor seal that monitors the presence of moisture in the oil in the chamber between the outer and the inner mechanical seals per manufacturer's standard.
2) Module shall have, at a minimum, one NC and one NO contact for moisture monitoring. Contacts shall be rated for operation on 120 Vac.

2. If the Contractor proposes to provide a different over-temperature and/or moisture protection device(s), it is the Contractor's responsibility at his cost to furnish, submit for approval, install, wire, and document all necessary measurement relays, wiring, cables, etc. necessary to provide a complete and fully functional system. The proposed protection devices shall meet the design intent of the contract electrical and control drawings and shall receive favorable approval from the Engineer prior to acceptance.

2.06 ELECTRICAL POWER CORD AND SENSOR CABLES

A. Provide suitable length of extra hard usage, water resistant, 600 V, UL listed and/or FM-approved power cord and sensor cable(s) for each pump with:

1. Leak-proof, torque free seal at cable entry to motor.
2. Sealing of the motor power cord and sensor cable(s) to prevent moisture entry into the motor due to wicking or capillary action through the cable.

3. Corrosion-resistant cable supporting means.
4. Free end of cable shall be sealed from moisture entry during shipping, storage, and prior to connection by a plastic sleeve securely clamped over the cable end.

2.07 SHAFT SEALS

A. Independently-mounted, tandem mechanical seals contained in an oil chamber that is formed as an intrinsic part of the motor frame and allows the seals to be completely submerged in, and lubricated by, the oil bath.

B. Mechanical Seal Nearest the Bearing:

1. Pumps: Shall utilize Corrosion resistant Tungsten carbide WCCR/Corrosion resistant Tungsten carbide WCCR faces, and shall isolate the seal cooling oil from the motor frame.

C. Mechanical Seal Nearest the Impeller:

1. Stainless steel or rubber bellows-type construction firmly attached to the rotating face and clamped to the shaft to prevent contaminants from contacting the stainless steel spring which loads the seal face.
2. Seal Faces:

   a. Pumps: Shall utilize Corrosion resistant Tungsten carbide WCCR/Corrosion resistant Tungsten carbide WCCR faces.
   b. Pumps: Shall utilize Carbon/Aluminum Oxide faces.

2.08 BEARINGS

A. Bearings:

1. Antifriction-type AFBMA standard sizes.
2. Minimum (L-10) life of 40,000 hours.
3. Thrust ratings not less than the combined static and dynamic loads imposed.

2.09 MOUNTING

A. Guide Rail System:

1. 316L stainless steel dual guide rail fixture permanently mounted in the wet well as shown on the Drawings.
2. Fixture shall cantilever the entire pump and motor from the volute discharge flange, providing an unobstructed sump floor under the pump.
3. Support pump with a positive metal-to-metal interlocking flange that is sealed by a leak-proof nitrile rubber ring pressed against the fixture flange by the weight of the pump.
4. A stainless-steel upper rail guide bracket shall be furnished to support and align the rails at the top of the sump. For all rail lengths greater than 12 feet, a stainless-steel intermediate rail guide bracket shall be included.

B. Discharge Base:

1. The installation shall include a rigid discharge base-elbow to support the total weight of the pumping unit.
2. The base is to be bolted directly to the floor with the 90 degree elbow having a 125-pound ANSI flange discharging vertically with mounts for two 316L stainless steel guide rails of standard schedule pipe.

2.10 LIFTING SYSTEM

A. Provide components for using a grip eye to lift pumps:

1. Provide a minimum of 2 feet of stainless-steel chain attached to the top of the pump with the remaining length being nylon cord attached to the side wall of the opening of the pump hatch on each pump.
2. Provide one grip eye for each pump.
3. All metal components shall be stainless steel and rated for lifting the weight of the pump with a safety factor of 2.0.

2.11 SHOP/FACTORY FINISHING

A. Pump and Motor: Manufacturer’s standard baked enamel finish.

2.12 SOURCE QUALITY CONTROL

A. Each pump shall be factory tested and certified test results submitted prior to shipment of pumps.

1. Impeller, motor rating, and electrical connections shall be checked for compliance to the Specifications.
2. A motor and cable insulation test for moisture content or insulation defects in accordance with ANSI/HI 11.6.
3. Performance and Hydrostatic Testing:

    a. Pumps: pump shall be operationally tested to demonstrate compliance with performance requirements. The pumps shall be tested at full speed with the minimum water depth specified. A minimum of five test points shall be plotted on the full speed pump curve showing horsepower, efficiency, and head and flow from shut-off head to the specified run out condition plus 20 percent. Reduced speed performance criteria may be demonstrated by applying the affinity laws to the full speed test curve. During the testing, each pump shall be run continuously for a minimum of 30 minutes. Performance and hydrostatic testing shall conform to the most recent Hydraulic Institute Standards test codes, ANSI/HI 11.6, Acceptance Grade 1U.

4. After performance and hydrostatic testing, the cable insulation shall be tested again for moisture content.
5. Tabulated and graphical test results shall be certified by the manufacturer and submitted for approval by the Engineer prior to shipment of the pumps.

PART 3 – EXECUTION

3.01 FIELD QUALITY CONTROL

A. Installation Certification: A manufacturer's authorized representative shall inspect and test each pump for proper installation, lubrication, alignment, and connection. Submit written certification of installation to the Engineer.

B. Performance Testing: A manufacturer's authorized representative shall witness and assist with the performance testing of each pump to verify smooth operation and satisfactory performance. Hydraulic performance in the project wet well shall be adequate to demonstrate compliance with performance requirements.

C. Pump Lift Test: Contractor must demonstrate successful removal of pump from wet well using manufacturer's guide rail.

D. Test Results: Test results certified by the pump manufacturer's authorized representative shall be submitted to the Engineer for approval prior to the Owner's acceptance of the equipment.

E. Coordination: All testing shall be coordinated with the Engineer, Owner, and installing contractor.

F. Should tests indicate an unsatisfactory operation such as noise, leaks, poor pump performance, the manufacturer's representative shall assist the Contractor in diagnosing the conditions. The malfunction shall be corrected at no cost to the Owner and the tests repeated as defined herein.

3.02 MANUFACTURER'S SERVICES

A. Pump manufacturer shall provide a minimum of 10 hours of on-site service for certification of installation, start-up testing, and training. Training shall instruct operating personnel in the operation, maintenance, and adjustment of the system and installation.

END OF SECTION

SECTION 432520 – MBR FEED PUMP STATION (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. This section covers pumps, motors, sump, and appurtenances for the MBR Feed Pump Station. The duplex submersible pumping station shall be designed for handling screened and equalized sewage. Pumps shall be designed for heavy duty service.

B. Furnish each Pump complete with base elbow, submersible motor, power cable, guide rails, and accessories.

C. The pump manufacturer shall warrant all equipment provided under this section, whether or not it is manufactured by the pump manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the pump supplier shall service the pumps and motors.

1.02 REFERENCES

A. ANSI/ASME B16.3, “Malleable Iron Threaded Fittings.”

B. ASME/ANSI B16.39, “Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300.”

C. ASTM A153, “Zinc Coated (Hot-Dip) on Iron and Steel Hardware.”

D. ASTM A283/A283M, “Low and Intermediate Tensile Strength Carbon Steel Plates.”

E. ASTM C443, “Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.”

F. ASTM D4101, “Propylene Plastic Injection and Extrusion Materials.”

G. HI SCRRP, “Centrifugal, Rotary, and Reciprocating Pumps.”

H. NEMA ICS 1, “Industrial Control and Systems.”

I. NEMA ICS 2, “Industrial Control Devices, Controllers, and Assemblies.”

J. NEMA ICS 6, “Enclosures for Industrial Control and Systems.”

K. NEMA MG 1, “Motors and Generators.”

L. NFPA 70, National Electrical Code.

M. NFPA 820, “Standard for Fire Protection in Wastewater Treatment and Collection Facilities.”

N. UL 508, “Standard for Industrial Control Equipment.”

1.03 SUBMITTALS

A. In accordance with Section 013300 – Submittal Procedures.

B. Submit manufacturer's literature and specifications for package lift station, including literature describing pumps, motors, equipment chamber, control panel, and level control. Provide the following specific data:

1. Manufacturer, model, weight, and horsepower.
2. Catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Manufacturer's published warranty documents.
4. Pump performance curves demonstrating compliance with performance requirements. Indicate all specified duty points and recommended limits of operation graphically on pump performance curve. Include curves for efficiency, brake horsepower, and net positive suction head required, each plotted against flow in gallons per minute (gpm).
5. Impeller type, size, and identification.
6. Motor Submittal Data:
7. Completed Motor Data Form.
8. Guaranteed minimum efficiency at rated load at rated voltage.
9. Guaranteed minimum power factor at rated load at rated voltage.
10. Expected efficiency at 1/2, 3/4, and full load at rated voltage.
11. Expected power factor at 1/2, 3/4, and full load at rated voltage.
12. Motor no-load current at rated voltage.
13. Full-load current at rated voltage.
14. Full-load current at 110 percent voltage.
15. Starting current at rated voltage.
16. Full-load speed.
17. Certified copy of test report for identical motor tested in accordance with NEMA and IEEE 841.
18. Cable Assembly Data:
19. Insulation and conductor materials of each cable assembly.
20. Outer diameter dimensions of each cable assembly.
21. Complete dimensional drawings of equipment, including pumps, motors, piping connections, details of construction, and weights.
22. Guide system and discharge elbow base dimensions and materials.
23. Copies of drawings with requested wet well dimensions to be specified by the pump manufacturer.
24. Factory finishing system.
25. Mechanical seal information.
26. Weight of each pump.
27. Size and template for anchor bolts for discharge elbows.
28. Bearing life calculations.
29. Seismic anchorage and bolting calculations.
30. Certificate of compliance with ISO 9001 Quality System.

C. Drawings on lift station, including outline dimensions, support details, cross sections, and control wire diagram.

D. Junction box data, including wiring diagrams, elementary diagrams, internal layout, material list, and descriptions of components.

E. Prior to factory testing:

1. Complete installation instructions.
2. Procedure for factory testing.

F. Prior to shipment to jobsite:

1. Operations and Maintenance Manuals.
2. Field testing procedure.
3. Certified factory test results.

G. Closeout Submittals:

1. Manufacturer's Certificate of Proper Installation.
2. Certified field test results.

1.04 QUALITY ASSURANCE

A. Excavating, backfilling, and compacting around lift stations shall comply with Section 311200 – Earth Moving.

B. Pump station wet well is classified as Class I, Division 1, Group D Environment as defined in NFPA 70. Pumps float switches, and other equipment in this environment shall comply with NFPA requirements for this classification, unless otherwise noted in this technical specification.

C. The pumps shall be submersible, centrifugal, explosion-proof sewage pumps meeting classification for NEC Class I, Division 1, Group C, D Hazardous locations.

D. Package sewage pump station assembled by vendor with minimum 3 years of company experience with similar installations.

E. Unit Responsibility: In order to ensure coordination, all pumps, motors, power cable, base elbows, and accessories shall be supplied by one pump manufacturer.

F. All pumping equipment furnished under this section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated as such to the satisfaction of the Owner.

G. To ensure a consistent high standard of quality, the manufacturer of this pumping equipment shall comply with the requirements of the ISO 9001 Quality System, and such compliance shall be verified by an independent certification agency approved by the International Organization for Standardization. Documentation shall be submitted for approval showing compliance with this requirement, and the equipment will not be released for shipment until approved.

1.05 SPARE PARTS

A. The following spare parts shall be provided for each size of pump:

1. One complete set of O-rings and gaskets.

2. One upper and one lower mechanical seal for each pump supplied.
3. One set of special tools.

B. Package to prevent damage during handling and storage.

C. Label with project number, equipment number, part name and number, and description.

1.06 WARRANTY

A. The submersible sewage pumps and associated equipment shall be warranted for a period of not less than 3 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

1.07 PROTECTION

A. Box, crate, or otherwise completely enclose and protect all equipment during shipment, handling, and storage.

B. Protect equipment from exposure to elements and keep all items thoroughly dry at all times.

C. Store motors, electrical equipment, and other equipment with moving parts in weathertight warehouses at a maintained temperature of 60 degrees F minimum.

D. Painted Surfaces: Protect against impact, abrasion, discoloration, and other damage.

E. Protect electrical equipment, controls, and insulation against moisture or water damage.

1.08 CRITICAL SPEED AND VIBRATION

A. Each complete pump assembly shall have no critical or resonant frequencies or multiples of resonant frequencies within 30% above and 30% below the range of pump speeds and blade pass frequencies required to meet the Performance Requirements. Complete assemblies shall be free of objectionable or destructive vibration throughout the specified operating range.

B. Vibration levels shall comply with the most recent edition of the Hydraulic Institute Standards.

C. Verify that equipment is mutually compatible and free of resonance over the complete operating range.

PART 2 – PRODUCTS

2.01 MBR FEED PUMP STATION CRITERIA

A. Contractor shall furnish all labor, materials, equipment, and incidentals required to provide pumping systems as specified herein. One manufacturer shall supply the pump to ensure suitability and assurance of experience in matching equipment together and to ensure single-source responsibility for equipment.

B. System shall consist of submersible sewage pump(s) or submersible pumps where noted and motor(s), electrical and controls junction box, basin assembly, internal discharge piping, check valve, shut-off valve, quick-disconnect slide rail system, lift chain, level control switches, stainless steel level-control bracket, discharge plumbing with hydraulically-sealed discharge flange, pump mounting plates with bottom rail supports, pedestal mount and cord sealing plate for panel, or NEMA 4 junction box. System shall be installed in factory-fabricated fiberglass wet well with cover and valve vault where noted on the Drawings.

2.02 MANUFACTURES AND PRODUCTS

A. MBR Feed Pump Station Pumps:

1. Grundfos Model SLV.30.A30.18A.EX.4.60J.C or approved equal.

2.03 PERFORMANCE REQUIREMENTS

A. MBR Feed Pump Station Pumps Guaranteed Performance:

1. Pumping Capacity at Full Speed:

   a. Capacity: 25 gpm.
   b. Total Head: 30 feet.
   c. Approximate Pump Speed: 1,760 rpm.

2. Minimum Shut-Off Head: 32 feet.
3. Maximum Particle Size: 3.15 inches.

B. Minimum Motor Horsepower: 1.3

C. Pumps shall operate without cavitation or undue vibration under all conditions.

D. Provide pump and motor units which are listed for explosion proof Class I, Division 1, Group D hazardous location in air and submersible in water and sewage.

2.04 MOTORS

A. Motors shall be of the submersible type. Motors shall be for three-phase, 120 Vac operation, UL listed for explosion-proof NEC Class I, Division 1, Group D.

B. Wiring from the motor shall be terminated in an NEC Class I, Division 1, Group D explosion-proof junction box that can be reached for maintenance and inspection without entering the wet well or concrete basin.

C. Motors shall include seal leak-detection probe, which shall be wired to the motor junction box.

D. Motor shall have an internal thermal overload switch, which shall be wired to the motor junction box. The temperature shall be wired to stop the pump on high temperature and reset automatically when the motor cools to a safe operating temperature.

E. Motor bearings shall be designed for a minimum of 50,000 hours B-10 life.

F. Motor stator windings shall be minimum Class F insulation.

2.05 BEARINGS AND SHAFT

A. Upper radial bearing and lower thrust bearing shall be required. Both shall be lubricated permanently by dielectric oil that fills motor housing.

B. Machine shaft from solid series 300 stainless steel. Design shall be of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life.

2.06 SEALS AND SENSORS

A. Separate rotor and stator in motor housing and protect from pumped liquid by an oil-filled seal housing incorporating two Type 21 carbon-ceramic mechanical seals mounted in tandem. Seal housing shall be equipped with two moisture-sensing probes installed between the seals. The sensing of moisture in the seal chamber shall be automatic, continuous, and not require pump to be stopped or removed from wet well. Sensor probes shall be isolated electrically with a resistor between each probe to eliminate grounding to casing.

2.07 IMPELLERS

A. Impeller shall be bronze multi-vane, semi-open, non-overloading design. May be either factory or field trimmed to meet specific performance conditions. Impellers shall be hydraulically and statically balanced at factory and machined for threading onto pump shaft. Wear or field trimming shall not deter factory balance.

2.08 ELECTRICAL POWER CORD

A. Electrical power cord shall be water resistant 600 V, 60 degrees C, UL listed.

2.09 SUMP LEVEL CONTROLS

A. Provide floats and pressure transducer as indicated on the Drawings, for the operation of the systems. Floats shall be suitable for NEC Class I, Division 1, Group D hazardous location. Operation point shall be adjustable.

B. Wiring from the floats shall be terminated to an NEC Class I, Division 1, Group D explosion-proof junction box that can be reached without entering the concrete basin or wet well. May be combined with motor junction box.

C. Supply float switches to control sump level and alarm signal. Seal switches in a solid polypropylene float for corrosion and shock resistance. Support wire shall have a heavy Neoprene jacket and shall be of sufficient length to reach the junction box with no splices. Attach a weight to cord above float to hold switch in place in sump and efficiently prevent sharp bends in cord when float operates. Quantity of floats and pressure transducers to provide control level is as shown on Drawings.

2.10 ELECTRICAL AND CONTROLS JUNCTION BOX

A. All internal pump electrical and controls wiring shall be terminated into an integral junction box incorporated with the wet well.

2.11 PIPING, CHECK VALVE AND VALVE VAULT

A. Discharge piping shall include a spring-loaded Buna N rubber flapper type check valve with hydraulically sealed discharge flange and a full port ball type shut-off valve upstream of the pressure gauge and a second ball valve of same make and model downstream of the check valve for each pump.

B. Discharge from station shall be fitted with either National Pipe Thread (NPT) coupling(s) or schedule 80 PVC solvent weld socket type hub for attaching external piping. Contractor shall furnish and install all external piping.

C. All valves, elbows, crosses and other piping appurtenances shall be a minimum of 2 inches in diameter.

2.12 PUMP STATION WET WELL

A. Refer to Division 3 for concrete manhole specifications.

2.13 RAIL ASSEMBLY

A. The lift-out rail system assembly shall permit easy removal and installation of the pump and lower check valve without the necessity of personnel entering the wet well.

B. Guide rails shall be stainless steel pipe, unless otherwise approved by the Engineer.

C. Pump to be supplied with grip eye retrieval system.

2.14 MISCELLANEOUS REQUIREMENTS

A. Nameplates: Provide pumps and motors with a nameplate of noncorrodible material, fastened securely in place and inscribed clearly and permanently with manufacturer’s name, model or type designation, serial number, rated capacity, and other appropriate data.

B. Operating Manuals and Parts List: Furnish four complete bound sets of literature containing the following:

1. Instructions for operation adjustment, lubrication, and other equipment maintenance.
2. A complete parts list for each item of equipment, with catalog numbers.
3. Other data necessary for ordering replacement parts. Parts list shall contain sufficient information so repair parts can be ordered when local pumping station representative is not available. Such instructions and lists shall have been prepared specifically for model and type of equipment furnished.

C. Guarantee: Manufacturer of pump station shall guarantee for 1-year structure and all internal parts to be free from defects in design workmanship and material. Manufacturer shall supply replacement parts at no cost for any component proven defective during guarantee period. Normal items of wear and maintenance are excluded.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify all pumps, motors, and materials are present and meet requirements of these specifications.

3.02 PUMP INSTALLATION

A. Install pumps in accordance with shop drawings and manufacturer's specifications.

B. Provide start-up checklist and certification of readiness for start-up by authorized manufacturer's representative. Manufacturer's representative shall participate in equipment start up.

3.03 TESTS

A. All items shall have a running test to ensure against leakage and vibration. Adjust level controls at this time.

B. Contractor shall provide water and staff for conducting pump station flow test, rotation check, amps and test of motor insulation, controls, and alarms.

C. Test the control systems and demonstrate satisfactory operation of all control panel operations and indications.

D. Simulate each remote indication and alarm condition and demonstrate proper display or indication on the remote monitoring display panel and call out using the autodialer.

END OF SECTION

SECTION 443000 – ODOR CONTROL (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Media Adsorption Hardware.

B. Media.

C. Manufacturer's Services.

1.02 REFERENCES

A. American Society of Testing and Materials (ASTM):

1. ASTM D3299-88 Standard Specification for Filament Wound Glass Fiber Reinforced Thermosetting Resin Chemically Resistant Tanks.

B. Voluntary Product Standard: PS 15-69.

C. Uniform Building Code (UBC).

1.03 DEFINITIONS

A. FPM: feet per minute

B. FRP: fiberglass reinforced plastic

C. PE: polyethylene

D. PVC: polyvinyl chloride

E. H2S: hydrogen sulfide gas.

F. ppm: parts per million by volume.

G. W.C. water column

H. CFM cubic feet per minute

1.04 SYSTEM DESCRIPTION

A. The Contractor shall furnish and install the self-contained, odor control canister described herein. The purpose of this canister shall be to remove H2S and other odors or VOCs emanating from ambient sewage emissions. The canister includes the following:

1. Adsorber canister.
2. Media.
3. Fan.

B. The canister and media function as a system and shall be the end products of ECS Environmental, or pre-approved equal, to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.

C. There will be one absorption canister required, as delineated below:

System Designation	Quantity	CFM – maximum	Vessel Dimensions
V1-TM	1	800	48″ D x 48″ H

1.05 SUBMITTALS

A. Submit the following items at the same time under one cover (3 weeks after receipt of order):

1. Documentation to demonstrate that the reaction system is the standard product of the supplier.
2. Documentation to demonstrate that the manufacturer has been regularly engaged in fabricating odor control systems for at least 5 years and provide documentation of at least 10 similar installations.
3. Shop drawings and/or catalog cuts of supplied items.

B. Submit also the following (3 weeks after receipt of order):

1. Installation instructions.
2. Operation and maintenance instructions.

C. Manufacturer shall provide laboratory analysis from “Weck Laboratory” for the high-capacity carbon verifying the hydrogen sulfide capacity. The analysis shall be performed within 6 months of the date of submittal.

PART 2 – PRODUCTS

2.01 GENERAL

A. The Contract Documents indicate specific required features of the equipment, but do not purport to cover all details of design and construction.

2.02 ADSORBER CANISTER

A. The self-contained, adsorber canister shall be a V1-TM, as supplied by ECS Environmental, or pre-approved equal.

B. The adsorber canister shall be manufactured of fiberglass reinforce plastic (FRP) with UV inhibitors. The canister shall have no moving parts. Plastic vessels will not be allowed.

C. The adsorber canister shall support the carbon bed on FRP grating and screen. Adsorber design shall utilize "Plug Flow" air distribution (influent air shall enter below the carbon bed support grating, this area shall pressurize equally, and the air passes through the media bed uniformly, exiting through the outlet nozzle at the top of the vessel). The inlet plenum shall be void of packing, gravel or any other material and shall be open without air flow restriction.

D. The canister shall have the following features:

1. Inlet: 8-inch plain end connection with Fernco fitting
2. Cover: Removable flanged FRP cover with stainless steel bolts and EPDM gasket
3. Drain: 3/4-inch drain with PVC ball valve
4. Hold Down Logs: Three (3) FRP hold down lugs welded to the vessel wall
5. Grounding Rod: 3/8-inch-diameter 316 stainless steel
6. Manways: Two (2) 8-inch spin-off manways

E. The canister shall be rated at plus or minus 2 psig.

F. The canister shall be capable of operating at a maximum airflow rate of up to 800 CFM with a maximum headloss of 5 inches W.C.

G. Grounding System: A stainless steel grounding rod shall be inserted through media beds. Rod will have an external means to connect with for grounding 4/0 AWG bare copper ground wire. Grounding rod is removable from outside of vessel to protect it from damage during media bed servicing.

2.03 MEDIA

A. The media utilized by the reactor vessel shall be provided by the system supplier and supplied pre-installed in the vessel before shipping.

B. Media: The media will consist of two layers of the following media:

1. Total Volume: 37.7 ft^3 or 1,310 lbs.

Top Layer: KmnO4 Impregnated Alumina, 12.6 ft^3 or 630 lbs

KMnO4 Content (wt percentage): 6	
Crush Strength:	35 minimum – 70 percent maximum
Average Abrasion:	4.5 percent maximum
Particle Size:	1/16-inch
Moisture:	15 to 20 percent by weight
Apparent Density:	49 to 51 lbs/ft^3

Bottom Layer – High-Capacity Carbon, 25.1 ft^3 or 680 lbs

Carbon Tetrachloride Number:	70
Apparent Density (g/ml):	0.46
Bulk Density (lb/ft^3):	28 to 31
Hardness Number (Ball pan):	95
Ash (wt percentage):	18
Moisture wt percentage):	12
Mean Particle Diameter (mm):	4.0
H2S Minimum Breakthrough Capacity (gm H2S/cc carbon):	0.18*

* System supplier shall provide an analytic analysis sheet from an independent laboratory using ASTM-D6646 test method for hydrogen sulfide capacity.

2.04 FAN AND MOTOR ASSEMBLY

A. Fan: The fan shall be a centrifugal fan of aluminum housing that meets AMCA 210-85 and ISO 5801 certification. Wheel shall be aluminum radial design, electrically and dynamically balanced. All parts of the fan that are exposed to the airstream shall be epoxy coated to insure corrosion resistance. Fans made of plastic housing will not be allowed.

1. All fans shall be equipped with the following features and accessories:

   a. Arrangement 4HM orientation.
   b. Fan mounted on vessel lid with stainless steel bolts.

2. Fan shall be as manufactured by Cincinnati Blower PB-12A and rated for 600 cfm at 7-inch W.C.
3. Fan shall be equipment with an integral outlet damper and screen.

4. The fan shall include a sound enclosure constructed of FRP that completely enclosed the fan with acoustical adsorbing material and louvered vents.
5. The exhaust of the fan must contain an exhaust silencer. The exhaust silencer shall be manufactured of linear density polyethylene (LDPE) with UV inhibitors. It shall have an exhaust screen and mounted to the top of the vessel. The silencer shall contain an internal perforated screen with acoustical adsorbing material.

B. Motor: The motor shall be a NEMA Premium Efficiency Explosion Proof TEFC, direct drive unit, with a 1.15 service factor, with the following ratings: 2.0 Hp 3-phase/60 Hz/208 V. The motor shall be rated for Class 1 Division 2.

2.05 GREASE/MIST FILTER

A. A grease filter/mist eliminator shall be supplied as shown on the contract drawings. This unit shall consist of a 2-inch stainless steel mesh pad followed by 4-inch PPL mesh pad. Construction of this housing should be similar to other FRP components previously mentioned in this specification. Additionally, all surfaces coming in contact with the removable pad should have a 200-mil carbon veil liner applied for abrasion resistance. The housing shall have a flanged access door or drop out flange, to allow removal and replacement of the mesh pads. A drain shall be supplied to allow removal of accumulated material. A Dwyer Series 2002 Magnehelic gauge or equal shall be installed on the housing to indicate pressure drop through the unit. This unit shall ship loose and be ready for installation into the reactor system supply ductwork, The FRP housing shall be flanged and drilled per PS 15-69 and come complete with gaskets, ready for installation.

PART 3 – EXECUTION

3.01 MANUFACTURER'S SERVICES

A. The manufacturer shall provide one day for installation inspection, system start up, flow balancing, air testing for hydrogen sulfide and mercaptans, and training. Manufacturer shall provide a written report on the results, air sample results and expected media life.

3.02 QUALITY ASSURANCE

A. The engineer may provide and direct inspectors to inspect the equipment at the place of manufacture or upon arrival at the job site. The manufacturer shall furnish all reasonable assistance, if required by the engineer or inspector, for the proper inspection of the work. Inspection shall not relieve the manufacturer from any obligation to perform the work strictly in accordance with this specification. Work not so performed shall be replaced by the manufacturer at his own expense.

END OF SECTION

SECTION 444276 – WASTEWATER SAMPLERS (FOR SCHEDULE B ONLY)

PART 1 – GENERAL

1.01 DESCRIPTION

A. Provide two refrigerated, flow paced, composite wastewater samplers (influent and effluent) complete with accessories, for installation as shown on the Drawings and specified herein.

B. Wastewater samplers shall be manufactured by Teledyne Isco, which shall be the basis of bid for this project.

C. All equipment and devices shall be listed by Underwriters Laboratories, bearing the U.L. label or bearing the CSA-C/US label.

1.02 SUBMITTALS

A. In accordance with the requirements of Section 013300 – Submittal Procedures, submit the following project data:

1. Manufacturer's technical data and description literature.
2. Catalog data describing sampler mechanism functions and confirming rated capacity, and electrical requirement. List of all optional features provided with the samplers.
3. Operation manuals at time of shipping.

1.03 ENVIRONMENTAL CONDITIONS

A. Influent sampler will be installed outdoors. Provide Plasti-Fab, or approved equal, sampler shelter for effluent sampler. Fiberglass enclosure shall be NEMA 3R, corrosion-resistant, seamless construction, integral floor, insulated, 500 Watt heater with integral thermostat, electrical connection, four-plex receptacle, stainless steel hinges, lockable, and drain fitting.

PART 2 – PRODUCTS

2.01 SAMPLERS

A. Provide samplers with NEMA 4X/6 electronics enclosure and housing and shall have stainless steel outer refrigerator enclosure for corrosion resistance. Samplers shall have 25 feet of 4 to 20 mA flow proportional cable with end adapters on one end for connection to the sampler, with 3-gallon bottle. The other end of the cables shall be blank for plug-in connection to flow meters. (Note: Contractor shall provide plug-in adapter for other end of cables, as shown on the electrical drawings.) Samplers shall have a minimum of 25 feet of 3/8-inch-diameter intake tubing and strainer. Samplers shall be designed for flow proportional sampling, with 4 to 20 mA input signal, pulse or for programmed timed operation.

B. Effluent autosampler shall sample from a pressurized line. Provide Manning Environmental, Inc., or approved equal, flow-through cell, 3/8-inch intake, with control relay and electrically actuated ball valve.

C. Equipment which meets the intent of these specifications are as follows:

1. Teledyne Isco Model 5800.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The equipment shall be installed in accordance with manufacturer's recommendations and as shown on the drawings.

B. These unit specified herein are part of the plant instrumentation system and shall be installed and wired in accordance with other applicable specification sections. Provide appropriate length and type of cable with ends to match “plug-ins” to receiving flow signal for flow proportional sampling.

3.02 TESTING AND START-UP

A. All equipment provided in accordance with these specifications shall be tested for operation in conformance with the requirements of this and other sections of these Specifications. The Contractor shall completely test all controls and instrumentation and demonstrate that each unit is satisfactorily performing its function.

END OF SECTION

SECTION 462010 – WATER TREATMENT EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Work includes installation of treatment equipment, pumphouse plumbing, and controls.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 STANDARD SPECIFICATIONS

A. All work shall conform to the specifications listed in WAC 246-290 (Group A Public Water Supplies) and the latest editions of the following references: The Washington State Department of Health Water System Design Manual, Washington State Department of Transportation (WSDOT) standard specifications, APWA standard specifications, AWWA standards, UPC, and the applicable county rules, regulations, and ordinances. The standards are listed in order of preference in the event that a conflict in standard arises.

1.4 QUALITY ASSURANCE

A. Contractor is responsible for all effort necessary to complete work in accordance with drawings and standards, until certified by the engineer and state and local agencies for correct installation and satisfactory operation of all equipment.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. NSF Compliance: All products in contact with potable water shall:

1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

2. Comply with NSF 372, "Drinking Water System Components – Lead Content."

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, performance standards, standard drawings, and catalog cuts for the following:

1. Source Meter
2. Chemical Injection Pumps

3. Filter Vessel
4. Filter Media
5. Filter Head
6. Motorized Alternating Valve
7. Flow Restrictors
8. Valves
9. All miscellaneous components and appurtenances

B. Shop Drawings: Supplier shall submit shop drawings. Shop drawings shall include material descriptions, specifications, dimensional and assembly drawings, installation instructions, parts lists, and job specific drawings.

C. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation and maintenance manuals.

1.6 STORAGE AND HANDLING

A. All equipment and materials shall be new and shall bear the manufacturers name and trade name. In cases where the standard has been established for the particular material, the material shall be so labeled. The equipment to be furnished shall essentially be the standard product of a manufacturer regularly engaged in the production of the required type of equipment for this type of work and shall be the manufacturers latest approved design. Equipment and material shall be suitably delivered and stored and shall be readily accessible for inspection. All items subject to moisture damage shall be stored in dry spaces. All material and equipment shall be protected against dirt, dust, water and chemical or mechanical injury, vandalism, and theft. Materials shall not be dropped, subjected to heavy impacts, bent, or subjected to abrasion. Any physical damage to the components shall be repaired or replaced by the contractor at the contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. All system components in substantial contact with water must be NSF 61 approved for drinking water. Chemical additives must be NSF 60 approved.

2.2 PERISTALTIC INJECTION PUMP

A. Injection pump shall be an adjustable peristaltic metering pump designed for drinking water applications. Injection pump and tubing must be compatible for proposed chemicals.

B. Characteristics and Capacities:

1. Pump and tubing must be compatible with 12.5 percent chlorine solution
2. Tubing must be NSF-61 listed
3. Field adjustable feed rate control
4. Injection pressure of up to 100 psi

C. Injection pump shall be Stenner 45MHP10 with #1 tubing, or approved equal.

D. A 1/4" check valve injection fitting shall be installed, or approved equal.

E. Tubing material shall be PP Santoprene EPDM.

2.1 FILTER VESSEL

A. Filtration housing shall be Custom Care C52-MG24-20 24"x72" filter canister, or approved equal.

B. Minimum design pressure rating shall be 100 psi or greater.

2.2 FILTER MEDIA

A. Filter media shall be Greensand Plus with an anthracite cap, or approved equal.

2.3 FILTER CONTROLS

A. Minimum design pressure rating of filter control valves shall be 125 psi.

B. Input control shall consist of a minimum of a master/slave input/output port, 2 dry contact inputs, and 1 4-20 mA input.

C. Output control shall consist of a minimum of one master/slave input/output port, 1 motorized alternating valve control circuit output, 2 dry contact output relays (minimum rating 1A, 30VAC/DC).

D. One master unit shall be equipped with expanded communication ports for connecting 3 additional units.

E. Control valve shall be Clack 2" WS2H or approved equal. Control valve must be fully programable and compatible for communication between other treatment vessel controls.

F. Filter controls will contain a Clack 2-inch WS2H control valve with bypass and a 2-inch 3-port motorized alternating valve (MAV), or Engineer approved equal for each treatment vessel.

2.4 FLOW RESTRICTORS

A. Flow restrictors shall be GH 35 Dole Flow Regulator Valves, or Engineer approved equal.

2.5 SAMPLE TAPS

A. Sample cocks shall be standard 3/4" 90-degree hose bibs (globe valve). Smooth nose sample taps shall be used in place of standard threaded hose bibs.

2.6 PIPE AND FITTINGS

A. All piping and plumbing shall be SCH 80 PVC or SCH 40 GIP unless otherwise specified.

2.7 VALVES

A. All gate valves shall conform to ANSI/AWWA Standard C509 or latest revision, Gate Valves for Ordinary Water Service, as manufactured by Mueller or AVK only with the following modifications:

5. All gate valves shall be Mueller or AVK resilient wedge gate valves unless otherwise noted on the plans.

6. All gate valves shall be non-rising stems, furnished with O-Ring stem seals. Number, size and design shall conform to Section 3.12 of the AWWA Standards for gate valves.

7. All gates shall have square operating nut which operates left (counterclockwise) to open.

B. Check valves shall comply with ANSI/AWWA C508, latest revision. The rated working pressure of check valves shall be 200 psig with a test pressure of 400 psig.

2.8 SIGNAL WIRE

A. Signal wire shall be a minimum of 18 AWG or as required by applicable code.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. All materials and equipment to be installed in a neat, workmanlike manner and shall result in an installation consistent with the best practices of trades.

B. All equipment specified shall be installed in accordance with the manufacturer's recommendations and constructions drawings. Conflicts of information shall be called to the attention of the certifying engineer for their clarification.

C. The contractor may choose to modify the layout in order to complete the project more efficiently. However, any Contractor initiated changes to the layout must be approved by the

Engineer prior to installation. Any such changes shall not constitute a change order, and any additional expenses or savings associated with the changes will not affect the contract price.

D. Equipment installations for the pumphouse shall be in accordance with the layout drawing. All piping circuits, valves, meters, and capped connections shall conform to the system schematic drawing. Work is shown only in diagrammatic form and does not necessarily indicate every required fitting, box, conduit, etc. Change included in the base bid shall be interpreted as including any change of up to ten feet from the locations indicated on the drawings. Verify all dimensions by field measurements.

E. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum interference with other installations. Install equipment and materials to maintain code required clearances and access.

F. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

G. Install work uniform, level and plumb, in relationship to lines of building. Do not install any diagonal, or otherwise irregular work unless so indicated on Drawings or approved by the Engineer.

H. Follow manufacturers' directions and recommendations in all cases where the manufacturers of articles used on this Contract furnish directions covering points not shown on the Drawings or covered in these Specifications.

I. Prior to using the installations for potable water service, all pipes, tanks, pumps, valves, and other appurtenances shall be disinfected, flushed, and shall be shown to be free of bacteriological contamination by laboratory test of one or more water samples. See standards and details for specified instructions for disinfecting each component.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Protect stored piping and equipment from moisture and dirt. Elevate above grade.

C. Protect flanges, fittings, and specialties from moisture and dirt.

3.3 PERISTALTIC INJECTION PUMP

A. Chlorine injection pump on dedicated circuit controlled in parallel with well pump operation via relay.

B. The injector nozzle shall extend into the middle of the fill pipe. The trimmed side of the nozzle shall be installed facing up-stream.

3.4 FILTER VESSEL

A. Treatment vessels shall be placed no closer than 3” from the exterior walls and 6” from other vessels.

B. All tanks shall be leveled with shims as required to within 1 percent slope.

3.5 FILTER MEDIA

A. All plumbing components, pipe thread, and other sensitive components shall be protected from entry of foreign material during media addition.

B. The Contractor shall perform initial media flushing to remove fines and properly bed media.

C. Engineer shall be present during filter vessel bedding. The Contractor must provide advance notice to Engineer and plan to bed vessels in one day, if possible, to reduce excessive visits by Engineer.

3.6 FILTER CONTROLS

A. Control valves shall be installed and plumbed per manufacturer’s direction.

B. The Engineer shall verify that the Treatment Skid, as installed by the Contractor, is compatible with other adjacent equipment, instruments, controls and structures to allow operation of system per the design intent.

3.7 SAMPLE TAPS

A. Sample taps shall be oriented to discharge downward, be no less than 12” from the floor and positioned direct flow toward the floor drain. Sample taps shall provide an even, gently stream of water.

3.8 PIPE AND FITTINGS

A. The Contractor shall secure all components according to the manufacturer’s installation directions.

B. Contractor shall support piping to protect the plumbing and components from damage and impose minimal loads and stresses on the equipment.

3.9 SIGNAL WIRE

A. Connect reservoir level transducer to the VFD and well pump meeting manufacturers direction. Reservoir operational levels shall be at the following setpoints: 13.4 and 14.4 feet above the reservoir foundation.

B. Operation of the controls will be confirmed by the Engineer.

3.10 STARTUP AND TESTING

A. The Contractor shall instruct Owner's personnel in the operation and maintenance of all components and conduct a training seminar at the site. Training shall thoroughly convey all relevant operational subject matter to the operator(s) and owner's representative(s).

3.11 COMMISSIONING

A. The treatment plant will be considered effective if the post-treatment iron and manganese onsite and lab samples are below 50 percent of their respective maximum contaminant levels (MCL's).

B. Results of the treatment plant must be consistently effective for a minimum of two backwash cycles.

C. If the treatment system fails to demonstrate effective results, the Contractor shall troubleshoot and/or modify and/or replace the necessary equipment to bring the system into compliance.

END OF SECTION