



Makah Dock Extension Specifications Neah Bay, Washington



MAKAH INDIAN
TRIBE

Submitted to
Makah Tribe
Port of Neah Bay
Neah Bay, Washington

SPECIFICATIONS

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DIVISION 02 – EXISTING CONDITIONS
Section 02 32 00 – Geotechnical Investigations

PART 1 - GENERAL

1.01 SUMMARY

- A. Investigations and analyses of the subsurface conditions have been made for purposes of design. Included with the Specifications is the report entitled “Geotechnical Engineering Report, Port of Neah Bay Dock Extension, Neah Bay, Washington”, dated February 13, 2017, prepared by Landau Associates, Inc.
- B. The report presents the results of investigations to study the subsurface soil and foundation conditions for the Makah Dock Extension. Some of the information in the report includes the following:
 - 1. A discussion of the soil types, densities, consistencies, classifications, etc., as observed in a series of subsurface borings.
 - 2. Logs showing soil descriptions at various depths and the corresponding standard penetration test results.
 - 3. Laboratory results of samples including grain size analyses.
 - 4. A generalized cross-section showing the existing subsurface conditions as interpreted for purposes of design.
 - 5. Various engineering studies, pile design parameters, and engineering properties of observed soils as interpreted for purposes of design.
- C. The accuracy of the report information is subject to the limitations of scope and generally accepted practices in the field of geotechnical engineering at the time the report was prepared.
- D. The Contractor shall review the report and further investigate, interpret, and evaluate, as necessary, the subsurface conditions in order to determine and assess the required means and methods of shoring, pile installation, Pile Driving Analyzer (PDA) activities, Wave Equation Analysis of Pile (WEAP) requirements, and other activities.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

DIVISION 02 – EXISTING CONDITIONS
Section 02 41 00 – Demolition

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions and General Requirements, apply to this work as if specified in this section. Work related to this section is described in the following.
1. Section 00 31 26 – Existing Hazardous Material Information
 2. Section 01 10 00 – Summary
 3. Section 01 33 00 – Submittal Procedures
 4. Section 01 35 29 – Health, Safety, and Emergency Response Procedures
 5. Section 01 50 00 – Temporary Facilities and Controls
 6. Section 01 74 19 – Construction Waste Management and Disposal
 7. Section 02 83 13 – Lead Hazard Control Activities
 8. Section 02 90 00 – Fugitive and Silica Dust Control Procedures
 9. Section 03 60 00 – Grouting
 10. Division 26 – Electrical
 11. Section 31 00 00 – Earthwork

1.02 DESCRIPTION OF WORK

- A. The extent and location of the "Demolition" work is indicated on the drawings, in the specifications, and as outlined below.
1. Removal and disposal, in whole or in part, all items (demolition materials, debris, etc.) in compliance with the specifications and all agencies of jurisdiction. All items shall become the property of the Contractor unless otherwise noted.
 2. Payment of all costs required for disposal of items at legal disposal sites, including all permit fees and related costs.
 3. Salvaging items as indicated on the drawings and in the specifications. Items noted to be salvaged shall be dismantled, transported, stored at a safe location, and reassembled at a location indicated.
 4. Backfilling and compaction of holes, voids, trenches, or pits that result from such removal.

DIVISION 02 – EXISTING CONDITIONS

Section 02 41 00 – Demolition

- B. The details shown on the drawings are based upon information contained in the reference drawings. The details indicate typical features of the various structures and shall not be construed as complete or adequate to supplant actual on-site inspection, additional review, and interpretation of the reference drawings by the Contractor.
- C. In general, demolition work shall be in accordance with all applicable local, state, and federal regulations, and all permit requirements for the project.

1.03 REFERENCE STANDARDS

- A. Standard Specifications for Road, Bridge, and Municipal Construction, M41-10, 2012 edition, by Washington State Department of Transportation (WSDOT Standard Specifications).

1.04 REFERENCE DRAWINGS

- A. The reference drawings shall be reviewed by the Contractor and are available for inspection at the Port. The Port does not warrant the completeness or accuracy of these documents and the Contractor assumes all risk regarding their use.
- B. The following reference drawings or documents are available for review:
 - 1. Port of Neah Bay, Commercial Dock Replacement, record drawings, dated 10/15/2013

1.05 SITE CONDITIONS:

- A. Coordinate and schedule, with the Engineer, access to the site in advance.
- B. The Contractor is notified that the demolition requirements occur along the trestle of an active commercial dock.
- C. For access to the site see Section 01 10 00 – Summary.
- D. All demolition items not identified for salvage or recycle shall become the property of the Contractor. Disposal of all demolition items shall be in accordance with the specifications, local, state and federal requirements.
- E. Refer to Section 00 31 26 – Existing Hazardous Material Information for additional information.
- F. Refer to Appendix C for Marine Mammal Monitoring Plan requirements during demolition.

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Section 02 41 00 – Demolition

1.06 SUMMARY

- A. Items and material categories for demolition include, but are not limited to, the following:
1. Cast-in-place reinforced concrete traffic barrier.
 2. HMA pavement
- B. Items or equipment to be salvaged or recycled shall be dismantled without damage. Items designated for salvage or recycling are listed below.

No.	Salvage/Recycle Item	Destination
1.	N/A	N/A

1.07 SUBMITTALS

- A. Demolition Management Plan (DMP) with documentation that includes and addresses the following:
1. Work sequence and schedule. Include phased demolition requirements consistent with the overall project schedule.
 2. Activity-based schedule.
 3. List of subcontractors proposed including point of contact and telephone numbers.
 4. List of equipment to be used for demolition operations.
 5. Means and methods to protect existing infrastructure, stockpile materials, and deliver salvaged material. Include the methods used to provide floats, false work, temporary supports, bracing, and shoring.
 6. Means and methods to prevent demolition materials, debris, water from construction activities, etc. from falling into or entering the water.
 7. Laydown areas for materials management.
 8. Worker safety, toolbox meetings, and signs.
 9. Protection of the public or other persons in areas surrounding the work.
 10. Environmental protection plan and compliance with permit requirements.
 11. Contractor quality control plan.

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Section 02 41 00 – Demolition

- 12. Hazardous material abatement plan.
- 13. Construction stormwater pollution prevention plan.
- 14. Schedule of disposal sites, their locations, and the materials that will be disposed at each site.
- B. If the DMP is revised, resubmit with any proposed changes for review by the Engineer prior to incorporating changes to means, methods, equipment, tools, temporary supports, etc.
- D. Utility locate survey results described in Part 3 – Execution

PART 2 - PRODUCTS

2.01 GENERAL

- A. All products that are required to accomplish, or be incorporated into the work shall be selected by the Contractor, subject to the approval of the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. A utility locate survey shall be performed and submitted to the Engineer for approval that locates all existing utilities prior to start of demolition. Coordinate and resolve with the Port and Public Works operators to turn off or de-energize affected services before starting demolition.
- B. Verify all items for demolition, disposal, and salvage as early as practicable prior to start of the work. Notify the Engineer immediately if observed conditions differ from anticipated conditions.

3.02 DEMOLITION OF STRUCTURES

- A. Coordinate and perform all demolition in accordance with the permit requirements and regulations.
- B. Completely remove and dispose of all designated items. Infrastructure or materials designated to remain that are damaged by Contractor activities shall be replaced or repaired at the Contractor's expense.
- C. All pavements, barriers, and curbs designated for removal shall be broken up, prior to loading and disposal. Do not damage existing pavement which is to remain in place. Pavement demolition shall be accomplished by making neat vertical saw cuts at the boundaries of areas to be removed.
- D. At no time shall any debris be allowed to enter the water. The Contractor shall make provisions using floats, falsework, scaffolding, and other means as

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Section 02 41 00 – Demolition

necessary to prevent debris from falling into the water. All debris that falls into the water, whether it sinks or floats, shall be removed immediately, on an ongoing basis, and be disposed of at no additional cost to the Port.

- E. Blasting shall not be used.

3.03 DEMOLITION OF UTILITIES

- A. Notify the Engineer of a minimum of 72 hours before scheduled demolition of utilities. Schedule with each utility agency the work required by that agency. Meeting the conditions required by the Port and affected utility shall be the sole responsibility of the Contractor.
- B. Piping: Remove all piping in the demolition area, including fire hydrants and underground piping or exposed piping.
- C. Electrical, camera, fiber optics cables and telephone items: Remove electrical conduit, fixtures and equipment from the demolition area. Salvage and reuse items designated for reinstallation as indicated in the specifications or on the drawings.
- D. Water Lines: Remove and cap water and other utility lines in accordance with applicable codes.
- E. Storm Drains: Remove catch basins and drains in the demolition area and trim pipes to clear construction. Plug all abandoned lines with controlled density fill unless otherwise directed by the Engineer.
- F. Electrical Supply: Remove electrical conductors to nearest manhole or point of termination.

3.04 BACKFILL AND EXCESS EXCAVATED MATERIAL

- A. Backfill: All areas disturbed during demolition shall be backfilled and compacted to match the elevations of the existing sub-base, as shown on the plans, or as directed by the Engineer, and repaved as shown on the drawings.
- B. Excess Excavated Material: Excess excavated material shall be reused on site or disposed of off-site in accordance with Section 31 00 00 – Earthwork and applicable local and state regulations.
- C. The Port encourages the salvage and recycling of materials from demolished structures. The Contractor shall salvage or recycle to the extent possible, in a manner acceptable to environmental agencies and the Port, any of the materials designated for demolition and disposal. See Section 01 74 19 – Construction Waste Management and Disposal.
- D. Disposal of all asphalt pavement shall be at a Contractor-selected recycle site.

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- E. Disposal of all concrete (plain and reinforced) shall be at a Contractor-selected recycle site.

3.05 DISPOSAL

- A. Disposal shall be in accordance with the Specifications, and in compliance with local, state, and federal regulatory agencies.
- B. Cleanup: After removal of all demolition items and materials, clean and grade the area. There shall be no debris, rubble or litter left at the site from any of the demolition operations and the site shall be clean.

END OF SECTION

DIVISION 02 – EXISTING CONDITIONS

Section 02 90 00 – Fugitive and Silica Dust Control Procedures

PART 1 - GENERAL

1.01 RELATED WORK DESCRIBED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this work as if specified in this section. Work related to this section is described in the following.
 - 1. Section 01 35 29 – Health, Safety, and Emergency Response Procedures
 - 2. Section 01 42 00 – References
 - 3. Section 01 50 00 – Temporary Facilities and Controls
 - 4. Section 02 41 00 – Demolition

1.02 DESCRIPTION

- A. The Contractor shall supply all labor, materials, facilities, equipment, services, employee training and testing, handling, transport, disposal, and agreements necessary to perform the work required for fugitive dust control activities and potential silica-containing dust control activities in accordance with these specifications and applicable regulations from the State of Washington Department of Labor and Industries (WISHA), Puget Sound Clean Air Agency (PSCAA), and any other applicable federal, state, and local government regulations. Whenever there is a conflict or overlap of the above references, the most stringent provisions are applicable.
- B. In all cases where potential silica dust exposures may occur, the Contractor shall use any and all feasible engineering and work practice controls to reduce and maintain employee exposure levels at or below the Washington State Permissible Exposure Limits (PELs) for silica compounds, as specified in WAC 296-62-07515. It shall be assumed that the workers generating the silica dust are exposed above the Permissible Exposure Limit (PEL) until the Contractor air monitoring demonstrates levels below the PEL.
- C. The work specified herein shall be performed by competent persons. Competent persons are those who are trained, knowledgeable, and qualified in both fugitive and silica dust evaluation and control methods.
- D. If fugitive dust emissions are visible beyond the perimeter of the work area, or if respirable crystalline silica dust concentrations exceed 0.05 mg/m^3 beyond the perimeter of the work area, the Engineer is authorized to stop work. The Contractor shall perform all necessary corrective actions to eliminate visible dust and reduce respirable crystalline silica concentrations to less than 0.05 mg/m^3 before resuming work. The Port may visually monitor for fugitive dust and collect air samples for silica at any time.

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Section 02 90 00 – Fugitive and Silica Dust Control Procedures

1.03 SCOPE OF WORK

- A. Construction work will potentially generate fugitive dust. It is the responsibility of the Contractor to control fugitive dust generation and emissions.
- B. Construction site work that requires control of silica-containing dust includes chipping, sanding, sawing, jack-hammering, and other aggressive methods on concrete building materials associated with this project.
- C. Work activities shall include the following, as applicable:
 - 1. Provide site security to assure that no member of the public is able to gain access to the construction work area at any time. The Contractor shall maintain access and egress routes at all times.
 - 2. Provide worker training, respiratory protection, and medical examinations, as necessary, to meet applicable silica regulations and regulatory guidance regarding silica exposures where work involves the generation of concrete or demolition-related dust.
 - 3. Adopt work practices that prevent the release of fugitive and silica dust outside of the work area, as described in Part 3 of this section.
 - 4. Use wet methods and HEPA vacuuming equipment within the work area to clean the work area and control fugitive dust during demolition and construction activities, and at the completion of demolition and construction activities.
 - 5. Use barriers to prevent the release of dust from the work area to other areas of the project.
 - 6. Provide for worker and equipment decontamination. Worker decontamination and equipment areas shall be cleaned daily or more frequently, as required, to prevent dust emissions.
 - 7. Protect personal security, life safety, and energy management systems, including associated wiring, which shall remain operational throughout the work activities.

1.04 PERSONAL PROTECTION

- A. Respiratory Protection
 - 1. Where exposures to respirable crystalline silica may exceed the PEL of 0.05 mg/m³ based on an 8-hour time-weighted average (8-hr TWA) per WAC 296-62-07515, workers shall be provided, as a minimum, with personally issued and marked respirators equipped with high efficiency particulate air (HEPA) filters approved by the National Institute for Occupational Safety and Health (NIOSH), 99.97% efficient, that shall be

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Section 02 90 00 – Fugitive and Silica Dust Control Procedures

worn in the designated work area. Sufficient filters shall be provided for replacement as required by the workers or applicable regulations. Disposable respirators shall not be used. Respirators and respirator supplies shall be provided to the workers at the expense of the Contractor.

2. The Contractor shall comply with OSHA 29 CFR Part 1926.134, WAC 296-62-071 (Respiratory Protection), and ANSI Standard Z88.2-1990 "Practices for Respiratory Protection."
3. No worker shall be exposed to levels greater than 0.05 mg/m³ respirable crystalline silica as determined by the protection factor of the respirator worn and the work airborne area respirable crystalline silica levels.
4. A sufficient supply of replacement parts and HEPA filter cartridges shall be provided to the workers.
5. The Contractor shall maintain daily inspection(s) of all respirators to verify cleanliness and to replace damaged, worn or missing parts.

B. Protective Clothing

1. Workers shall be provided with sufficient sets of protective full-body clothing to be worn in the designated work area whenever a potential exposure to respirable crystalline silica concentrations exists above the PEL. Such clothing shall include, but not be limited to, coveralls and eye protection.
2. Protective clothing shall not be worn outside the work area. Non-disposable-type protective clothing and footwear shall be left in the work area.
3. Eye protection shall be provided and worn as required by applicable safety regulations. Equipment shall conform to ANSI Z87.1-1989.
4. Head Protection: Hard hats or other head protection shall be provided as required by applicable safety regulations. Hard hats shall conform to ANSI Z89.1-1991, Class A or B.
5. Foot Protection: Nonskid footwear shall be provided to all workers. Footwear shall conform to ANSI Z41.1-1993, Class 75.
6. Workers shall not eat, drink, smoke, or chew gum or tobacco in or near the work areas.

1.05 FUGITIVE DUST AND SILICA CONTROL SUBMITTALS

- A. Contractors shall provide complete submittals as per Section 01 33 00 – Submittal Procedures for review by the Engineer. Following receipt of review comments from the Engineer, submit additional complete sets of revised submittals. No

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Section 02 90 00 – Fugitive and Silica Dust Control Procedures

hazardous material abatement work or demolition work will be permitted prior to submittals being approved by the Engineer. Allow fifteen (15) calendar days for submittal review.

- B. Pre-Work Submittals: The Contractor shall submit to the Engineer for review and acceptance the Contractor's Work Plan as a prerequisite to issuance of the Notice to Proceed. The work plan must be reviewed and signed by a Certified Industrial Hygienist chosen by the Contractor. The plan must be suitably titled and indexed, providing detailed information concerning the following items as a minimum in the order listed below:
1. Safety and health hazards;
 2. Personal protective measures and decontamination system requirements;
 3. Respiratory protection program, fit testing and training records for all employees potentially exposed above the PEL;
 4. Specific work practices and procedures;
 5. Description of engineering controls designed to keep fugitive dust and silica exposures below the levels specified herein, for outside and inside each work area;
 6. Silica Air Monitoring Plan;
 7. Dust disposal plan;
 8. Emergency procedures; and
 9. Internal administrative and inspection procedures.

1.06 SILICA AIR SAMPLING EVALUATION BY CONTRACTOR

- A. The Contractor shall conduct air sampling of workers and subcontractors for respirable crystalline silica in accordance with NIOSH Method 7500, and according to the Contractor's Work Plan. This sampling is performed to evaluate workers' exposure levels.
- B. The Contractor shall conduct perimeter area air sampling in areas of the building occupied by the Public and Port Employees for respirable crystalline silica in accordance with the NIOSH Method 7500, and according to the Contractor's Work Plan. This sampling is performed to evaluate potential exposures to building occupants.
- C. The Contractor shall conduct air sampling in accordance with the NIOSH Method to collect a sufficient volume of air to determine if the airborne silica dust levels are below the PELs. If the sampling detection levels are above the PELs, the Contractor is required to re-sample at no expense to the Port.

DIVISION 02 – EXISTING CONDITIONS

Section 02 90 00 – Fugitive and Silica Dust Control Procedures

- D. Results of area air samples collected by the Contractor shall be submitted to the Port Engineer within 48 hours after sample collection.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT

- A. Provide a list and description of equipment and supplies necessary to support the work as described in the work plan, as required. Equipment and supplies may include but are not limited to:
 - 1. Chemicals to be used on site including solvents, dust suppressants, wetting agents, cleaning products, degreasing agents, welding/cutting supplies, and encapsulants;
 - 2. Enclosure equipment (for dust control);
 - 3. Demolition equipment;
 - 4. Materials and debris hauling/moving equipment;
 - 5. Material storage containers and supplies;
 - 6. Decontamination equipment and supplies;
 - 7. Protective clothing and respirators;
 - 8. Suitable tools for dust collection and water-jet dust suppression systems; and
 - 9. Sufficient number of HEPA-filtered vacuum cleaners to cleanup visible dust residues.

PART 3 - EXECUTION

Options for the control of fugitive and silica dust concentrations are given in the following paragraphs.

3.01 WET METHODS

- A. Use “wet” systems that eliminate or reduce dust generated by demolition activities including cutting off concrete piles. Cleanup sludge and /or waste immediately following its generation.

3.02 ENCLOSURE METHOD

- A. Use enclosures in conjunction with air filtration devices. Air shall be moved through the filtration unit with a minimum of 1500 CFM. Provide HEPA filter-based shop vacuum units to control dust generated at the work face and use tools that include dust control features where possible.

DIVISION 02 – EXISTING CONDITIONS

Section 02 90 00 – Fugitive and Silica Dust Control Procedures

3.03 OVERSIGHT

- A. An environmental consultant (Consultant) may be retained to advise the Port in all matters pertaining to the work performed in accordance with these specifications and requirements. Where an outside consultant is not hired, Port personnel will serve as this consultant. References to the consultant herein shall include the outside Consultant or Port personnel.
- B. The Consultant will act as the Port's liaison in technical matters involving the fugitive dust and silica-related work and will report any findings to the Engineer.
- C. The Consultant is authorized by the Port to have free access to all fugitive dust silica work areas, to assist in interpretation of procedures, and to advise on all provisions of the contract documents pertaining to the control of dust.
- D. The Consultant will advise the Engineer to stop work if in the course of performing their monitoring duties they observe an instance of substantial non-conformance with the contract documents and/or a situation presenting a health hazard to workers, Port employees, or the public. Work shall not resume until corrective measures have been enforced. Instances of substantial non-conformance shall include but not be limited to the following:
 - 1. Visible dust emissions outside of the work area barriers;
 - 2. Loss of negative pressurization (if required);
 - 3. Activities or misconduct affecting worker's or building occupant's safety; and
 - 4. Breaches of containment that could substantially damage building life safety systems.
- E. If poor work practices are observed, the Engineer shall direct the Contractor to make the necessary corrections. If appropriate corrections are not made, or if there is an immediate threat exists that silica dust could be released outside the work area, work shall be stopped. The decision to stop work shall be made by Engineer. The decision to stop work can also be made by the Contractor as part of the Contractor's management and control of the site and site activities.
- F. The Consultant may perform air sampling inside and outside the work area during the project. The Contractor shall cooperate fully with the Consultant and ensure the cooperation of his workers during collection of air samples and work area inspections.
- G. The Consultant's role in advising the port on environmental health matters does not relieve the Contractor's obligation to comply with all applicable health and safety regulations promulgated by the federal, state, or local governments. Air monitoring results generated by the Consultant shall not be used by the Contractor to represent compliance with regulatory agency requirements for

DIVISION 02 – EXISTING CONDITIONS

Section 02 90 00 – Fugitive and Silica Dust Control Procedures

monitoring of workers exposure to airborne silica, nor shall any other activity on the part of the Consultant represent the Contractor's compliance with applicable health and safety regulations.

3.04 WORK AREA ISOLATION, CLEANUP, AND DISPOSAL

- A. The Contractor shall characterize any waste that is generated and provide the disposal facility with a waste profile sheet for advance notice of acceptance. The Port will use the waste profile sheet to obtain a Generator EPA Identification Number for wastes that are regulated as dangerous waste.
1. Dangerous Waste: the Transporter and Disposal Facility must each have an EPA Identification Number. The Contractor shall submit the name, address, emergency contact phone numbers, and EPA Identification Number of the Transporter and Disposal Site to the Port prior to the disposal of hazardous/dangerous waste.
 2. The Contractor shall notify the Engineer three (3) days in advance of the time when wastes are to be removed from the site. A copy of the completed hazardous/dangerous waste manifest/bill of lading (for non-hazardous waste), and/or other documents required by the state or local agencies, shall be signed by the Port, with the final copy submitted to the Port within two weeks of pickup. These shall be signed by the generator, licensed transporter, and approved disposal or treatment facility representative.
 3. Completed certificates of destruction signed by the disposal facility shall be provided to the Port within ten (10) days of the time at which the hazardous materials are destroyed.
 4. The Contractor shall be responsible for the safe handling and transportation of all demolition wastes generated by the work from the point of generation to the designated disposal or treatment facility.
 5. It is a condition of Final Completion by the Port and a condition for final payment of this project that the Port has received all of the required waste disposal documentation that demonstrate proper handling, transportation, and disposal/recycling of demolition wastes and materials.
 6. Payment for disposal of waste will not be made until a signed copy of the disposal documentation from the treatment or disposal facility certifying the amount of dangerous waste delivered is provided to the Port.

3.05 RECORDKEEPING

- A. The Contractor shall maintain for at least thirty (30) years, employee health and safety records for the project, as specified in WAC 296-62-052. Furnish one copy to the Engineer. The record shall include the following information:

DIVISION 02 – EXISTING CONDITIONS**Section 02 90 00 – Fugitive and Silica Dust Control Procedures**

1. The starting and completion dates of the project;
2. A copy of all analytical results;
3. Copies of negative pressure documentation records (as required);
4. The name and address of the analytical laboratory used for silica analyses;
and
5. The name, address, and social security number of all persons who were engaged in the demolition activities.

END OF SECTION

DIVISION 03 – CONCRETE

Section 03 10 00 – Concrete Forming and Accessories

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this work as if specified in this section. Work related to this section is described in:
 - 1. Section 03 20 00 – Concrete Reinforcing
 - 2. Section 03 30 00 – Cast-in-Place Concrete
 - 3. Section 03 40 00 – Precast Concrete

1.02 DESCRIPTION OF WORK

- A. The Work includes furnishing all necessary material, labor, and equipment for providing the structural support and physical barriers or forms which control the shape and location of the concrete. Also included in this section are the requirements for the removal of the forms and their supports.

1.03 REFERENCE STANDARDS

- A. American Concrete Institute ACI 301-16: Specifications for Structural Concrete.
- B. American Concrete Institute ACI 318-14: Building Code Requirements for Structural Concrete and Commentary.
- C. American Concrete Institute ACI 347-14: Guide to Formwork for Concrete.
- D. Precast/Prestressed Concrete Institute PCI MNL-116, 4th Edition: Quality Control for Plants and Production of Structural Precast Concrete Products.

1.04 QUALITY ASSURANCE

- A. Design all forms, falsework, accessories, and shoring to meet the requirements of the concrete type, sequence of placing, schedule, and other conditions of the project. Use a designer having at least five (5) years of experience designing and constructing forms and falsework under similar project conditions.
- B. Before casting concrete, inspect all forms, falsework, accessories, and shoring, using workers having at least five (5) years of experience with the types of construction involved and the techniques necessary for completion of the work.

1.05 SUBMITTALS

- A. Documentation demonstrating the falsework designer's qualifications and experience as described above.

DIVISION 03 – CONCRETE

Section 03 10 00 – Concrete Forming and Accessories

- B. Documentation demonstrating each inspection worker's qualifications in and experience at inspecting or supervising concrete work, forms, falsework, accessories, and shoring as described above.
- C. Submit form, falsework, and shoring drawings and calculations for review prior to executing the work.
 - 1. Drawings shall show details of member sizes, connections, product data, and other related elements including proposed construction joints.
 - 2. Drawings shall indicate the construction sequence, the methods for release, and the sequence of removal.
 - 3. Calculations shall clearly state the material weights, lateral pressures, rates of pour, direction of pour, and working loads for form ties, friction collars, wedges, she-bolts, and accessories used in the design.
 - 4. Drawings and calculations for forms, falsework, accessories, and shoring designs shall be stamped by a Professional Engineer registered in the state of Washington.
- D. Documentation demonstrating friction collar capacity and clamping device test procedures and results.
 - 1. Provide drawings and documentation indicating the specific geometry, materials, and loadings used in the tests.
 - 2. Conduct tests using the same materials and in the same configuration to be used for the work.
 - 3. Successful previous test results of friction collars or clamping devices using the same configurations will be considered sufficient test data.
- E. In the event patented or prefabricated systems are used for forms or falsework, submit complete drawings, details, and calculations for review. Paper, fiberglass, micarta, asphalt-impregnated fiber, and other miscellaneous form materials shall be approved by the Engineer prior to delivery, fabrication, and construction.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials for concrete forms may be new or used. The quality of the materials, not the age or previous usage, will be the determining factor as to their suitability.
- B. All prefabricated form details, whether they are part of a patented system or custom-fabricated, shall be submitted for approval by the Engineer prior to assembly or arrival on site. Forms shall be kept in a condition to produce finished work meeting the location, alignment, and surface tolerances specified.

DIVISION 03 – CONCRETE

Section 03 10 00 – Concrete Forming and Accessories

2.02 WOOD FORMS

- A. For all exposed concrete forms, Grade B-B or B-C Plyform Plywood shall be used.
- B. For unexposed concrete forms, plywood shall be exterior type without splits or knotholes and sanded smooth. The face grain of the plywood shall run perpendicular to the pile caps. All joints in surfaces of forms used on exposed surfaces shall be vertical or horizontal. Plywood shall not be less than ½-inch thick except where curved areas require the use of ¼-inch thick material. When ¼-inch-thick material is used, it shall be backed with heavier material.
- C. Use commercial Grade No. 2 or better for all species of framing lumber. Framing lumber shall be of standard dimensions and of such quality as to meet the requirements of the applied stresses or loads.
- D. Shiplap, square-edged boards, or tongue-and-groove sheathing may be used for forming unexposed concrete surfaces.
- E. Use metal, fiberglass, or other special form linings where required.

2.03 STEEL FORMS

- A. Steel forms shall be designed and fabricated to meet the requirements of the member/members to be cast. Use only new materials for steel form construction.
- B. Forms for round elements shall consist of self-supporting metal shell or tube which will give a smooth, even surface. Forms which produce a spiral appearance or those made of wood shall not be used except as approved by the Engineer.

2.04 FORM LINERS AND COATINGS

- A. Forms shall be lined, coated, or treated with a suitable release agent or bond-breaker to ensure their timely removal with no damage to the concrete.
- B. Release agents or bond-breakers shall be non-coloring and shall not leave a film on the concrete surface that may inhibit subsequent finishing activities required to attain the prescribed finish.

2.05 FORM TIES AND ACCESSORIES

- A. Do not use form ties or she-bolts for forms, falsework, or shoring below MHHW.
- B. Wire form ties and wood spacers shall not be used.
- C. Form ties shall be pre-manufactured items with published allowable stress values from the manufacturer. Form ties shall have a premeasured, break-back, weakened area so that ties can be removed ¾-inch below the concrete surface.
- D. Tie rods for use with she-bolts shall be set back (1-1/2 inches) from the concrete surface. Tie-rod steel shall have published allowable stress values.

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- E. Corner brackets, friction collars, column clamps, and other specialized accessories shall be utilized in accordance with the manufacturer's recommendations.

2.06 FALSEWORK AND SHORING

- A. Materials and elements for shoring, falsework, mudsills, or structural staging shall be selected and sized according to the Contractor's design. The use of steel scaffold-type falsework, when approved by the Engineer, shall be furnished, erected, and braced in accordance with the manufacturer's recommendations.
- B. The capacity of friction-supported forms shall be established by tests that are performed by the manufacturer or by independent test results. Tests shall be conducted using the same material and in the same configuration to be used in the work.

PART 3 - EXECUTION

3.01 GENERAL

- A. Do not construct forms or falsework until the Engineer has reviewed the drawings and calculations. Review by the Engineer does not relieve the Contractor of the responsibility for sufficiency of the forms or falsework.
- B. Set forms and falsework to allow for structural camber plus an allowance for shrinkage and settlement. The finished concrete shall conform to the location lines and grades indicated on the drawings.
- C. Forms shall be constructed as to be rigid, unyielding, true to line, level, and sufficiently tight to prevent escape of mortar.
- D. Openings, embedded objects, and reinforcement shall be placed at the locations shown on the drawings. They shall be formed and fastened securely in position to maintain minimum cover for all reinforcement, and to leave smooth surfaces, true openings, accurate geometry, etc., after the forms are removed.
- E. Clean forms of all waste, debris, or other objects and substances deleterious to the concrete, concrete surface, or concrete element, prior to casting.

3.02 FORM INSTALLATION

- A. Prior to final setting or placing of reinforcing steel, forms for exposed concrete shall be treated with a release agent, bond-breaker, or parting compound. Apply the compound at a rate recommended by the manufacturer, to provide a smooth surface free of dusting action caused by the chemical reaction of the compound.
- B. Immediately remove any release agent or bond-breaker that comes in contact with reinforcement or embedded objects.

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- C. Forms may be set with a slight bevel or draft for easy removal, where approved by the Engineer. Use ¾-inch chamfer strips on all exposed inside and outside corners including the bottoms of pile caps and all vertical faces.
- D. All forms shall be mortar-tight.
- E. Remove all debris, waste, foreign objects from forms before assembly. Standing water in the forms shall not be permitted. Forms shall be cleaned with fresh water before assembly and prior to placing concrete.

3.03 FORM REMOVAL

- A. Forms shall remain in place for the minimum length of time indicated below, provided the ambient temperature is 40 degrees Fahrenheit or higher during that time period.
 - 1. Soffit forms for pile caps, or bulkheads: 7 days
 - 2. Side forms for pile caps, bulkheads or wall faces: 7 days
- B. When temperatures lower than 40 degrees prevail, forms shall remain in place longer and at the Engineer's direction.
 - 1. All periods where the ambient temperature is below 40 degrees Fahrenheit shall be disregarded in determining the length of time forms are to remain in place.
 - 2. The Contractor may submit for prior approval a cold-weather concreting plan in accordance with Section 03 30 00 – Cast-in-Place Concrete.
 - 3. Development and incorporation of an approved cold-weather concreting plan shall be at the Contractor's expense.
- C. The removal of forms as stipulated herein shall in no case relieve the Contractor of responsibility for the performance, acceptability, or finish of the work.
- D. All form and falsework removal shall be accomplished in a manner that prevents damage to the concrete, concrete finishes, and adjacent work elements.

END OF SECTION

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Section 03 20 00 – Concrete Reinforcing

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this work as if specified in this section. Work related to this section is described in:
 - 1. Section 03 10 00 – Concrete Forming and Accessories
 - 2. Section 03 30 00 – Cast-in-Place Concrete
 - 3. Section 03 40 00 – Precast Concrete
 - 4. Section 05 50 00 – Metal Fabrications

1.02 DESCRIPTION OF WORK

- A. The work includes the requirements for manufacture, detailing, cutting, bending, transporting, handling, and placing of all concrete reinforcement and associated items required or indicated on the drawings.

1.03 REFERENCE STANDARDS

- A. American Concrete Institute ACI 301-16: Specifications for Structural Concrete for Buildings.
- B. American Concrete Institute SP-66(04): ACI Detailing Manual (including ACI 315-99).
- C. American Concrete Institute ACI 318-14: Building Code Requirements for Structural Concrete and Commentary.
- D. American Society for Testing Materials (ASTM), Standard Specifications and Standard Test Methods, designated by basic reference in this section (use the most current edition at the time of bid unless otherwise indicated).
- E. American Welding Society (AWS) D1.1 Structural Welding Code – Steel, 2015 Edition.
- F. American Welding Society (AWS) D1.4 Structural Welding Code – Reinforcing Steel, 2011 Edition.
- G. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (MSP), 2009, 28th Edition.
- H. Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge and Municipal Construction M41-10, 2016 Edition.

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- I. Washington Association of Building Officials (WABO) Standard No. 27-13, WABO Welder and Welding Operator Performance Qualification Standard for Structural Steel, Sheet Steel, and Reinforcing Steel.

1.04 QUALITY ASSURANCE

- A. Provide at least one (1) qualified person who shall be present at all times during execution of this portion of work, be thoroughly familiar with the type of materials being installed, be skilled in the required methods for installation, and who shall direct all the work. Qualified personnel shall have a minimum of five (5) years experience in placement of reinforcement for concrete and prestressed concrete structures.
- B. All welders shall be qualified in accordance with AWS D1.4 and WABO Standard 27-13 for the weld procedures and positions to be performed.

1.05 SUBMITTALS

- A. Documentation demonstrating the qualifications and experience of the supervisor's and welder's of the work, as described above.
- B. Detailed shop drawings that are coordinated and checked for all concrete reinforcement prior to casting concrete.
 - 1. Do not deliver concrete reinforcement to the site prior to acceptance of the shop drawings.
 - 2. The shop drawings shall include, but not be limited to, material specifications, bar lengths, bar bending schedules, order lists, splice lengths, and proposed splice locations.
- C. Mill certificates for each heat of reinforcing steel and threaded bars to be furnished, indicating specification compliance, yield strength, ultimate strength, and chemistry.
- D. Qualified weld procedure specification (WPS) including all information contained in Annex A of AWS D1.4.
- E. Weld procedure and welder qualification test reports, including valid WABO card for welds and positions to be performed.
- F. Headed reinforcement details and manufacturer data sheets.
- G. Threaded bar reinforcement details and manufacturer data sheets.
- H. Data sheets for mortar blocks and chairs used for placing reinforcement.

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PART 2 - PRODUCTS

2.01 HANDLING

- A. Protect from damage all reinforcement before, during, and after installation in the work. Protect from damage the installed work and materials of other trades.
- B. All reinforcement shall be new and free from rust, grease, oil, wax, paint, soil, dirt, kinks, bends, or other defects. Store in a manner to prevent corrosion, or fouling with bond-breaking or deleterious coatings.
- C. The surface of prestressing steel shall be free from any substance or coating that may impair bond transfer length or pullout strength. If calcium stearate is used as a die lubricant during manufacture, methods approved by the Engineer shall be used to clean the steel completely.
- D. Maintain reinforcement identification after the bundles are broken. Indicate to the Engineer what bar types and grades are stored in each location.
- E. In the event of damage, immediately make all repairs and replacements necessary as directed by the Engineer and at no additional cost to the Port.

2.02 REINFORCEMENT

- A. All reinforcing bars, except as noted below, shall be deformed billet-steel bars conforming to ASTM A 615, Grade 60, deformed. Bars conforming to ASTM A 706 may be substituted for ASTM A 615 reinforcing bars at the Contractor's expense.
- B. All high-strength threaded bars shall be meet the requirements of ASTM A 615, Grade 75. Bars shall be continuously threaded (all thread). All hardware and accessories used with threaded bars (nuts, washers, plates, etc.) shall meet all requirements for use with the threaded bars and shall be provided by the same manufacturer as the threaded bars.
- C. All dowel reinforcing bars for piling, bars for ladders and grab bars, bars requiring welds, and bars designated as weldable shall conform to ASTM A 706, Grade 60, deformed. The carbon equivalent shall not exceed 0.55 percent (0.55%)
- D. Prestressing steel shall be uncoated, low-relaxation seven-wire strand conforming to ASTM A 416, Grade 270.
- E. Cold drawn steel wire for spirals shall conform to ASTM A 82.
- F. Welded headed studs and welded shear connectors shall conform to ASTM A 108, Grades 1010 through 1020 according to ASTM A 29. Head geometry shall conform to AWS D1.1, Section 7.2.

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- G. Mechanical couplers, where approved, shall be as follows.
 - 1. Couplers shall develop a minimum of 125% of the minimum specified yield strength of the reinforcing bar.
 - 2. Dayton Superior D-250 Bar-Lock S/CA-Series couplers, or approved equal.
 - 3. Lenton Lock mechanical couplers by Erico Inc, or approved equal.
 - 4. HRC Series 400 High Performance Mechanical Couplers by the Headed Reinforcement Company, or approved equal.
- H. Headed reinforcement shall conform to ASTM A 970.
 - 1. Heads shall be round in configuration.
 - 2. Pile Dowels: Bars shall be Lenton Terminator – D6 end anchors by Erico, Inc., Dayton Superior D-158 end anchors, Headed Reinforcement Company HRC Type 150, or approved equal.
 - 3. Other: Bars shall be Dayton Superior D-158 double-ended anchors, Headed Reinforcement Co. HRC double-ended bars with Type 150 anchors, or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Prior to installation of this section, carefully inspect the installed work of other trades and verify that such work is complete to the point where reinforcement installation may commence.
- B. Details of bending, placing, and splicing of all reinforcing steel shall conform to ACI 318, except as modified herein.

3.02 REINFORCING STEEL BARS

- A. Order Lists: Before ordering material, furnish all order lists and bending diagrams for approval by the Engineer; reinforcement placing drawings submitted for approval shall conform to the CRSI MSP. Do not order material until such lists and bending diagrams have been approved. The approval of order lists and bending diagrams by the Engineer shall in no way relieve the Contractor of responsibility for the correctness of such lists and diagrams.
- B. General Fabrication Requirements for Reinforcing Bars: Bend all bars cold to the shapes indicated on the drawings unless otherwise approved by the Engineer. Do not field-bend bars partially embedded in concrete except as indicated on the

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drawings or as approved by the Engineer. Make bends and hooks in accordance with the applicable portions of the CRSI MSP.

C. Placing and Fastening:

1. Place all steel reinforcement accurately and hold firmly in the position indicated on the drawing during the placing and setting of concrete. Tie bars at all intersections.
2. Minimum concrete cover to reinforcement shall be as indicated on the drawings:
3. Maintain the minimum distance from the forms by means of stays, blocks, ties, hangers, or other approved supports.
 - a. Holding reinforcement from contact with the forms shall be by approved metal or plastic chairs. Metal chairs which are in contact with the exterior surface of the concrete shall be plastic-coated for the full depth of the indicated concrete cover.
 - b. Maintain clear cover to tie wire.
 - c. Separate layers of bars by plastic chairs, by precast mortar blocks of compressive strength not less than 3750 pounds per square inch, spacing bars, or by other devices approved equal.
 - d. The minimum spacing between bars, except at lap splices, shall not be less than one bar diameter or one inch minimum, but not less than 1-1/3 times the maximum size of the coarse aggregate.
4. In the event that conduits, anchor bolts, piping, inserts, sleeves, embedded objects, headed studs, or other items interfere with placing reinforcement as indicated on the drawings, or as otherwise required, immediately contact the Engineer and obtain approval of a new procedure before placing concrete.

3.03 SPLICING

- A. Furnish all reinforcement in the full lengths indicated on the drawings, except that reinforcement over forty feet in length may be spliced.
- B. Splicing of bars, except when indicated on the drawings, will not be permitted without approval of the Engineer. When approved, splices shall be staggered with no more than fifty percent of any particular bar type being spliced at any one location. Minimum length of lap splice shall be 50 times the bar diameter or 18 inches minimum unless noted otherwise on the drawings. Minimum distance between spliced zones shall be three lap lengths.

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3.04 WELDING

- A. Welding of reinforcing steel shall be performed only as indicated on the drawings.
- B. Welding shall be performed by welders certified by the Washington Association of Building Officials (WABO) and shall conform to the current specifications of the American Welding Society (AWS) D1.4 except that weld size and reinforcement shall be as shown on the drawings.
- C. Processes used to place welds shall be either shielded metal arc or flux core arc (inner shield only) welding. All slag shall be removed from each weld.
- D. Procedures and welder qualification tests shall be witnessed by an AWS-certified welding inspector (CWI) approved by the Engineer. All tests shall be conducted in accordance with Section 6 of AWS D1.4. Such tests shall include longitudinal tension tests and macro-etch tests. Procedures and welder qualification tests shall be provided for weldable grade deformed reinforcing bars and wire spiral used in precast concrete piling. Macro-etch tests for wire spiral in precast piling are not required (tension tests only). Welding on a production basis shall not start until qualified welding procedures have been established and approved by the Engineer.
- E. Filler metal, preheat, and interpass temperature requirements shall conform with Section 5 of AWS D1.4.
- F. Exposure times for low hydrogen coated electrodes shall be in accordance with Section 5.8 of AWS D1.4.
- G. An ongoing inspection and verification program will be established by the Engineer in which visual inspection and tensile tests shall be performed for quality assurance on deck panel weld splices or other welded splices.
 - 1. As a minimum, all welds will be visually inspected by the Engineer. The Engineer will reject any and all welds failing visual inspection and direct that they be repaired according to AWS D1.4 or replaced at the Contractor's expense.
 - 2. The Contractor may choose to have rejected welds further examined by a certified testing agency at its own expense. If welds prove to be of unacceptable quality, the defective welds shall be removed and replaced by the Contractor at its own expense.
 - 3. The Port, at its discretion, will perform tension test(s) of sample welded connection coupon(s) identical to the production connections. The Contractor shall provide sample tension connection coupons at its own expense to the Port for this purpose.

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4. In the event that a sample connection fails testing, all production welds made by the welder responsible for the failing sample shall be identified and considered suspect. The Contractor shall demonstrate, at its own expense, by further testing, inspection, or other industry standard techniques that all suspect production welds are sufficient and free of defects according to AWS. Failure of the production welds to meet additional testing or inspection acceptability requirements shall be cause for rejection by the Engineer.

3.05 CLEANING REINFORCEMENT

- A. Steel reinforcement, at the time concrete is placed around it, shall be free from loose rust or mill scale, oil, salt water, paint, and all other coatings which will destroy, impair, or reduce the bond between steel and concrete.

END OF SECTION

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Section 03 30 00 – Cast-in-Place Concrete

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this work as if specified in this section. Work related to this section is described in:

- A. Section 03 10 00 – Concrete Forming and Accessories
- B. Section 03 20 00 – Concrete Reinforcing
- C. Section 03 40 00 – Precast Concrete

1.02 DESCRIPTION OF WORK

- A. The extent and location of the "Cast-in-Place Concrete" work is indicated on the drawings. The work includes the requirements for providing all cast-in-place concrete and associated work in conformance with these specifications and as indicated on the drawings.

1.03 REFERENCE STANDARDS

- A. American Concrete Institute ACI 301-16: Specifications for Structural Concrete.
- B. American Concrete Institute ACI 305R-10: Hot Weather Concreting.
- C. American Concrete Institute ACI 306R-16: Cold Weather Concreting.
- D. American Concrete Institute ACI 308R-16: Guide to Curing Concrete.
- E. Modification of ACI 305R, 306R, and 308R: accomplish work in accordance with these guides except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Engineer.
- F. American Concrete Institute ACI 318-14: Building Code Requirements for Structural Concrete and Commentary.
- G. American Society for Testing Materials (ASTM), Standard Specifications and Standard Test Methods, designated by basic reference in this section (use the most current edition at the time of bid unless otherwise indicated).
- H. Standard Specifications for Road, Bridge, and Municipal Construction, M41-10, 2016 edition, by Washington State Department of Transportation (WSDOT Standard Specifications).

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- I. International Building Code (IBC) 2015, as amended and adopted by the Makah Tribe of Indians.

1.04 QUALITY ASSURANCE

- A. All concrete work shall conform to the requirements of ACI 301, unless otherwise noted in the drawings or the specifications.
- B. Inspection and Testing: As determined by the Engineer, the Port will provide inspection and testing as required. The Contractor shall provide all necessary access and assistance in carrying out such inspections and tests at its own expense. The Contractor may obtain results of tests performed by the Port from the Engineer.
- C. Qualifications of Supplier: Ready-mixed concrete plants shall be approved and certified by the National Ready Mix Concrete Association (NRMCA) or qualified by WSDOT. Ready-mixed concrete shall be batched in accordance with the applicable portions of ASTM C 94.
- D. Qualifications of Personnel:
 - 1. Provide at least one qualified person who shall be present at all times during execution of this portion of the work, who shall be thoroughly trained and experienced in placing the types of concrete specified, and who shall direct all work performed under this section. Qualified personnel shall have at least five (5) years experience performing the work described in this section.
 - 2. Trained and experienced journeyman concrete finishers having at least five (5) years experience shall be responsible for finishing all exposed surfaces.
- E. Building Code: All concrete shall meet the requirements of the IBC. Where provisions of pertinent codes and standards conflict with this specification, the more stringent provisions shall govern, as determined by the Engineer.

1.05 SUBMITTALS

- A. Documentation demonstrating the qualifications and experience of supervisors and directors of work, as described above.
- B. Proposed concrete design mixes, indicating all material contents per cubic yard of concrete, including certificates of specification compliance. Written evidence that the ready-mix concrete plant is approved and certified by the NRMCA and other organizations. Include provisions for extending the time of placement, if applicable.

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- C. Test certificates for compressive strength, yield, air content, and slump of the proposed concrete mix. Report strength test results in accordance with ACI 318, Section 5.3.
- D. Manufacturer's name, address, catalog number, and specifications for all proposed admixtures, concrete bonding agents, curing compounds, etc.
- E. Identify all aggregate supply pit names and locations. Submit certificates of specification compliance for materials to be used including aggregate alkali-silica reactivity (ASR).
- F. Proposed curing methods including manufacturer's data for curing membranes, evaporation retardants, accelerated cure methods, etc. Submit detailed plans for concreting in ambient temperatures below 40 degrees F. Describe the specific methods and procedures used for substrate preparation, concrete placement, curing, and protection. Provide specific references to ACI 306R and ACI 308R.
- G. Shop drawings showing pour sequences, construction joints, expansion joints, etc. Manufacturer's data for proposed pre-fabricated construction joint systems and hardware.
- H. Concrete delivery tickets for each truck delivered to the site. Submit delivery tickets to the Engineer before unloading at the site and in accordance with ASTM C 94, Section 14.

PART 2 - PRODUCTS

2.01 CONCRETE

- A. General:
 - 1. All concrete, unless otherwise specifically permitted by the Engineer, shall be batched and mixed at the approved Ready-Mix plant. Batching, mixing, and delivery of ready-mix concrete shall conform to ASTM C 94.
 - 2. All cast-in-place concrete shall be proportioned on the basis of field experience or laboratory trial mixtures according to ACI 318, Section 5.3.
- B. Cementitious Materials:
 - 1. All cement shall be Portland cement conforming to ASTM C 150.
 - 2. Portland cement for use in mixes without fly ash shall be Type I-II or Type II conforming to ASTM C 150 and to the requirements of WSDOT Standard Specifications, Paragraph 9-01.2(1).
 - 3. Portland cement for use in mixes with fly ash shall be Type I or Type I-II conforming to ASTM C 150.

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4. Fly ash, if used, shall meet the requirements of ASTM C 618, Type F, with the added provision that the loss on ignition shall not exceed 1 percent, and that the fly ash is stored in a separate silo from the cement. Split bins are not acceptable.
- C. Aggregates:
1. Aggregates shall conform to ASTM C 33. All coarse and fine aggregate shall consist of hard, tough, durable particles free from foreign and deleterious materials, and shall be stored in such a manner as to prevent segregation, excessive breakage, and the introduction of foreign material.
 2. Evaluate and test fine and coarse aggregates to be used in all concrete for alkali-aggregate reactivity in accordance with ASTM C 1260 or ASTM C 1293. Test both coarse aggregate size groups if from different sources. Test results of the combination shall have a measured expansion equal to or less than 0.10 percent at 16 days after casting when aggregates are tested in accordance with ASTM C 1260 or 0.04 percent for aggregates tested in accordance with ASTM C 1293.
 3. Grading shall conform to WSDOT Standard Specifications paragraph 9-03.1(5) Combined Aggregate Gradation for Portland Cement Concrete. Maximum nominal aggregate size shall be $\frac{3}{4}$ inch, unless approved by the Engineer.
 4. The maximum size of coarse aggregate shall not be larger than three fourths of the minimum clear spacing between reinforcing bars, between reinforcing bars and side forms, and between reinforcing bars and top or bottom surface of the concrete.
 5. The maximum size of aggregate for “pea gravel” concrete shall be $\frac{3}{8}$ inch.
- D. Water used for mixing concrete shall conform to the quality requirements of paragraph 9-25.1 of the WSDOT Standard Specifications.
- E. Admixtures: All admixtures shall be supplied by one manufacturer approved by the Engineer.
1. Air-entraining admixtures shall conform to ASTM C 260. Dosage rates shall be in accordance with the manufacturer’s recommendations to meet the air content specified herein.
 2. Water-reducing admixtures shall conform to the requirements of ASTM C 494. Dosage rates shall be in accordance with the manufacturer’s recommendations.

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3. Water reducing admixture shall be Type A, D, F, or G. The amount shall control the desired workability and water/cement ratio of the mix and shall be within the manufacturer's recommended range.

F. Epoxy Bonding Agent:

1. Meets ASTM C 881, Type V, Grade 2, Temperature Class A, B, or C, and match the surface temperatures to which the bonding agent is applied, as endorsed by the manufacturer.
2. Concrese Liquid LPL manufactured by BASF, or Sikadur 32 HI-MOD LPL, manufactured by Sika Corporation, or equal, as approved by the Engineer before the start of the work where it will be used.

2.02 OTHER MATERIALS

- A. All other materials not specifically described but required for a complete and proper installation of cast-in-place concrete shall be selected by the Contractor subject to the approval of the Engineer.

2.03 MIX PROPORTIONS AND STRENGTH

- A. The mix proportions shall produce a mixture that will readily work into all corners, sides, and angles of the forms, around reinforcement and embedded items, with no segregation, and prevent free water from collecting on the surface.
- B. The mix proportions shall be selected in accordance with ACI 318.
1. Test data representing thirty recent consecutive tests for each design shall be submitted to establish the standard deviation used in Section 5.3.1.
 2. The criteria for acceptance of submitted tests shall be accordance with Section 5.3.1.1. Section 5.3.1.1(b) shall be amended to read, "... 500 psi of $f'c$ ", instead of 1000 psi.
 3. Where 30 recent consecutive tests are not available, the standard deviation may be determined by records based on no less than 15 tests as described in Section 5.3.1.2.
 4. Where no previous data are available, the mix or mixes shall be overdesigned in accordance with Section 5.3.2.2.
 5. When consecutive test data have been established during the project the overdesign criteria may be relaxed in accordance with Section 5.5.
 6. Deviation from any reviewed design mix without approval of the Engineer will not be permitted.

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- C. Unless otherwise indicated, concrete minimum 28-day compressive strengths are shown on the drawings.
- D. Concrete, shall meet the following requirements:
1. Minimum Cementitious Material

Cement without fly ash	6 sacks/cy (564 lbs/cy)
Cement with fly ash	5.5 sacks/cy (517 lbs/cy) and 100 lbs fly ash/cy
 2. Maximum Water/Cement Ratio
(by weight, including free moisture on aggregate) 0.45*

* If fly ash is used, the water/cement ratio shall be calculated as the weight of water divided by the weight of cement plus the weight of the fly ash.
 3. Air Content 3.5 percent to 6.5 percent
 4. Slump: Maximum 8 inches, and chosen to enhance workability without violating the maximum water/cement ratio requirement.
- E. “Pea gravel” concrete shall meet the following requirements:
1. Minimum Cementitious Material

Cement without fly ash	6.5 sacks/cy (611 lbs/cy)
Cement with fly ash	6 sacks/cy (564 lbs/cy) and 100 lbs fly ash/cy
 2. Maximum Water/Cement Ratio
(by weight, including free moisture on aggregate) 0.40*

* If fly ash is used, the water/cement ratio shall be calculated as the weight of water divided by the weight of cement plus the weight of the fly ash.
 3. Air Content 3.5 percent to 6.5 percent
 4. Slump: Maximum 8 inches, and chosen to enhance workability without violating the maximum water/cement ratio requirement.
- F. “Pipe/Conduit Encasement” concrete shall meet the following requirements:

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1. Commercial Concrete, Class 3000, per WSDOT 6-02.3(2)B.

PART 3 - EXECUTION

3.01 PREPARATORY WORK

A. General:

1. Prior to casting, inspect the installed work of all other trades and verify it is complete to the point where this installation may commence.
2. Verify that all items to be embedded in concrete are in place, properly oriented, located, and secured.
3. Verify that concrete may be placed to the lines and elevations indicated on the drawings with all required clearances for reinforcement.
4. All areas in which concrete is to be placed shall be thoroughly cleaned to remove wood debris, sawdust, tie wire cuttings, and all other deleterious material.
5. Tie wire ends shall be bent back so they do not encroach into the specified clear cover of the concrete.
6. Concrete forms which have not been treated with oils, waxes, or other bond breakers shall be thoroughly wet prior to placing concrete.
7. Clean and roughen existing concrete or concrete from previous pours to provide a bondable surface.
8. All transporting and handling equipment shall be cleaned of all hardened concrete and other debris.

- B. Notification:** Notify the Engineer at least 48 hours in advance of any concrete pour. Notify the Engineer when inspection by the Contractor is complete. In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation until all discrepancies have been fully resolved.

3.02 TRANSPORTING AND PLACING CONCRETE

A. Placement:

1. Concrete that does not reach its final position in the forms within 1-1/2 hours after the addition of cement shall not be used. During hot weather, this time limit shall be reduced in accordance with ACI 305R.

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2. Place concrete as soon as possible after mixing. Concrete which has developed initial set or partially hardened shall not be re-tempered or remixed.
 3. The method and manner of placing concrete shall not allow segregation of the aggregates or displacement of reinforcement and embedded objects.
 4. When using a concrete pumps as the placing system, the pump priming slurry shall be discarded before placement into the forms. Initial acceptance testing may be delayed until the pump priming slurry has been eliminated. No pump shall be used that allows free water to flow past the piston. Aluminum conduits or tremies shall not be used for pumping or placing concrete.
 5. Place concrete in continuous horizontal layers, or lifts, not exceeding 18 inches and compact so that there will be no line of separation between layers. Carefully fill each part of the forms by depositing concrete directly in its final destination.
 6. When concrete must be dropped more than five feet into the forms, it shall be deposited through a sheet metal or other approved conduit. Approved conduit shall also be used to place concrete in sloping forms or in other locations, as directed by the Engineer, to prevent concrete from sliding around reinforcing or other embedded objects.
 7. The methods of depositing and compacting concrete shall produce compact, dense, impervious concrete with the required surface finishes and no segregation. Remove defective concrete as directed by the Engineer at no additional cost to the Port.
 8. During pile driving, or other vibratory activity, do not place concrete within 100 feet of the activity, and do not perform or resume the activity within 100 feet of placed concrete until a minimum of 3 days after initial concrete set.
 9. Concrete shall not be placed or allowed to fall in the water or on the bank. Otherwise, concrete shall be immediately removed from the water or the bank.
- B. Hot/Cold Weather Placement: Do not place concrete on frozen ground or against frosted reinforcing steel or forms. Do not mix or place concrete while the atmospheric temperature is below 40° F. If air temperature exceeds 90°F, provide water spray or other approved methods to cool contact surfaces to less than 90°F. Hot and cold-weather concrete placement shall follow the respective recommendations in ACI 305R and ACI 306R.
- C. Underwater Placement: Concrete shall not be placed in the water.

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Section 03 30 00 – Cast-in-Place Concrete

D. Consolidation of Concrete:

1. Provide suitable internal vibrators for use in compacting all concrete. The vibrators shall be of the type designed to be placed directly in the concrete, and their frequency of vibration shall not be less than 7,000 impulses per minute when in actual operation.
2. Vibration shall be such that the concrete becomes uniformly plastic. Insert vibrators to a depth sufficient to vibrate the bottom of each layer effectively, but do not penetrate partially hardened concrete. Do not apply the vibrators directly to steel which extends into partially hardened concrete. The intervals between points of insertion shall be not less than 2 feet, nor more than 3 feet.
3. Do not continue vibration in any one spot such that pools of cement or cement and sand are formed. In vibrating and finishing top surfaces which are exposed to weather or wear, avoid drawing water or laitance to the surface. In relatively high lifts, the top layer shall be comparatively shallow and the concrete mix shall be as stiff as can be effectively vibrated into place and properly finished.
4. Do not use vibrators to transport or move concrete inside the form.
5. A sufficient number of vibrators shall be supplied to effectively vibrate all of the concrete placed. Hand-tamping or rodding shall be required wherever necessary to secure a smooth and dense concrete on the outside surfaces.

3.03 CONSTRUCTION JOINTS

- A. Joints and stoppages, except as specifically shown on the drawings, shall conform to ACI 318, Chapter 6. Wire mesh or similar materials shall not be used.
- B. Submit for the Engineer's approval all requests for additional, deleted, or relocated construction joints. Changes as a result of such requests shall be at the Contractor's expense.
- C. Thoroughly clean and roughen all joint surfaces and remove loose concrete, gravel, sediment, laitance, and all other deleterious substances.
- D. Thoroughly wet and condition all joint surfaces to a saturated surface dry (SSD) condition for a minimum twelve hour period immediately prior to placing fresh concrete.
- E. Horizontal surfaces of construction joints, such as between precast pile caps and Stage 2 pile cap pours, shall have a clean roughened surface but need not have a bonding agent or neat cement paste applied.

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Section 03 30 00 – Cast-in-Place Concrete

- F. Unless otherwise noted, joints requiring roughened surfaces shall have grooves ½-inch to 1-inch wide, ¼-inch to ½-inch deep, which are spaced at twice the width of the groove.
- G. Where a roughened surface is not required, provide shear keys with a positive mechanical bond using formed depressions covering one third to one half of the joint area and approximately 1-1/2 inches deep. Provide shear keys on vertical surfaces between pours.

3.04 CURING CONCRETE

- A. Follow ACI 308R.
- B. Concrete shall be maintained above 40° F and in a moist condition for at least the first seven days (168 hours) after placement.
- C. Do not use curing compounds on surfaces to receive additional concrete.
- D. Where permitted, apply an ASTM C 309, Type 1, Class A or B curing compound to the fresh concrete immediately after finishing the concrete and as soon as the visible bleed water has evaporated or as directed by the Engineer. Apply according to the manufacturer's recommendations. The rate of coverage shall be at least one gallon per 100 square feet and be sufficient to effectively obscure the original color of the concrete.
- E. Apply the curing compound in two applications to ensure full coverage of the concrete, with the second coat applied in a direction perpendicular to that of the first application.
- F. Do not apply curing compound to construction joint surfaces, reinforcing steel, or embedded items in the concrete. Curing compound on construction joints, reinforcing steel, or embedded items shall be completely removed before the following concrete pour.
- G. Supply backup spray equipment and sufficient workers to properly apply the curing compound.
- H. Within 12 hours following the application of the curing compound, the top surfaces shall be covered with cotton mats, an approved vapor proof curing paper, or white polyethylene sheeting. If the covering used is cotton mats, it shall be kept continuously wet day and night for the period of time specified above, and if curing paper or plastic film is used, it shall be left in place for the same length of time.
- I. Curing paper and white polyethylene sheeting shall be kept tightly in place by taping and weighting joints, or other methods for the prescribed length of time.
- J. Membrane curing compounds which leave a waxy film on the concrete shall not be used.

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Section 03 30 00 – Cast-in-Place Concrete

- K. After the concrete has cured for the required time, the top surfaces shall be swept clean.
- L. All concrete shall be protected from damage and accelerated drying. No fire or excessive heat shall be permitted near the concrete at any time.
- M. In lieu of curing compounds the Contractor may use wet burlap or other wet cure methods as approved by the Engineer.
- N. Only wet cure methods shall be used on concrete surfaces against which additional concrete will be cast.
- O. Wet cure methods shall be continuous for the prescribed duration of the curing period.

3.05 FINISHING CONCRETE

- A. Finish: All permanently exposed surfaces, unless specifically noted otherwise, shall be free from local bulging and all ridges or lips shall be removed to leave a smooth, flat surface. Patching mortar, if used, shall be of the same color as the surrounding concrete. White Portland cement shall be added to the patching mortar for color matching. A test section, approved by the Engineer, shall be completed prior to production work.
- B. Protect finished surfaces from damage, stains and abrasion. Surfaces or edges damaged during construction shall be repaired at the Contractor's expense.
- B. Defects:
 - 1. Surface defects include honeycomb, rock pockets, spalls, chips, air bubbles, voids, pinholes, bug holes, and indentations greater than or equal to 1/4 inch in depth, or greater than or equal to 1/2 inch in width, length, or diameter. These defects shall be chipped out to reveal sound concrete and then shall be patched according to Section 03 60 00 – Grouting.
 - 2. Surface cracks greater than or equal to 0.007 inches in width. These cracks shall be patched according to Section 03 60 00 – Grouting.
 - 3. Surface irregularities include embedded objects, embedded debris, lift lines, sand lines, bleed lines, segregation, form pop-outs, fins, form leakage, texture irregularities, stains and other discolorations that cannot be removed by water blast cleaning. These defects shall be repaired as specified in this Section unless otherwise directed by the Engineer.

DIVISION 03 – CONCRETE
Section 03 30 00 – Cast-in-Place Concrete

C. Vertical Surfaces and Walls:

1. Immediately after removal of forms or form linings, inspect the concrete surfaces for defects and irregularities.
2. All defects, defective concrete, and tie rod holes shall be repaired immediately after the forms are removed unless otherwise directed by the Engineer. Exposed tie wires shall be removed (chipped out) and the resulting holes patched. The repair mortar shall be BASF EMACO R350 CI or an epoxy mortar approved by the Engineer applied according to the manufacturer's instructions by experienced personnel qualified by the manufacturer of the repair material.
3. All vertical surfaces, against which concrete will be cast, are construction joints, and shall be thoroughly cleaned and roughened to an amplitude of 1/4 inch. Roughening shall be accomplished using methods in accordance with the construction permits and approved by the Engineer, to expose sound concrete without undercutting around the edges of the larger aggregate particles or cracking the concrete to remain.
4. Building Walls: ACI 301 Surface Finish 3.0 (SF-3.0)

D. Horizontal Surfaces:

1. All horizontal surfaces that will carry additional concrete are construction joints and shall be thoroughly cleaned and roughened to an amplitude of 1/4 inch. Roughening shall be accomplished using methods in accordance with the construction permits and approved by the Engineer, to expose sound concrete without undercutting around the edges of the larger aggregate particles or cracking the concrete to remain.
2. Exterior surfaces:
All exposed, exterior, horizontal surfaces that will not receive additional concrete shall have a light broom finish. The broom stria shall be 1/16 inch to 1/8 inch.

3.06 TESTING

- A. Testing of concrete will be performed by an accredited testing agency retained by the Port. Methods of sampling, testing, evaluation, and acceptance will conform to ACI 301. The Contractor shall assist the Port with access to collect samples.
- B. Testing as described above will be at the Port's discretion and in no way relieves the Contractor of any obligations.
- C. The Contractor shall perform its own tests and institute a quality assurance program to assure the specified quality of materials and work are provided.

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Section 03 30 00 – Cast-in-Place Concrete

- D. Tests performed by the Port will be done at no cost to the Contractor, except as noted below.
1. Additional testing and inspection required because of changes in materials, proportions, and procedures requested by the Contractor.
 2. Additional testing of materials or concrete when either fails to meet the specification requirements when tested in accordance with the ACI standards outlined and the appropriate ASTM standards contained therein.

END OF SECTION

DIVISION 03 – CONCRETE
Section 03 40 00 – Precast Concrete

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this Work as if specified in this Section. Work related to this Section is described in:
 - 1. Section 03 10 00 – Concrete Forming and Accessories
 - 2. Section 03 20 00 – Concrete Reinforcement
 - 3. Section 03 30 00 – Cast-in-Place Concrete
 - 4. Section 03 60 00 – Grouting

1.02 DESCRIPTION OF WORK

- A. The Work includes furnishing of all necessary material, labor, and equipment for providing precast and precast prestressed concrete products, including manufacture, transportation, erection, and other related work, as required for a complete installation.

1.03 REFERENCE STANDARDS

- A. American Concrete Institute ACI 301-16: Specifications for Structural Concrete
- B. American Concrete Institute ACI 308R-16: Guide to Curing Concrete
- C. American Concrete Institute ACI 318-14: Building Code Requirements for Structural Concrete and Commentary
- D. American Society for Testing Materials (ASTM), Standard Specifications and Standard Test Methods, designated by basic reference in this section (use the most current edition at the time of bid unless otherwise indicated)
- E. Precast/Prestressed Concrete Institute (PCI) MNL-116-99, Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products

1.04 QUALITY ASSURANCE

- A. Acceptable Manufacturers: A company specializing in providing precast and/or precast prestressed concrete products and services normally associated with the industry for at least 5 years. Submit written evidence to the Owner to show experience, qualifications, and adequacy of plant capability and facilities for performance of contract requirements, including proof of plant certification by PCI. Upon request by the Owner, make the manufacturing facility available for inspection.

DIVISION 03 – CONCRETE
Section 03 40 00 – Precast Concrete

- B. Precast concrete materials, manufacturing, testing, quality control, record keeping, and product tolerances shall be in accordance with the provisions of PCI MNL-116.
- C. The Owner may inspect some or all precast units at the casting yard. All damaged and/or otherwise defective panels and piles shall be rejected.
- D. Erection: Demonstrate experience erecting precast structural concrete elements similar to those required for this project.

1.05 SUBMITTALS

- A. Complete plant quality control plan including specific references to PCI MNL-116 provisions and proof of PCI plant certification.
- B. Complete shop drawings indicating all shop and erection details, including position and quantities of reinforcing steel, prestressing steel, inserts, element geometry, etc. Indicate the concrete compressive strength, prestressing forces, and material stresses at the various stages of manufacture, handling, and erection. Provide supporting calculations for handling and delivery stress calculations for each element type.
- C. Proposed concrete mix design, indicating material contents per cubic yard, including test certificates for compressive strength, yield, air content, slump, admixtures, etc. Include manufacturer's data sheets for all proposed admixtures, release agents, curing compounds, epoxy grout, etc.
- D. Record of the actual curing temperature regime and cast date for each precast element.
- E. Mill certificates indicating specification compliance regarding strength and chemistry of reinforcing steel to be furnished.
- F. Certificates indicating specification compliance of constituent concrete materials, including alkali-silica reactivity (ASR) for aggregates.

PART 2 - PRODUCTS

2.01 CONCRETE

- A. See Section 03 30 00 – Cast-in-Place Concrete. Use air-entrained concrete for precast deck panels, channel beams, and pile caps. Develop the minimum 28-day compressive strength as indicated on the Drawings. Portland cement for use in precast concrete elements without fly ash may be Type III conforming to ASTM C150, having tricalcium aluminate (C3A) content not greater than 8% and not less than 6%, and having a total alkali content no greater than 0.6% per ASTM C114.

DIVISION 03 – CONCRETE
Section 03 40 00 – Precast Concrete

2.02 OTHER MATERIALS

- A. Reinforcement: See Section 03 20 00 – Concrete Reinforcement.
- B. Grout: See Section 03 60 00 – Grouting.
- C. Deck Panel and Channel Bearing Pads: Preformed continuous-strip asphalt saturated fiber expansion material conforming to ASTM D 1751.

PART 3 - EXECUTION

3.01 FABRICATION

- A. Use manufacturing procedures complying with PCI MNL-116.
- B. Formwork: See Section 03 10 00 – Concrete Forming and Accessories. Construct forms to maintain units within specified tolerances and to withstand tensioning and detensioning operations. Thoroughly clean forms after each use.
- C. The prestressing elements shall be accurately held in position and stressed by jacks. A record shall be kept of the jacking force and corresponding elongations. The prestressing elements shall be released only after the concrete has attained a minimum strength of 71 percent of the specified 28-day strength for the deck panels and channel beams. The prestressing elements shall be released in such an order that lateral eccentricity of prestress is minimized.
- D. See Section 03 30 00 – Cast-in-Place Concrete, for mixing, placing, consolidating, and repair requirements.
- E. Locate lifting devices on the tops of members only, and within the horizontal face if Stage II concrete is to be applied (pile caps).
- F. If accelerated curing methods are used, meet the requirements of PCI MNL-116, Division IV.
- G. Use a maximum curing temperature of 150°F.
- H. Leave areas to receive additional concrete clean and rough with an amplitude of 1/4 inch. Provide a wood float finish at all other exposed surfaces. Provide a smooth dense steel-formed surface free of defects, abrasions, voids, stains, etc. at all formed surfaces.
- I. Manufacturing Tolerances:
 - 1. Length +3/4 inch, -0 inch
 - 2. Width +1/4 inch, -0 inch

DIVISION 03 – CONCRETE
Section 03 40 00 – Precast Concrete

3. Thickness +1/4 inch, -0 inch
 4. Horizontal alignment (sweep) 1/4 inch maximum
 5. Differential camber between adjacent deck panels 1/4 inch maximum
- J. Product Identification Number: Mark each deck panel using a permanent system that includes, as a minimum, the element type, cast date, cast length, and casting number.

3.02 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling:

1. Lift and support precast concrete members during manufacturing, stockpiling, transporting, and erection operations only at the lifting or supporting points, or both, as shown on the approved shop drawings, and with approved lifting devices.
2. Perform transportation, site handling, and erection with industry standard equipment and methods, and by qualified personnel.
3. Do not damage members during all handling and delivery operations. Do not overstress, crack, damage, fracture, or produce impact on the members. Repair all damaged members at no cost to the Owner using repair methods approved by the Owner prior to start of repair work. Remove and replace members damaged beyond repair at no additional cost to the Owner.

B. Storage:

1. Store all members off the ground.
2. Place stored members so that identification marks are discernible.
3. Separate stacked members by battens across full width of each bearing area.
4. Stack so that lifting devices are accessible and undamaged.
5. Store members on level ground using timber blocking so that the axis of each member is maintained in a straight line and that bending stresses are not produced. Locate the blocking of successive tiers exactly above the blocking of the lower tiers.

DIVISION 03 – CONCRETE
Section 03 40 00 – Precast Concrete

6. Do not use the upper member in a stacked tier as storage area for shorter member(s) or heavy equipment.

3.03 ERECTION

- A. Preparation: Provide true, level bearing surfaces on all field-placed supporting members.
- B. Erection: Do not erect panels until the concrete has attained the minimum specified compressive design strength and only after a minimum of 14 days after casting.
- C. Installation: Lift members with suitable lifting devices at points provided by the manufacturer. Set members on bearing pads as indicated on the Drawings. Provide necessary temporary shoring and bracing, where required, to keep members plumb and stable. Align and level members as required.
- D. Cut off lifting devices before placement of Stage II concrete. Lifting device voids shall be filled with an approved non-shrink cementitious grout, such as Masterflow 928 manufactured by BASF. If cementitious grout is used for deck panel lifting device voids, surface preparations and curing shall be performed in strict conformance with the manufacturer's recommendations.
- E. Inspection: Erected precast units will be inspected by the Owner at its discretion. Provide access to the Owner for these inspections at no additional cost to the Owner.

END OF SECTION

DIVISION 03 – CONCRETE
Section 03 60 00 – Grouting

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this work as if specified in this section. Work related to this section is described in:
 - 1. Section 03 30 00 – Cast-in-Place Concrete
 - 2. Section 03 40 00 – Precast Concrete
 - 3. Section 05 50 00 – Metal Fabrications
 - 4. Section 32 62 00 – Driven Piling

1.02 DESCRIPTION OF WORK

- A. The work includes furnishing of all necessary material, labor, and equipment for grouting and doweling as shown on the drawings and described in the specifications. The work also includes the patching of damaged surfaces.

1.03 REFERENCE STANDARDS

- A. American Society for Testing Materials (ASTM), Standard Specifications and Standard Test Methods, designated by basic reference in this section (use the most current edition at the time of bid unless otherwise indicated)

1.04 QUALITY ASSURANCE

- A. The Port will provide testing and inspection services as required. The Contractor shall provide all necessary assistance in testing of materials and provide access for testing and inspection at its own expense.
- B. Provide at least one person who shall be present at all times during execution of the work, who shall direct all work performed, and who has at least five (5) years experience with the materials and the methods of installation necessary to meet the performance specifications.
- C. Dowel installers shall be trained and certified by the doweling adhesive, grout, or system manufacturer.

1.05 SUBMITTALS

- A. Documentation that the supervisor's directing the work and that the dowel installers have the qualifications and experience as described above.

DIVISION 03 – CONCRETE
Section 03 60 00 – Grouting

- B. For each application, manufacturer's name, address, catalog cuts, and specifications for grout, epoxies, adhesives, admixtures, and proprietary products.
- C. Manufacturer's test certificates for grout compressive strength and non-shrink properties of proposed cementitious grout. Indicate the working time, fluid consistency, flow rate, volume change characteristics, and manufacturer's recommended installation temperatures.
- D. Doweling system manufacturer's instructions for preparation, placement, drilling holes, installation of anchors and adhesive, and handling of cartridges, nozzles, and equipment.
- E. Doweling system manufacturer's ICC Evaluation Service - ES Reports and written letter of certification identifying the installer's qualifications to install the manufacturer's products.

PART 2 - PRODUCTS

2.01 NON-SHRINK CEMENTITIOUS GROUT

- A. Locations: supporting metal fabrications, and all other locations not specified.
- B. Requirements:
 - 1. Meet ASTM C 1107 for hydraulic-cement non-shrink grout.
 - 2. Plastic height change of 0% to +4% according to ASTM C 827.
 - 3. Hardened height change of 0% to +0.3% according to ASTM C 1090.
 - 4. Fluid consistency at 25 to 30 seconds according to ASTM C 939.
 - 5. Minimum working time of 30 minutes.
 - 6. Minimum compressive strength of 7,500 psi @ 28 days when prepared in fluid consistency according to ASTM C 109.
 - 7. Shall not contain powdered aluminum.
- C. Suppliers, or approved equal:
 - 1. Euclid Chemical Co., Hi-Flow Grout, Cleveland, OH.
 - 2. Masterflow 928, by BASF Construction Chemicals LLC, Shakopee, MN.
 - 3. SikaGrout 328, by Sika Corporation, Lyndhurst, NJ.
 - 4. Sure-Grip High Performance Grout, by Dayton Superior Corp., Dayton, OH.

2.02 REPAIR MORTAR

- A. Typical locations: under-dock repairs, incomplete drilled holes for dowels, damaged concrete, locations determined by the Engineer.
- B. Shrinkage-compensated mortar EMACO R350 CI manufactured by BASF Construction Chemicals LLC, or approved equal.

2.03 EPOXY GROUT

- A. Typical Locations: lifting locations for precast elements, overhead repairs, damaged concrete, locations determined by the Engineer.
- B. Five Star High Performance (HP) precision epoxy grout, or approved equal.

2.04 DRILLED-IN AND BONDED DOWEL ADHESIVE

- A. Store adhesive at temperatures and in locations indicated in the manufacturer's literature. Do not use and dispose of adhesives with expired shelf lives.
- B. Meet ASTM C 881, Type IV, Grade 2 or 3. Overhead applications shall meet Grade 3. Temperature Class A, B, or C shall match, or be endorsed by the manufacturer, the surface temperature of the concrete to which the bonding system is applied.
- C. Suppliers, or approved equal:
 - 1. Hilti HIT-RE 500, or Hilti HIT-RE 500 SD adhesive, by Hilti Inc., Tulsa, OK.
 - 2. Epoxy-Tie SET adhesive, by Simpson Strong-Tie Co., Dublin, CA.

2.05 CRACK REPAIR

- A. Products shall be appropriate for the specific defect and are subject to the approval of the Engineer. Suppliers, or approved equal:
 - 1. EpoXeal GS Structural, by BASF Construction Chemicals LLC, Shakopee, MN.
 - 2. Sikadur 35, Hi-Mod LV, by Sika Corporation, Lyndhurst, NJ.
 - 3. SCB Concrecive 1350, by BASF Construction Chemicals LLC, Shakopee, MN.
 - 4. SCB Concrecive 1360, by BASF Construction Chemicals LLC, Shakopee, MN.

PART 3 - EXECUTION

3.01 GENERAL

- A. Products shall be stored, mixed, placed, and cured in accordance with the manufacturer's published specifications. Surface shall be prepared in accordance with manufacturer's published specifications unless otherwise indicate herein. In case of a discrepancy the more strict requirements, as determined by the Engineer, shall apply.
- B. Concrete surfaces shall be thoroughly cleaned and wetted before placing grout. Steel members to be embedded and grouted shall be set level at proper elevation with the use of steel shims or leveling screws before grout placement begins.

3.02 DOWEL INSTALLATION

- A. Drilling hammers for dowel holes shall be pneumatic rotary type with medium or light impact. Holes for dowels shall not be core drilled unless otherwise shown on the drawings or approved by the Engineer.
- B. Use a drill bit diameter meeting the ICC-ES Report requirements of each dowel system and as recommended by the manufacturer.
- C. Locate drilled holes to avoid reinforcing steel and other embedded objects. Prior to drilling, locate the reinforcement using a pachometer or other non-destructive methods approved by the Engineer.
- D. When reinforcing steel is encountered, obtain criteria from the Engineer for relocating and re-drilling the hole. Incomplete holes, or holes that expose reinforcing steel shall be patched.
- E. Clean, roughen, prepare, wet, and inspect each hole in accordance with the manufacturer's instructions before installing dowels and adhesive, or grout.

END OF SECTION

DIVISION 05 – METALS
Section 05 50 00 – Metal Fabrications

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this work as if specified in this section. Work related to this section is described in:
 - 1. Section 03 30 00 – Cast-in-Place Concrete
 - 2. Section 03 40 00 – Precast Concrete
 - 3. Section 03 60 00 – Grouting
 - 4. Section 09 96 00 – High Performance Coatings

1.02 DESCRIPTION OF WORK

- A. All metal fabrications are indicated on the drawings and in the specifications. The work shall consist of furnishing all materials, labor, and equipment for fabricating and/or repairing, galvanizing, and erecting metal fabrications, in accordance with the drawings, notes, and this specification.

1.03 REFERENCE STANDARDS

- A. American Galvanizers Association (AGA), Quality Assurance Manual.
- B. American Institute of Steel Construction (AISC), Specification for Structural Steel Buildings, 2010.
- C. American Institute of Steel Construction (AISC), Code of Standard Practice for Steel Buildings and Bridges, 2010.
- D. American Society for Testing Materials (ASTM), Standard Specifications and Standard Test Methods, designated by basic reference in this section (use the most current edition at the time of bid unless otherwise indicated).
- E. American Welding Society (AWS) D1.1 – 2015, Structural Welding Code – Steel.
- F. American Welding Society (AWS) A2.4 – 2012, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- G. National Association of Architectural Metal Manufacturers (NAAMM), AMP 521, Pipe Railing Manual.
- H. Society for Protective Coatings (SSPC), Surface Preparation Specifications.

DIVISION 05 – METALS
Section 05 50 00 – Metal Fabrications

- I. Washington Association of Building Officials (WABO) Standard No. 27-13, WABO Welder and Welding Operator Performance Qualification Standard for Structural Steel, Sheet Steel, and Reinforcing Steel.

1.04 QUALITY ASSURANCE

- A. Demonstrate that the fabricator has a minimum of five (5) years experience fabricating and working similar metals and configurations, including cutting, bending, forming, welding, and finishing.
- B. Welders shall be currently certified by the Washington Association of Building Officials (WABO) for structural welding.
- C. Qualify welding procedures, operations, welders, and tackers in accordance with AWS D1.1.
- D. The galvanized coating applicator shall specialize in hot-dip galvanizing after fabrication and follow the procedures in the AGA Quality Assurance Manual.
- E. Perform nondestructive testing (NDT) and inspection of all shop and field welds in accordance with AWS D1.1 by an independent testing agency retained by the Port. Welds failing to comply shall be repaired or replaced at the Contractor's expense.

1.05 SUBMITTALS

- A. Detailed and coordinated shop drawings indicating all shop and erection details, including cuts, copes, connections, holes, fasteners, material specifications, welds, surface preparations, and finishes.
- B. Documentation that the fabricator has the qualifications and experience described above.
- C. Welder qualifications and certifications.
- D. Weld Procedure Specifications (WPS's) proposed for use on the project. Submit supporting Procedure Qualification Records (PQR's) for all WPS's not prequalified by AWS.
- E. Galvanized coating applicator's Certificate of Compliance that the hot-dip galvanized coatings meets or exceed the specified requirements of ASTM A 123 or A 153, as applicable, and has followed the procedures in the AGA Quality Assurance Manual.
- F. Mill certificates for each heat number of structural and miscellaneous steel.

DIVISION 05 – METALS
Section 05 50 00 – Metal Fabrications

PART 2 - PRODUCTS

2.01 GENERAL

- A. All products shall be new, free from oxidation, corrosion, and defects, and shall be of the specified quality.
- B. Protect all materials and fabrications before, during, and after installation from damage. Protect the installed work of other trades from damage.
- C. Protect galvanized finishes and painted coatings from damage by use of padded slings and straps.
- D. In the event of damage, immediately make all repairs and replacements as per the manufacturer's written recommendations and as approved by the Engineer at no additional cost to the Port.

2.02 STRUCTURAL STEEL

- A. Plates and bars: ASTM A 572, Grade 50, unless noted otherwise.
- B. Angles and channels: ASTM A 36.
- C. Wide flange shapes: ASTM A 992.
- D. HSS Rectangular sections: ASTM A 500, Grade B, $F_y = 46\text{ksi}$
- E. HSS Rounds sections: ASTM A500, Grade B, $F_y = 42\text{ksi}$
- F. Pipe: ASTM A 53, Grade B, ASTM A 106, Grade B or C.

2.03 BOLTS, NUTS, AND WASHERS

- A. Unless noted otherwise, hot-dip galvanize all bolts, nuts, and washers.
- B. Anchor bolts or anchor rods: ASTM F 1554, Grade 55, headed, unless noted otherwise.
- C. Economy bolts, hex head bolts, and other bolts not specified as high-strength: ASTM A 307, Grade A.
- D. Nuts and washers for economy bolts, hex head bolts, and other bolts not specified as high-strength: ASTM A 563, suitable for grade of bolt, ASTM F 844, wide series, maximum thickness, respectively.
- E. High-Strength bolts, nuts, and washers: ASTM F3125 Grade A325-X, Type 3, ASTM A 563-DH, and ASTM F 436, respectively.

2.04 STEEL RAILINGS AND HANDRAILS

- A. Provide per OSHA requirements.
- B. Design guardrails and handrails to resist a minimum concentrated load of 250 lbs in any direction at any point of the top of the rail or 20 lbs per foot applied horizontally to top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts.
- C. Provide kickplates between railing posts where indicated, and consist of 1/8-inch steel flat bars not less than 6 inches high.
- D. Galvanize and paint all ferrous metal components.
- E. Ensure proper alignment and matching at butting joints throughout the length.
- F. Space posts no greater than 8-foot on center.

2.05 OTHER MATERIALS

- A. Drilled-in expansion anchors AISI Type 316 stainless steel: Simpson Strong-Tie Wedge-All anchor, Hilti Kwik-Bolt 3 expansion anchor, or approved equal.
- B. Welded headed studs and shear stud connectors: See Section 03 20 00 – Concrete Reinforcing.
- C. Gratings: UV resistant fiberglass with non-slip top. Design floor gratings to support a live load of 60 pounds per square foot with a maximum deflection of $L/240$, or 1/4-inch, whichever is smaller. Attach gratings to structural members with stainless steel fasteners, per manufacturer's recommendations. Color green or gray.
- D. Chains, shackles, and links: See Section 35 59 13 – Marine Fenders.
- E. All other materials not specifically described but required shall be proposed by the Contractor, new, free of corrosion, and subject to the approval of the Engineer.
- F. Hinged Vault and Handhole Covers:
 - 1. Manufacturer's literature describing frame and lid/grate shall clearly state load rating is consistent with use at Airports and/or Port facilities. Frames and grates shall meet Load Class "F" based on modified AASHTO M 306 for airport loading of 100,000 pounds. Frame and lid/grate shall be compatible and be of same manufacturer, and include bolted fasteners.

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Section 05 50 00 – Metal Fabrications

2. Castings shall be of uniform quality, free from sand holes, gas holes, shrinkage, cracks and other surface defects. Castings shall be ground smooth and well cleaned by shot blasting. Bearing surfaces between frames and lids/grates shall be cast or machined with such precision to prevent rocking. Cast the words "ELECTRIC" or "TELECOMMUNICATIONS", "SEWER", or "WATER" in the top face of power, telecommunications, sanitary sewer, and water manhole covers, respectively. A foundry certification shall be obtained from the manufacturer and submitted to the Government stating that samples representing each lot have been tested and inspected in accordance with AASHTO M 306, and are in accordance with all requirements in this specification. Castings shall be identifiable and show, at a minimum, the following: name of the producing foundry, ASTM material designation, part number, and cast or heat date.

PART 3 - EXECUTION

3.01 PREPARATORY REVIEW

- A. Prior to all work of this section, inspect the installed work of all other trades affecting this work and verify that all such work is complete to the point where this installation may commence.
- B. Coordinate and furnish placement drawings, templates, instructions, and directions for installation of embedded anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items.
- C. Verify that the work can be fabricated and installed in accordance with the drawings, specifications, and reference standards. Immediately report discrepancies to the Engineer and do not proceed with fabrication or installation until discrepancies are resolved and direction is provided.

3.02 FABRICATION

- A. All structural steel shall be fabricated in accordance with the approved shop drawings and reference standards.
- B. Shop-fabricate and preassemble all items complete for installation to the extent practicable to minimize field assembly. Disassemble units only as necessary for shipping and handling limitations.
- C. Unless otherwise indicate on the drawings, weld all shop connections unless otherwise directed on the drawings. All joints shall be tightly fitting, securely fastened, square, plumb, straight, and true.
- D. Drill or punch all holes required for attachments and bolted connections including those of other trades. Burned holes are not acceptable.

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Section 05 50 00 – Metal Fabrications

- E. Welding of all metal fabrications shall conform to AWS D1.1.
- F. Install and erect all miscellaneous metal and metal fabrications in accordance with the design drawings, shop drawings, and reference standards.

3.03 PROTECTIVE COATINGS

- A. Galvanizing:
 - 1. All miscellaneous metal, metal fabrications, and fasteners, except as noted in this specification, shall be hot-dip galvanized in conformance with ASTM A 123, A 143, A 153, A 384, and A 385, as applicable.
 - 2. All miscellaneous metal, metal fabrications, and fasteners that have a galvanized coating, and are to be further coated (painted), shall be cleaned, prepared, primed, and coated with additional coatings over the galvanized coating as specified in Section 00 96 00 – High Performance Coatings.
 - 3. Identify proposed drain holes or vent holes required to produce galvanized coatings to the specified standards. Clearly locate these holes on the shop drawings.
 - 4. Galvanize items, to the extent practicable, immediately after fabrication is complete.
 - 5. Damaged galvanizing, including damage due to welding, shall be restored in accordance with ASTM A 780, annex A3. Zinc-rich paints and cold spray materials are not acceptable. Surface preparation and application shall be according to the manufacturer's specifications.
- B. The following metal fabrications shall be galvanized and coated as specified in Section 09 96 00 – High Performance Coatings.
 - 1. Mooring bollards and Cleats
 - 2. Ladders, grab bars, and bars protruding from concrete weights
 - 3. Utility vault cover plates
 - 4. Seismic joint plates
 - 5. Guardrails
 - 6. Fender brackets
 - 7. Wales
 - 8. Vehicle pipe bollards

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Section 05 50 00 – Metal Fabrications

3.04 INSTALLATION AND ERECTION

- A. Install and erect all miscellaneous metal and metal fabrications in accordance with the design drawings, shop drawings, and reference standards.

END OF SECTION

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Section 05 51 36 – Metal Walkways

PART 1 – GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

The provisions and intent of the Contract including the General Conditions Supplementary Conditions, and General Requirements, apply to the Work as if specified in this Section. Work related to this Section is described in:

- A. Section 05 50 00 – Metal Fabrications
- B. Section 09 96 00 – High Performance Coatings

1.02 DESCRIPTION OF WORK

- A. The extent and location of the catwalk work is indicated on the Drawings. The Work includes contractor-designed and installed aluminum or steel catwalk structures spanning between:
 - 1. The main trestle and the concrete floats for small crafts
- B. The Work includes furnishing all design, agency permitting, materials, fabrication, transportation, labor, and installation according to the Drawings and Specifications. It also includes decking, deck fastenings, railings, mounting brackets, hinges, hinge pins, transition plates, cover plates, connection assemblies, rollers, roller guides, and other features as shown.

1.03 REFERENCE STANDARDS

- A. The Aluminum Association, Inc., Aluminum Design Manual, 2015
- B. American Institute of Steel Construction (AISC), Specification for Structural Steel Buildings (AISC 360-16), 2016
- C. American Institute of Steel Construction (AISC), Code of Standard Practice for Steel Buildings and Bridges (AISC 303-16), 2016
- D. American Welding Society (AWS) D1.1 – 2015, Structural Welding Code – Steel
- E. American Welding Society (AWS) D1.2, 2014, Structural Welding Code – Aluminum
- F. American Welding Society (AWS) A2.4, 2012, Standard Symbols for Welding, Brazing, and Nondestructive Examination
- G. The International Code Council (ICC), International Building Code (IBC) – 2015

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Section 05 51 36 – Metal Walkways

1.04 QUALITY ASSURANCE

- A. Catwalk Design: Comply with the reference standards, except as otherwise specified or shown on the Drawings.
- B. Apply for and obtain all permits necessary for the catwalk structures including, but not limited to, City of Neah Bay Building Permit. The Owner will reimburse the Contractor for permitting application fees. Acquire all permits for fabrication and installation of the catwalks in order to meet the project schedule. Delay in acquisition of the necessary permits shall not be grounds for a delay claim.
- C. Welders: Currently AWS certified for the aluminum and structural steel welds to be incorporated in the work.
- D. Perform visual inspection and nondestructive testing (NDT) and inspection of all welds will be performed in accordance with AWS procedures. Welds failing to comply shall be repaired or replaced at no additional cost to the Owner.
- E. Catwalk Suppliers: Minimum 5 years' experience designing and fabricating aluminum or steel catwalk superstructures of similar size and materials as those specified.

1.05 SUBMITTALS

- A. A list of at least 10 similar installations, including catwalk descriptions and contact references within the past 5 years, including proof of liability insurance for the design and manufacture of these installations.
- B. Welder qualifications and certifications. Submit with the shop drawings.
- C. Prior to proceeding with design and detailing of catwalks, submit a basis of design document, including, as a minimum, the following:
 - 1. Design loads and other criteria
 - 2. Outline specifications
 - 3. General arrangements, elevations, and cross-sections of the catwalks
 - 4. Bearing details
 - 5. Weld details
 - 6. Detail of bolted splices (if applicable)
 - 7. Camber details

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- 8. Modifications, if necessary, to the catwalk support details shown on the Drawings
- D. Complete project-specific shop Drawings, Specifications, and design Calculations, sealed by a Professional Engineer licensed in the state of Washington, indicating all details of assembly, layout, installation, and coordination with substructure details at support locations. Include details for design criteria, camber determination, reactions and loads, first flexural vertical frequency, member sizes, connections, bearings, rollers, rollers guides, slides, railings, decking, slip-resistant materials, and other features.
- E. Manufacturers' data for slip resistant surface fabrications, including documentation that demonstrates applicability for use in a marine environment.
- F. Contractor's written certification that the catwalk structures have been installed according to the Owner's and Supplier's requirements.
- G. Contractor's written warranty that the catwalk structures are free of defects in material and workmanship and that it agrees to remove and replace, without cost to the Owner, any defects within 5 calendar years from the date of project substantial completion.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Catwalk Suppliers: Verify before bidding that the supplier can meet the requirements of the Drawings and Specifications. Suppliers who have provided similar structures are as follows:
 - 1. Mantle Industries, Blaine, WA. (360) 332-5276
 - 2. Topper Industries, Battle Ground, WA. (360) 687-1232

2.02 PRODUCT HANDLING

- A. Protect the catwalk structures and materials from damage before, during, and after installation and protect from damage to the installed work and materials of others.
- B. Lift, handle, transport, store, and install catwalk systems from supply source to the installation locations at the project site.
- C. In the event of damage, make all repairs and replacements necessary at no additional cost to the Owner.

DIVISION 05 – METALS
Section 05 51 36 – Metal Walkways

2.03 DESIGN AND COORDINATION

- A. Catwalks shall be contractor-designed and shall have the same appearance as one another. Design, fabricate, and erect the catwalks in conformance with the Reference Standards, Drawings, and Specifications.
- B. The supporting substructure elements (platforms, dolphins, and walkways) have been designed to meet the loading criteria indicated in this Specification. Immediately notify the Engineer and obtain direction if the Contractor's design load criteria differ from the criteria indicated in this Specification. Meet industry standards for similar structures in a marine environment with regard to all other criteria used in design.
- C. Coordinate the catwalk support details at the platforms, dolphins, and walkways and provide complete shop drawings before fabrication. Design the ends of the catwalks to accommodate the embedded objects and reinforcement as shown. Notify the Engineer of any required modifications to the embedded objects or reinforcement.
- D. Provide all modifications necessary to the supporting substructure elements as a result of the catwalk design as approved by the Engineer and at no additional cost to the Owner. This includes resubmittal of modified substructure design drawings and calculations sealed by a Professional Engineer licensed in the state of Washington.
- E. Coordinate, provide, and resolve conflicts for supports for electrical equipment as shown on the Drawings.

2.04 MATERIALS AND CRITERIA

- A. Aluminum: Alloy-Temper 6061-T6 per ASTM B 209, ASTM B 221, ASTM B 308, and ASTM B 429.
- B. Other Materials: As selected by the Contractor subject to the approval of the Resident Project Representative.
- C. For steel catwalk, provide protective coating as specified in Section 05 50 00 – Metal Fabrications.
- D. Design: In accordance with the requirements of the Aluminum Design Manual or AISC, AWS, IBC 2006, and the following:
 - 1. Geometry is indicated on the Drawings. Camber each catwalk structure such that it has an upward displacement at the center of the span under its own self-weight. Establish the magnitude of the camber such that the

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Section 05 51 36 – Metal Walkways

- bottom chord is flat, or cambered up, under full live load plus self-weight plus utility dead load.
2. Live Load: 50 pounds per square foot uniform load over the full deck area or concentrated load of 400 pounds applied to any 12-inch by 12-inch area.
 3. Utility Dead Load: As indicated on the Drawings. Supports for utilities shall be provided at the aluminum cross members, which are transverse to the catwalk span.
 4. Handrails: 50 pounds per lineal foot or 200 pounds horizontally applied to handrail or the top chord of the catwalk truss. Provide a minimum of 3 inches clear between the back of the handrail and the truss inside face.
 5. Guardrails: Provide continuous intermediate rails or guards from the toe guard to a height of 42 inches such that a 4-inch-diameter sphere cannot pass through any opening. Design rails for 25 pounds per lineal foot applied horizontally.
 6. Wind: Basic wind speed (3-second gust) = 150 mph, Exposure D, I = 1.0.
 7. Deflections and Stiffness: Maximum vertical deflection under dead plus live load shall not exceed $L/360$ where L is measured from center to center of bearing points. Maximum vertical deflection under live load shall not exceed $L/500$. The first flexural vertical frequency shall be equal to or greater than 3.0 Hz.
 8. Provide aluminum or steel catwalk grating with a permanent slip-resistant metal fabricated surface.
 9. Provide aluminum or steel walking surfaces of hinge and transition cover plates with a permanent slip-resistant metal fabricated surface.
 10. Do not use tread plate or checker plate for walking surfaces.
- E. Supports: Unless otherwise shown on the drawings, all catwalk connection assemblies shall be designed and furnished in accordance with the approved shop drawings.
1. Steel for plates, bars, and angles: ASTM A 36 or ASTM A 572.
 2. Steel plates, bolts, nuts and other appurtenances shall be hot-dip galvanized and shop coated in accordance with ASTM A 123, ASTM A 153, or ASTM F 2326 as applicable.

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Section 05 51 36 – Metal Walkways

3. Where used, provide slider bearings incorporating ultra high molecular weight polyethylene (UHMW-PE) pads in conformance with ASTM D 368, ASTM D 638, ASTM D 785, ASTM D 790, and ASTM D 792.
4. Design catwalk mounting brackets for the vertical and lateral loads specified and to provide the support conditions as indicated on the Drawings.
5. Isolators shall be used when connecting dissimilar metals as defined and according to military standard MIL-STD-889B, "Dissimilar Metals".

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Coordinate and resolve the catwalk design and delivery schedule with the construction schedule of the mooring dolphins, breasting dolphins, and the electrical equipment installation.
- B. Handle catwalks and components in a manner that prevents all damage and distortion. Replace damaged material resulting from handling or storage techniques at no additional cost to the Owner.
- C. If approved by the Engineer, perform all field welding with AWS/WABO-certified welders, with all materials, methods, sequences, etc., in accordance with the catwalk manufacturer's written instructions. Repair damaged galvanizing in accordance with Section 05 50 00 – Metal Fabrications.

END OF SECTION

DIVISION 09 – FINISHES

Section 09 96 00 – High Performance Coatings

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this work as if specified in this section. Work related to this section is described in:
 - 1. Section 01 25 00 – Substitution Procedures
 - 2. Section 05 55 00 – Metal Fabrications
 - 3. Division 26 – Electrical

1.02 DESCRIPTION OF WORK

- A. The work includes furnishing all materials, labor, equipment, and accessories for preparing and providing the required finished painting and protective coatings on the fabrications and items identified on the drawings and in the specifications.

1.03 REFERENCE STANDARDS

- A. Society for Protective Coatings (SSPC), SSPC Painting Manual, Volume I, 4th Edition, “Good Painting Practice”.
- B. SSPC Painting Manual, Volume II, 2008 Edition, “Systems and Specifications”.
- C. SSPC, “The Fundamentals of Cleaning and Coating Concrete”.
- D. SSPC, “Procedure for Determining Conformance to Dry Coating Thickness Requirements”, SSPC-PA2.

1.04 QUALITY ASSURANCE

- A. Coating application shall be by qualified and experienced personnel having demonstrated at least five (5) years of experience in coating applications for marine structures.
- B. Conform to all manufacturers’ specifications and recommendations for achieving published results with each product, application, and condition. If manufacturers’ specifications or recommendations differ from those in these specifications, report the discrepancy to the Engineer and obtain further direction before proceeding.
- C. The Engineer may inspect coating preparation, application, or touchup at its discretion. Provide access to the Engineer for these inspections and at no additional cost to the Port.

DIVISION 09 – FINISHES
Section 09 96 00 – High Performance Coatings

1.05 SUBMITTALS

- A. A complete list of products and product descriptions proposed for use as coating systems.
 - 1. Provide manufacturer product data and accessories, including specifications, physical characteristics, and performance data.
 - 2. Manufacturer instructions and directions for application of the coating systems.
 - 3. Manufacturer instructions and procedures for use in performing field repairs and touch-ups to the coating systems.
 - 4. Use the same manufacturer's products for all coats unless otherwise approved by the Engineer.
- B. Documentation that key personnel of the coating applicator have at least the minimum experience and certifications described above and below. Demonstrate consistent experience applying the proposed coating systems under similar conditions. List information by individual and include the following.
 - 1. Position or responsibility
 - 2. Employer (if other than the contractor)
 - 3. Name of facility owner
 - 4. Mailing address and telephone number of facility owner
 - 5. Name of contact reference in facility owner's organization
 - 6. Location, size, and description of structure
 - 7. Dates work was performed
 - 8. Description of work performed on structure
- C. Samples of all paints and finishes proposed for use.
- D. Schedule of coating operations with dates and items listed.
- E. Measurement reports of dry paint thickness on metal surfaces according to SSPC-PA2.

DIVISION 09 – FINISHES

Section 09 96 00 – High Performance Coatings

1.06 PRODUCT HANDLING

- A. Deliver paint and associated materials in undamaged and unopened containers bearing labels of the manufacturer, which indicate the contents and directions for use, storage, and handling. Store materials in a location where the ambient temperature and humidity is not outside the ranges recommended by the manufacturer.
- B. Prevent fire. Open containers of inflammable materials only as needed. Keep rubbing cloths, oily rags, etc., in tightly closed metal containers, or remove from the job site daily. Benzene, gasoline, or distillates shall not be stored on the job site.
- C. Do not damage the coating materials before, during, or after installation and prevent damage to the installed work and materials of other trades.
- D. In the event of damage, immediately make all repairs and replacements as directed by the Engineer according to the manufacturer's recommendations and procedures at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 COATING SYSTEMS

- A. Manufacturers who have provided acceptable coating systems for past marine projects include the following. This does not imply that products from any manufacturer listed below will be acceptable.
 - 1. Carboline Protective Coatings (1-206-243-6494)
 - 2. International Marine Coatings of AkzoNobel (1-206-763-8003),
 - 3. Sherwin Williams Co Industrial and Marine Coatings (1-360-931-4645)
 - 4. Tnemec Company (1-206-762-5755)
 - 5. Wasser High-Tech Coatings (1-253-218-2222)
 - 6. Fields Company LLC (1-253-627-4098)
- B. Coating systems selected for each type of finish surface shall be products of a single manufacturer. Coating materials shall be suitable for corrosion protection in an aggressive marine environment.
- C. Materials not specifically noted but required for the work, such as thinners, or other materials, shall be products of the approved paint manufacturer or compatible products accepted by the coating manufacturer.

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Section 09 96 00 – High Performance Coatings

- D. Paint products for coating systems shall be mixed according to the manufacturer's directions. Do not deviate except with written approval of the Engineer.

2.02 SUBSTITUTIONS

- A. Manufacturer-specific coating systems are referenced in this specification. The manufacturer's product identification numbers indicate the product type, quality, and performance required for a specific application. Bids shall be based upon the manufacturer-specific coating systems referenced herein.
- B. Submit in writing a request to the Engineer for review and approval prior to material procurement and in accordance with Section 01 25 00 – Substitution Procedures. Substantiating technical data and documentation are required as described above for all submittals.
- C. Proposed coating system substitutions will be reviewed and evaluated, subject to the approval of the Engineer, based on equivalency to the coating systems referenced in this herein. Substitute coating system data and documentation that does not demonstrate equivalency will not be approved.
- D. Approved substitutions shall be at no additional cost to the Owner.

2.03 COLOR SCHEDULE

- A. OSHA safety yellow: Mooring bollards, cleats, ladders, ladder grab bars, handrails and posts, light stations, vehicle pipe bollards.
- B. Black: Pipe Piling.
- C. Standard gray with non-skid coating on walking surfaces and OSHA safety red lettering: Vault cover plates and expansion joint plates.
- D. Standard gray: All other items scheduled for painting, including but not limited to fender brackets and wales.

2.04 COATING SCHEDULE

- A. Steel pipe piles
 - 1. Solvent cleaned to remove contaminants using a biodegradable, water soluble, cleaner in conformance with SSPC-SP1.
 - 2. Abrasive blast steel surfaces to near-white metal in accordance with SSPC-SP10. Provide a 1-1/2 to 2-mil angular surface profile.
 - 3. First coat: Devran 261QC (Gray) epoxy by International Marine Coatings, applied to a minimum dry film thickness of 8 mils.

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Section 09 96 00 – High Performance Coatings

4. Second coat: Devran 261QC (black) epoxy by International Marine Coatings, applied to a minimum dry film thickness of 8 mils.
- B. Galvanized surfaces to be painted or coated, and above MHHW.
1. Solvent cleaned to remove contaminants using a biodegradable, water soluble, cleaner in conformance with SSPC-SP1.
 2. Solvent cleaned galvanized surfaces shall receive a light, sweeping abrasive sand blast to create a toothed surface profile in accordance with SSPC-SP7.
 3. Primer: Intergard 345 epoxy primer by International Marine Coatings of AkzoNobel, applied to a minimum dry film thickness of 5 mils on all surfaces.
 4. Top coat: Intergard 345 epoxy primer by International Marine Coatings of AkzoNobel, applied to a minimum dry film thickness of 5 mils on all surfaces.
 5. Non-skid coating: Intergard 631 epoxy non-skid deck finish EK 6312A by International Marine Coatings of AkzoNobel, applied to a minimum dry film thickness of 40 mils on specified surfaces.
- C. Non-galvanized surfaces to be painted or coated, and above MHHW.
1. Surfaces shall be “white metal blast cleaned,” conforming to SSPC-SP5.
 2. Primer: Interzinc 52, zinc-rich epoxy primer by International Marine Coatings of AkzoNobel, applied to a minimum dry film thickness of 2.5 mils for all surfaces.
 3. Top coat: Intergard 345 epoxy primer by International Marine Coatings of AkzoNobel, applied to a minimum dry film thickness of 5 mils on all surfaces.
- D. Galvanized surfaces or non-galvanized surfaces to be painted or coated, and with any part below MHHW.
1. Solvent cleaned to remove contaminants using a biodegradable, water soluble, cleaner in conformance with SSPC-SP1.
 2. Solvent cleaned galvanized surfaces shall receive a light, sweeping abrasive sand blast to create a toothed surface profile in accordance with SSPC-SP7.
 3. Primer: Interzone 954 modified epoxy barrier coat by International Marine Coatings of AkzoNobel, applied to a minimum dry film thickness of 15 mils on all surfaces.
 4. Top coat: Interthane 990 acrylic polyurethane by International Marine Coatings of AkzoNobel, applied to a minimum dry film thickness of 2.5 mils on all surfaces.

DIVISION 09 – FINISHES

Section 09 96 00 – High Performance Coatings

PART 3 - EXECUTION

3.01 GENERAL

- A. Apply paints and coatings in accordance with the manufacturer's recommendations for each application. Adhere to the manufacturer's provisions, directions, and procedures for the following.
 - 1. Surface preparation
 - 2. Ambient temperature and humidity monitoring
 - 3. Mixing techniques
 - 4. Minimum and maximum thickness per coat to achieve total thickness
 - 5. Minimum time between coats
- B. Use clean equipment and brushes. Spread materials evenly without runs, drips, sags, laps, brush marks, variations in color, texture, or sheen, and without "holidays".
- C. Vary color or sheens between coats and apply all coats to uniform thicknesses. Refinish any work determined defective or damaged, and repair all defective or damaged work at no additional cost to the Port. Leave finished surfaces clean, completely covered, and uniform in appearance.

3.02 APPLICATION

- A. The location, lettering size, and style of the surface regulatory markings shall be as indicated on the drawings and in the specifications.
- B. Number of coats as specified herein.
- C. Thickness of coats: Use ample undiluted materials; apply in uniform thickness over entire areas; do not exceed manufacturer's recommended spreading rate per gallon.
- D. Tint prime coats if necessary to obtain uniform finish coats.

3.03 TOUCHUP PAINTING

- A. Paint film damaged due to field welding or other Contractor activities shall be immediately restored to its original thickness after thorough cleaning and necessary surface preparation according to the written manufacturer's recommendations.
- B. Touchup painting shall be at the Contractor's expense.

DIVISION 09 – FINISHES**Section 09 96 00 – High Performance Coatings**

- C. Pile touchup: Use Devran 261QC by International Coatings. Submit field repair plan including underwater and splash-zone repair material for approval by the Engineer.

3.04 INSPECTION

- A. The Contractor shall perform measurements of dry paint thickness on all metal surfaces by means of magnetic gages as described in SSPC-PA2.
- B. Copies of the measurement reports shall be provided to the Engineer.
- C. The Engineer will perform verification testing/inspection at the Port's expense. The Contractor shall make arrangements for these tests/inspections at all facilities performing coating applications and give the Engineer a notice at least 14 days in advance of each coating operation.

END OF SECTION

DIVISION 21 - FIRE SUPPRESSION

Section 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes the general requirements for fire suppression systems, to include all types of standpipe systems.
- B. Design, fabricate and install a complete fire suppression system in accordance with the standards set forth in this section.
- C. Obtain and pay for all building permits required by the Authority Having Jurisdiction.
- D. Arrange for, perform, and pay all fees associated with all tests required by the Authority Having Jurisdiction.

1.02 REFERENCE STANDARDS

- A. General: References used throughout Division 21 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.
- B. International Code Council
 - 1. IFC, International Fire Code
- C. National Fire Protection Association
 - 1. NFPA 13, Standard for the Installation of Sprinkler Systems.
 - 2. NFPA 14, Standard for the Installation of Standpipe and Hose Systems
 - 3. NFPA 24, Standard for the Installation of Private Fire Service Mains.
- D. Underwriter Laboratories (UL)
 - 1. Fire Protection Equipment Directory

1.03 INTENT OF DRAWINGS

- A. All fire suppression work is contractor-design. The Plans may depict the design location of piping or equipment. These locations may be changed

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Section 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

with prior coordination and approval by the Owner's Representative if required to conform to the applicable codes. There is no intent by the Owner or his representatives to provide design for any portion of the fire suppression systems except for the general location and arrangement of the standpipe at the trestle.

1.04 QUALIFICATIONS OF INSTALLER

- A. Installing Fire Suppression Systems Subcontractor shall be a firm regularly engaged in installing fire suppression systems. Contractor shall also be a firm that has maintained an office in the State of Washington for a minimum of two-years prior to the bid date for this project.
- B. The fire suppression system Contractor shall be licensed by the State of Washington as a fire suppression system Contractor. The fire suppression system contractor shall have at least one individual who holds a minimum of a Level III certificate of competency from the State of Washington.

1.05 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Division 1 submittal procedures. Provide the following submittals:
- B. Shop Drawings
 - 1. Layout drawings of complete standpipe system at trestle, indicating relationship of all other piping, structural, electrical, and all other items. Sprinkler system design capabilities and water demands should also be noted on the drawing.
 - 2. Complete details and sections as required to clearly define and clarify the design, including a materials list describing all proposed materials by manufacturer's name and catalog number.
 - 4. Installation drawings shall be submitted and approved by the Authority Having Jurisdiction prior to submittal to the Owner's Representative.
- C. Product Data: Submit all product data on all fire suppression systems piping and equipment.
- D. Record Drawings: During progress of the work of this Section, maintain an accurate record of all changes made in the design of the fire suppression system. Upon completion of the installation, and as a condition of its acceptance, accurately transfer all as-constructed information to identical

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blueline prints of the approved Shop Drawings. Include this in the Operations and Maintenance Manual.

- E. Manual: Upon completion of the installation, and as a condition of its acceptance, provide the following information in the operation and maintenance manual.
 - 1. Identification: Manual For Fire Suppression Systems
 - 2. Neatly typed index, at or near the front, with all emergency information locations clearly identified by room number and descriptive area location. This index shall include such information as location of alarm valves, tamper and flow switches, fire alarm control panel, auxiliary drains, sectional control valves, and any other vital components.
 - 3. A complete list of all components of the system with manufacturer's names, catalog numbers, and all data required for ordering replacement parts.
 - 4. One copy of the Record Drawings described above.
 - 5. All information required to effect or secure emergency repairs or service. This shall include an emergency service phone number.

1.06 USE OF THE SYSTEMS PRIOR TO COMPLETION

- A. Owner reserves the right to order entire fire suppression system or any portion thereof turned on and made operational at any time after installation has been completed sufficiently to permit beneficial use without causing unreasonable delays in Contract work. If so ordered, comply within 24-hours after receipt of order. Such use of system by Owner shall not, however, be construed as acceptance of any part of the work, and claims which Owner may have against Contractor shall not be deemed to have waived by such use. The following items shall occur if the system is used prior to completion:
 - 1. Arrangements for monitoring the system shall be made.
 - 2. Portions of the system planned for use shall be hydrostatically tested.
 - 3. All parties involved with construction or operation agree to assume responsibility for damage as a result of system leakage, which they cause.

DIVISION 21 - FIRE SUPPRESSION

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1.07 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01 60 00 for product storage and handling.

1.08 CLOSEOUT REQUIREMENTS

- A. Refer to Section 01 70 00 for execution and closeout requirements.
- B. Refer to Section 01 78 00 for closeout submittal procedures.
- C. Refer to Section 01 79 00 for Demonstration and Training.

1.09 MISCELLANEOUS REQUIREMENTS

- A. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products.
- B. Verification Of Dimensions: The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Owner's Representative of any discrepancies before performing work.
- C. Welding: Welding shall be in accordance with NFPA 13. Only shop welded appropriate welding fittings shall be used.

PART 2 PRODUCTS

2.01 GENERAL

- A. All equipment and components shall be UL rated and listed for fire service. UL rating alone without specific approval for fire service is not acceptable.
- B. All materials and equipment shall be new, of good quality, and free from defects.
- C. Materials and equipment specified herein are for the purpose of establishing a level of quality. Nothing in this specification is intended to limit competition or to exclude manufacturers of non-specified equipment.
- D. The materials and equipment specified herein are not intended to be all-inclusive.
 - 1. Provide all components required for complete system installation in accordance with NFPA 13.

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2. Provide all components required for complete system installation in accordance with NFPA 14.
 3. Provide all components required for complete system installation in accordance with NFPA 24.
 4. Provide all components required for complete system installation in accordance with other references and standards cited in Division 21.
- E. All materials, including supports and hardware, shall be suitable for installation in marine environments. Provide hot dipped galvanized pipe, galvanized fitting and zinc coated all thread rod or approved equivalent. See drawings for low point drains, ball drip valves and metraflex loops at expansion loops. Provide new Fire Department Connection where show on drawings. Provide 2 ½" hose valves where shown on drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. Unless otherwise indicated or specified, all materials and equipment shall be installed and tested in accordance with the manufacturer's recommendations and in accordance with NFPA or IFC standards. Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted.
- B. Until approval has been obtained from the Authority Having Jurisdiction, shop fabrication or installation may proceed at the Contractor's risk. The Contractor shall make all changes to fabricated or installed components in order to conform to the plans approved by the Authority Having Jurisdiction.
- C. The location of other piping, and other equipment takes precedence over fire suppression system piping. Provide all offsets, fittings, and transitions required to install the fire suppression system in the available space as part of the scope of work.

END OF SECTION

DIVISION 21 - FIRE SUPPRESSION
Section 21 12 00 - FIRE-SUPPRESSION STANDPIPES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Standpipe system.
- B. Fire department connection.
- C. Fire extinguishers located in hose cabinets.

1.02 RELATED REQUIREMENTS

- A. Section 21 05 00 - Common Work Results for Fire Suppression: Fire protection piping.

1.03 REFERENCE STANDARDS

- A. FM P7825 - Approval Guide; Factory Mutual Research Corporation.
- B. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc..
- C. NFPA 10 - Standard for Portable Fire Extinguishers; National Fire Protection Association.
- D. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association.
- E. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc..

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.
- C. Shop Drawings: Indicate supports, components, accessories, and sizes.

DIVISION 21 - FIRE SUPPRESSION

Section 21 12 00 - FIRE-SUPPRESSION STANDPIPES

1. Submit shop drawings and product data to Owner's insurance underwriter for approval.
2. Submit proof of approval to Owner's Representative.
- D. Project Record Documents: Record actual locations of components.
- E. Operation Data: Include manufacturer's data.
- F. Maintenance Data: Include servicing requirements and test schedule.
- G. Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 14. Maintain one copy on site.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 2 years' experience approved by manufacturer. Contractor shall hold a minimum Level III State of Washington Fire Sprinkler Contractor's License

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in shipping packaging until installation.

PART 2 PRODUCTS

All materials, including supports and hardware, shall be suitable for installation in marine environments. Provide all components required for complete system installation in accordance with NFPA 14 and other sections of this specification.

2.01 FIRE HOSE CABINETS

- A. Not Required

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Section 21 12 00 - FIRE-SUPPRESSION STANDPIPES

2.02 VALVES

- A. Hose Connection Valve: Angle type; brass finish; 2-1/2inch (65 mm) size, thread to match fire department hardware, 300 psi (2070 kPa) working pressure, with threaded cap and chain of same material and finish; refer to Section 21 05 00.
- B. Hose Connection Valve Cabinets:
 - 1. Not Required

2.03 FIRE DEPARTMENT CONNECTION (FDC)

- A. Type: Standard two-way exposed inlet.
- B. Hose connection: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
- C. Label: "Standpipe - Fire Department Connection".

2.04 PIPE

- A. Pipe to be hot dipped galvanized, suitable for use in a marine environment, and approved for use in accordance with NFPA 14. Pipe to be protected against corrosion internally and externally. Fittings and couplings to be galvanized.

2.06 FIRE EXTINGUISHERS

- A. General: Comply with NFPA 10; UL, FM, and ITS (Warnock Hersey) listed.
- B. Multi-Purpose Dry Chemical Type: Cartridge operated with hose and shut-off nozzle or integral shut-off nozzle.
 - 1. 10 pound (4.5 kg) capacity with 4A:40BC rating at each standpipe outlet and as instructed by local Fire authority.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Size main hydraulically based on 500gpm flow at the most remote outlet at 100psi. Assume inlet flow of 500gpm and pressure of no more than 150psi at the FDC. Minimum main size is 4inch (or larger as required per calculations) in accordance with NFPA 14.

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Section 21 12 00 - FIRE-SUPPRESSION STANDPIPES

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 14.
- C. Locate hose valve manifold along the edge of the trestle, protected from impact, with hose valves at a nominal height of 30 inches above the trestle walking/driving surface.
- D. Install FDC on the along the edge of the trestle, protected from damage, adjacent to the transition to shore. Install FDC at a nominal height of 30 inches above the trestle walking/driving surface.
- E. Standpipe main shall be installed on the underside of the trestle, coordinated with other trades.
- F. At the hose valve manifold and FDC locations, loop the standpipe under the beam edge of the trestle and up to appropriate mounting elevation for the hose valves and FDC inlets.
- G. Main will be subject to freezing temperatures. Slope all pipe in accordance with NFPA 14 (minimum ¼" per 10ft) and to avoid creating locations where water can be trapped. Provide a means to drain any low points and trapped sections.
- I. Flush entire system of foreign matter.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Test entire system in accordance with NFPA 14.
- C. Test shall be witnessed by Fire Marshal.

END OF SECTION

DIVISION 22 - PLUMBING

Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Common work results for Division 22 (plumbing).

1.02 REFERENCE STANDARDS

- A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.
- B. International Code Council (ICC)
 - 1. IMC, International Mechanical Code
 - 2. IBC, International Building Code
 - 3. IFC, International Fire Code
- C. International Association of Plumbing and Mechanical Officials (IAPMO)
 - 1. UPC, Uniform Plumbing Code
- D. National Electrical Manufacturers Association (NEMA)
- E. National Fire Protection Association (NFPA)
 - 1. NFPA 70, National Electrical Code
- F. Manufacturers Standardization Society Of The Valve And Fittings Industry (MSS)
 - 1. MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
 - 2. MSS SP-69, Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
- G. Sheet Metal And Air Conditioning Contractors' National Association (SMACNA)

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1. SMACNA 1650, Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition
- H. Underwriters Laboratories (UL)
1. Fire Resistance Directory
 2. Building Materials Directory

1.03 SUBMITTALS

- A. General: Submit in accordance with Section 01 33 00 for submittal procedures. Additional information is found in paragraph "Detailed Submittal Instructions" below, and in the body of the specification.
- B. All material used on the project shall be new domestic material free from defects. This Contractor shall submit catalog data and engineering data on all equipment as specified or having approval. Submittals shall be provided in a single loose-leaf binder. Multiple submittals as information becomes available will not be accepted.
1. All equipment, appliances, and fixtures provided shall be Energy-Star compliant unless specifically not available. Provide written certification from the manufacture that said compliance is not possible.
 2. Material and equipment specified; may be designated by various manufacturers' catalog numbers. Acceptable alternate manufacturers may also be listed. Such manufacturers are excepted from the prior approval clause of these Specifications, but must submit standard submittal data for final approval as otherwise noted.
 3. Submittal shall be arranged in numerical order according to specification section number and item number. Submittal shall be bound in hard cover, loose-leaf binder.
 4. For manufacturer's submittal data that includes various sizes or options on a single page, visually indicate which item is submitted, as well as which options are provided, for each item. This indication may be made by pen and ink circles, stamped arrows, or other similar method to make the intent of the submittal clear.
- C. Pipe hangers and supports.

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- D. Riser diagram for valve tags.
- E. Contract As-Built Plans
- F. Operation & Maintenance Manuals (O&M)
- G. Extended warranties.
- H. Certification of completion and request for final inspection.
- I. Certification of warranty.
- J. Certification of inspection from the governing building authority.
- K. Certification of training.
- L. Seismic support calculations and any required certification.

1.04 QUALITY ASSURANCE

- A. Manufacturer: A company specializing in manufacturing products specified in Division 22 with a minimum of three years documented experience.
- B. Electrical Equipment
 - 1. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical hookup, such as fans, pumps, hot water tanks, boosters, air handling equipment, etc., shall be provided with an approved label from either Underwriters Laboratories (UL), the American Gas Association (AGA) or the Canadian Standards Association (CSA).
 - 2. Approval of agency must be for the total package (approval of individual components not acceptable) and all labels must be located outside of equipment and shall be visible to inspector.
 - 3. It shall be the responsibility of the Contractor to meet the Agency Approval requirements of this section. Any allowance for agency costs to provide appropriate label for a piece of equipment must be included in this Bid and Contract. Failure by the Contractor or supplier to obtain labels associated with agency approval prior to bid shall be sufficient cause for the Contractor to obtain all such labels and approvals at no additional cost to Owner.

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- C. Performance Certification: All equipment performance (water flow, heating capacity, etc.) shall be certified by a recognized national agency such as the Air Conditioning and Refrigeration Institute (ARI), Air Movement and Control Association (AMCA) and the American Society of Mechanical Engineers (ASME).

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01 60 00 for product requirements.
- B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure and finish.
- C. Protect products from weather and moisture. Provide coverings of plastic or canvas. Cover openings into pipe and duct. Isolate components from contact with the soil. Provide a means of heating for those components that may become damaged by high or low temperatures.
- D. For extended outdoor storage, remove motors and other electrical equipment from enclosures not designed for outdoor use and store separately.

1.06 DEFINITIONS

- A. The term "approved equal" means final approval by the Architect of a material or piece of equipment substituted for that which is shown in the Specifications or Plans.
- B. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.

1.07 GENERAL REQUIREMENTS

- A. Section includes general requirements that apply to the entirety of Division 22 – Plumbing, both interior and exterior to the building, as indicated on the plans and specified herein.
- B. All specification sections with Division 22 – Plumbing are complementary. All specification sections within Division 22 shall be considered to reference each other.
- C. Provide all plumbing work as indicated in the drawings and specified herein.

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Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

1.08 MISCELLANEOUS REQUIREMENTS

A. Intent of Drawings

1. The drawings are intended to depict the general scope of arrangement. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in ductwork and piping. Provide additional fittings, offsets and extensions in piping, ductwork and related mechanical insulation to provide full systems functionality and to assure access for equipment maintenance and as detailed elsewhere in the contract. Relocate or shift piping and ductwork where conflict exists with other mechanical systems, Structure, Architecture or Electrical. Report conflicts before proceeding with work. Provide reasonable planning and layout in advance of installation in order to avoid conflicts and delays. The Contractor will be directed to adjust systems due to conflicts that could have been reasonably foreseen at the Contractor's own expense.
2. Examine the Architectural, Civil, Structural and Electrical Drawings before work is started, consult with each of the other Contractors regarding locations and spaces required for the work and lay out work to avoid interference. Failure to provide reasonable coordination shall result in the Contractor, at his own expense, moving his work to provide the necessary space for the other Contractors.

B. Permits and Fees: Obtain and pay for all permits and construction fees. Furnish Final Certificate to Owner showing compliance with code requirements.

C. Scheduling: Comply with requirements of Division 1.

D. As-Specified Equipment: These specifications and drawings; generally list 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, capacity, electrical power requirements and performance. The product so identified is designated "as specified."

E. Prior Approvals:

1. Specifications have been written around equipment and materials selected for this project based on quality, size, capacity, and performance required to meet building design criteria. All equipment

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and materials used in this project that have been specified around a specific product or products shall have prior approval for product substitutions.

2. Request for Approval must be submitted in accordance to Division 1 requirements, including allowable review time and type of form. If no form is specified, use the form published by the Construction Specifications Institute. Submittal information shall be accompanied with full data information regarding items to be substituted. If supplier wants reply to request for approval, please send self-addressed, stamped envelope with request. Prior approval requests communicated via a facsimile machine (Fax) or e-mail will not be accepted.
 - a. If supplier wants reply to request for approval, please send self-addressed, stamped envelope with request. Prior approval requests communicated via a facsimile machine (Fax) or e-mail will not be accepted.
 - b. All prior approvals will be identified by listing in project bidding addenda only.
 3. Supplier and/or Mechanical Contractor shall be responsible to ensure that substituted material or equipment is of same size, quality, capacity, weight and electrical characteristics as that specified or shown on the drawings. Any changes and cost increases required during construction due to substituted equipment; shall be paid by the Contractor/Supplier. Prior approval to bid does not mean final approval of material or equipment. Final approval will be given after final submitted data has been presented, complete with full information regarding weights, capacities, size, electrical requirements and quality. Prior approval review
- F. Contractor's Cost Breakdown: Submit a cost breakdown (schedule of values) of the major portions of the work. Provide this submittal along with the equipment submittals. Organize the costs generally by specification section. If one Section (Copper Pipe, for example) applies to both plumbing and hydronics, apportion the appropriate amount to each area of work.

1.09 CLOSEOUT REQUIREMENTS

- A. Refer to Section 01 70 00 for execution and closeout requirements.
- B. Refer to Section 01 70 00 for demonstration and training requirements.
- C. Certifications

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1. Provide written certification; that work has been fully completed in accordance with plans and specifications and requesting final inspection.
2. Provide written certification that Contractor will replace materials and workmanship that prove defective for one-year after date of acceptance.
3. Provide written certification of inspection from the governing building authority, stating that all work has been inspected, accepted, and approved as complying with existing governing ordinances and codes.
4. Provide written certification that Owner or appointed representative has been fully instructed in the operation and function of all mechanical systems.

PART 2 PRODUCTS

2.01 GENERAL

- A. See technical specifications for detailed product specifications.

2.02 DAMAGED OR REJECTED MATERIALS

- A. Damaged or rejected materials shall be removed from the site immediately upon discovery.

2.03 FIRE INTEGRITY

- A. All mechanical system penetrations of fire rated assemblies shall be protected in accordance with the building code in force in the Authority Having Jurisdiction for this project. This includes piping, supports, conduit, and any other system and appurtenance provided by Division 22. In addition, all through-penetration sealing methodologies shall be listed in the Underwriter's Laboratories (UL) Fire Resistance Directory, issue current at time of bid.

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PART 3 EXECUTION

3.01 EXECUTION

- A. Provide all work in accordance with ASME B31.9, Building Services Piping, the UPC, State and local Health Codes, and the requirements of the Authority Having Jurisdiction.

3.02 LAYING OUT WORK

- A. Locate all general reference points as established by the General Contractor and take such action as is necessary to prevent their destruction; lay out work and be responsible for all lines, elevations, grading for utilities and other work required under the Contract. Exercise proper precaution to verify figures shown on drawings before laying out work and be responsible for any error resulting from failure to exercise such precaution. Coordinate the utility installation with the final site grading and elevations. Locate existing utility lines that will be affected by the building location before any footing work begins. Report conflicts with the Plans before proceeding with the work. Failure to follow reasonable precautions with regards to this instruction will require Contractor to alter the work at the Contractor's expense.

3.03 ELECTRICAL WORK

- A. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to the NEC (NFPA 70) and all applicable codes.
- B. All electrical work performed under this Section of the Specifications shall require a permit. Contractor shall obtain & pay for all required permits & fees.
- C. All electrical work performed under this Section of the Specifications shall be performed by a electrician licensed in the jurisdiction where the work is performed.

3.04 WORKMANSHIP

- A. Furnish and install all equipment in a neat and finished appearance. If any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall remove the

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equipment, reinstall and patch and paint surrounding surfaces without any increase in cost.

3.05 PIPE INSTALLATION

- A. Lay pipe in straight lines with uniform slope, leaving no pockets. Care shall be taken to keep all foreign materials out of the pipes during installation.
- B. All piping and ductwork run above the floor shall not be located over electrical panels or switchboards except where located above the structural ceiling. This piping shall include, but not be limited to, waste and vent, domestic water, heating water and fire sprinkler lines.
- C. Isolation valves shall be provided on inlets and outlets of all major pieces of equipment to facilitate serving and removal of such equipment without the necessity of draining the associated system.

3.06 OPENINGS IN PIPES AND DUCTS

- A. Keep closed during the work.

3.07 PIPE SLEEVES AND SEALANTS

- A. General: Provide pipe sleeves or sealants for piping passing through foundations, walls, floors, partitions, and roof to allow piping to pass freely through.
- B. Floor Slabs On Grade: Standard weight (Schedule 40) galvanized steel pipe. Extend the sleeve 1" above the floor. Provide "Link Seal" or equivalent for moisture resistance. Fill the space above the "Link Seal" with foam or other product to prevent debris build-up in the annular space.
- C. Building Walls Above Grade
 - 1. Non-Masonry Construction
 - a. Fire Rated Assembly: Provide a metallic tube pipe-sleeve, and maintain the fire rating around the exterior of the sleeve. Fire-stop in the annular space between the sleeve and pipe. For non-metallic pipe, provide an intumescent fire stop system installed in accordance with manufacturer's instructions.
 - b. Non-Fire Rated Assembly: No sleeve is required. If the interior wall contains insulation, insure that the pipe is sealed to the wall on either side. Also insure that the pipe cannot move with respect to the wall so that the sealing system will not become damaged.

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2. Masonry Construction

- a. Fire Rated Assembly: Core-drill and seal with a fire-stop material. For non-metallic pipe, provide an intumescent fire-stop system installed in accordance with manufacturer's instructions. A galvanized Schedule 40 pipe sleeve is acceptable in lieu of a core drill opening.
- b. Non-Fire Rated Assembly: Core drill and seal with an expanding foam. A galvanized Schedule 40 pipe sleeve is acceptable in lieu of a core drill opening.

D. Floors Above Grade

1. Non-Masonry Construction

- a. Fire Rated Assembly: Thread a flange onto a galvanized Schedule 40 steel pipe sleeve. Make a hole in the floor to the outside diameter of the pipe (snug as possible) and install the sleeve into the hole. Seal the flange to the floor with mastic, silicon, or other waterproof sealant. Install a through penetration fire stop compound between the sleeve and the pipe. For non-metallic pipe, provide an intumescent fire stop system installed in accordance with manufacturer's instructions. Rest the riser clamp on top of the sleeve/flange assembly.
- b. Non-Fire Rated Assembly: Make a hole in the floor just larger than the pipe and install the pipe. Provide a galvanized sheetmetal flashing around the pipe; install the riser clamp over the sheetmetal flashing. Insure that the galvanized sheetmetal flashing is galvanically isolated from non-ferrous piping, and no possibility for floor to floor water flow exists through the pipe opening. Also insure that standing water will not collect on top of the galvanized flashing material. The flanged sleeve specified above is also acceptable, provided the annular space is filled with expanding foam.

2. Masonry Construction

- a. Fire Rated Assembly: Same as for the fire rated non-masonry floor above, except that galvanized Schedule 40 steel sleeves may be installed at the time of concrete placement in lieu of the sleeve/flange assembly installed after concrete placement. If a steel sleeve is used, extend 1" above finished floor and rest the riser clamp at the top of the sleeve.
- b. Non-Fire Rated Assembly: Same as for the non-fire rated non-masonry floor above. Cast in place sleeves and the specified flanged sleeve are also acceptable, provided the annular space is filled with expanding foam.

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3.08 WALL AND FLOOR PLATES AND ESCUTCHEONS

- A. Where pipes pass through finished walls, floors or ceilings, provide chromium plates, with suitable set screws or other approved holding devices. Where extended sleeves are necessary, the plates shall be of sufficient depth to cover the sleeves.

3.09 INSERTS

- A. Inserts in concrete for the suspension of piping and equipment; shall be provided by this Contractor unless otherwise noted on the Plans. Inserts in "poured in place" concrete shall be Grinnell, Kinsdorf, Elcen, or approved equal. Provide as necessary for support of systems installed.

3.10 PIPE HANGERS AND SUPPORTS

- A. General: It shall be the responsibility of the Contractor to provide an adequate pipe suspension system in accordance with recognized engineering practices, using, where possible, standard, commercially accepted pipe hangers and accessories. Use a safety factor of five unless otherwise approved in writing.
- B. All pipe hangers and supports shall conform to the latest requirements of the ANSI Code for Pressure Piping, B31.9, and Manufacturers Standardization Society Documents MSS SP-58 and MSS-SP-69. Seismic restraints shall be in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems. Use Seismic Hazard Level-A unless otherwise indicated.
- C. Where thermal movement in the pipe will occur, the pipe hanger assembly must be capable of support in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger location in order to prevent excessive stress in either pipe or equipment connection.
- D. Concrete Inserts: Where piping is supported from the concrete structure, inserts shall be provided for rod sizes up to 3/4". Where support rod sizes exceed 3/4" diameter or where pipe load exceeds the recommended load for the inserts, use two inserts with a trapeze type connecting member below the concrete.
- E. Riser Clamps (Vertical Piping): Pipe shall be supported at each floor with a riser clamp or at sufficient intervals to carry the weight and its contents. See

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the specification for hanger spacing in this section. Stacks shall be supported at their base by a concrete pier or by a suitable hanger located on the horizontal run, close to the riser. Riser clamp extensions shall rest on the building structure where possible; auxiliary steel supports shall be provided where it is impractical to rest directly on the building structure.

- F. Hangers shall be subject to tensile loading only. Where lateral or axial movement is anticipated, provide a suitable linkage in hanger rod to permit swing.
- G. All rods shall be electro plated to prevent corrosion. All support materials shall be hot dip galvanized if located outdoors, in moist areas or in corrosive environments.
- H. Hanger Spacing: Special instructions for pipe support intervals shall be as detailed on the drawings. General pipe support interval instructions shall be as specified below. For any missing pipe systems, support intervals shall be per the Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS) Standard SP-69, "Pipe Hangers and Supports - Selection and Application" and the current mechanical code in force in the jurisdiction of the work. Where concentrated loads of valves, fittings, etc., occur, closer spacing will be necessary and shall be based on the weight supported and the recommended loads for the hanger components.
 - 1. Steel & brass pipe for water or DWV with threaded or welded joints
 - a. 3/4" and smaller:
 - 1) Horizontal: 10'
 - 2) Vertical: Every other floor, 25' maximum.
 - b. 1" and larger:
 - 1) Horizontal: 12'
 - 2) Vertical: Every other floor, 25' maximum.
 - 2. Steel or brass piping with mechanical joints
 - a. Horizontal: 10'
 - b. Vertical: 10'
- I. Hangers (Horizontal Piping):
 - 1. General: All hangers shall be provided with means of vertical adjustment. Hanger components shall be in accordance with the Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS) Standard SP-58, "Pipe Hangers and Supports - Materials, Design and Manufacture".

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2. Pipe hangers and supports that are in direct contact with piping shall be of materials that are compatible with the piping and do not support galvanic action.
3. Pipe hangers and supports that are in direct contact with plastic or other malleable piping shall be constructed of materials that do not damage the surface of the piping.
4. Shields shall be placed by Mechanical Contractor on the outside of the insulation and shall be sized to prevent crushing of the high density insert at each hanger location. Do not damage the vapor barrier.
5. Roller Hangers: Provide roller hangers for all applications where thermal movement causes hanger rods to deviate more than 4" from vertical or longitudinal movement exceeds 1/2". Provide roller hangers used in conjunction with protection saddles to suit the insulation thickness.
6. Vibration Control: Provide a vibration control hanger for all piping within a mechanical room and at the first three hanger locations from any motor operated equipment. Hanger shall consist of steel frame and spring with neoprene washers.
7. Anchors, Guides, And Sliding Supports: Shall be provided as necessary to prevent excessive stress in either piping or equipment.
8. Auxiliary Steel: All auxiliary steel necessary for the installation of the pipe hangers and supports shall be designed in accordance with the AISC Steel Handbook, and furnished by the Contractor. All auxiliary steel shall receive one shop coat of primer paint.
9. Submittals: Submittals on pipe supports will not be required if the Contractor employs items as specified in MSS SP-58, or standard "strut" based products. Submit specifics on all other support types and methodologies.

3.11 CUTTING AND PATCHING

A. General:

1. Prior to cutting, saw cutting, or core drilling any concrete, Contractor shall locate any reinforcing steel (rebar) and the like located in the concrete where the cutting is to be performed. Obtain specific

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approval prior to cutting any concrete reinforcement. Approval must be obtained for each specific instance of cutting reinforcement.

2. Unless directed otherwise by Structural Documents, maintain the following minimum clearances from any concrete reinforcement:
 - a. Reinforcing steel: 2"
- B. New Work: Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample time to avoid delays and unnecessary labor. The expense for cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements shall be borne by this Contractor.
- C. Existing Structure:
 1. All necessary cutting and patching of existing structures necessary for the installation of mechanical work shall be as part of this Contract. Unless cutting and patching locations are specifically shown on the drawings, obtain approval prior to proceeding.
 2. All surfaces must be patched upon completion of work. Final finish of all patched surfaces (walls, ceilings, floors etc.) shall be done per finish schedules normally shown on the Architectural Drawings, or patched to match the adjacent surface if the finish schedule is not available.

3.12 ACCESSIBILITY

- A. Locate valves, traps, damper operators, access doors, etc., with easy accessibility, either accessible in mechanical spaces or through access panels specified hereinafter. The Contractor shall insure that all maintainable items are easily accessible. New work items not reasonably accessible shall be modified, relocated or otherwise changed for adequate accessibility.

3.13 MAINTENANCE AND OPERATION ACCESS

- A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair. In concealed spaces where access has not been provided by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the service intended, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflicts. Access door locations; shall be approved by the Architect prior to installation.

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3.14 SEISMIC SUPPORT

- A. Piping: Support piping per the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems. Use Seismic Hazard Level-A unless otherwise indicated.

3.15 PRESSURE TESTS AND IN-SERVICE TEST

- A. All work under this Contract shall be thoroughly and systematically tested, both during construction and after completion. Pipe testing shall be either as specified in the appropriate specification section, or as specified in the applicable plumbing or mechanical code. Tests shall be maintained until approved.
- B. Notifications shall be sent to the following parties 48 hours in advance of all tests:
 - 1. Architect.
 - 2. Owner.
 - 3. Authority Having Jurisdiction over the specific work to be inspected.
 - a. Notifications to AHJ shall be provided in accordance with requirements of each specific AHJ, including amount of advance notice allowed.
- C. No systems, whether prescribed for testing or not, shall be covered or concealed in structures or generally from ease of viewing without first notifying all of the above-listed parties for inspection. Failure to provide such notification of concealed systems shall be cause to require this Contractor to uncover and re-cover such systems at no additional cost.
- D. A log of all tests shall be kept. The log shall note date, time of day test started, system or portion of system tested, length of test and test results.
- E. The Contractor shall test the completed installation as in regular service. The systems provided under this Contract shall be operated in normal service for a period of at least a week prior to requesting substantial completion inspection, and any resulting defects repaired.
- F. The Contractor; shall guarantee the entire system and all parts thereof for a period of one-year from the date of final acceptance, and shall repair or

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replace any part which may show signs of failure in that time if such failure is due to imperfections in material or to improper workmanship.

3.16 STARTUP, BALANCING AND COMMISSIONING

- A. Equipment startup; shall be performed by qualified personnel. The technical specification sections will detail other special requirements, if any. Provide a statement of the startup technician's qualifications if requested by the Architect or elsewhere specified.
- B. The systems in this Contract; are classified as "simple" by the Washington State Non-Residential Energy Code. Provide startup and commissioning actions as required by the version of that code in force at the time of bid, and per manufacturer's written startup instructions. Provide written verification that all manufacturer's recommended actions have been accomplished.

3.17 CLEANING UP

- A. Comply with requirements of General Specifications (Division 1, General Conditions, Etc.).
- B. Pipes shall be maintained as clean as possible during construction, and shall be blown clean before the building field painting operations are started. Piping shall be thoroughly cleaned before systems are operational. Strainers shall be cleaned prior to turning the system(s) over to the owner.
- C. All equipment and material installed by this Contractor shall be properly protected from damage during the course of construction. Fixtures and equipment shall be thoroughly cleaned before final inspection. Remove all labels from plumbing fixtures.

3.18 SPECIAL PROTECTION

- A. Exercise maximum precaution to provide positive protection for the building and equipment from damage of any kind, and in particular, prevent water and dust seepage into new equipment.
- B. Any damage to the building, systems, or property, caused by the Contractor shall result in the Contractor repairing or replacing the damaged item(s) at no additional cost to the Owner. This provision shall include any preventable damage caused by lack of due diligence in planning and investigation, and shall not be applied to field conditions which could not reasonably be ascertained prior to the activity causing damage.

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3.19 FINAL INSPECTION

- A. This Contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall provide notification. It shall be understood that the work shall be essentially complete, and the open items list provided at that time. The warranty period will not start until the punchlist and back-check are complete. Additional inspections required because of lack of diligence by the Contractor will be conducted on a schedule convenient to the inspectors.

3.20 INSTRUCTION PERIODS

- A. See Section 01 70 00 for demonstration and training requirements requirements.
- B. Scope: Following installation of mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner's staff.
- C. General Description Of Instruction Period: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings; followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, and equipment cleaning procedures, temperature control settings and available adjustments.
- D. Scheduling Of Instruction Period: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given at least two-weeks prior to the instruction period, and agreement finalized as to the date at which the instruction period is to be performed. Notify two-weeks prior to date when ready to conduct instruction and demonstrations; receive approvals of proposed date prior to making final arrangements.

3.21 ON SITE OBSERVATIONS AND SAFETY MEASURES

- A. The Contractor is solely responsible to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The duty of any other individual or organization to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. The contractor shall be responsible for providing all safety measures and shall consult with the

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State and/or Federal Safety Agency or Inspector for interpretation whenever in doubt as to compliance with State and/or Federal regulations.

Furthermore, the Contractor distinctly assumes all risk or damages or injury to any persons or property wherever located resulting from any action or operation under this Contract or in connection with the work.

3.22 CONTINUITY OF BUILDING AND UTILITY AND SHUTDOWNS

- A. General: Continuity of utilities services in the existing building (located on the existing dock) shall be maintained at all times as required to provide heat, water, lighting, and power to all portions of the building. Utility systems shutdowns required for extensions, alterations or connections of new services; shall be accomplished in accordance with the following requirements.
- B. Shutdowns: While building is in operation, utilities shutdowns shall be scheduled for weekends, holidays, or at night, if the shutdown affects the use of the building or surrounding buildings. The actual time and date will be coordinated with and approved by the Owner or other designated party at least 72-hours in advance.
- C. Costs: The Contractor shall include in their bid proposal all costs associated with utilities shutdowns. No extra payment will be made for overtime work, schedule changes or failure to complete utilities connections within authorized shutdown periods.
- D. Liability: Failure to coordinate with the serving utility or to sufficiently pursue the work in time to return utilities to service shall not constitute a basis for avoiding any contractual penalties.

END OF SECTION

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Section 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible Hose Expansion Loops.

1.02 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 PRODUCTS

2.01 FLEXIBLE HOSE EXPANSION LOOPS

- A. Provide flexible hose expansion loop(s) as indicated on the drawings to accommodate thermal expansion & contraction as well as seismic movement, and movement at dock/trestle joints due to wave or tidal action.
- B. Flexible hose expansion loops shall be manufactured complete with two parallel sections of corrugated metal house, compatible braid, 180 deg return bend, with inlet and outlet connections. Field fabricated loops shall not be acceptable.
- C. Flexible loops shall be capable of movement in the $\pm X$, $\pm Y$, and $\pm Z$ planes.
- D. Flexible hose expansion loops shall impart no thrust loads to system support, anchors or building structure.
- E. Where expansion loops are connected to steel piping systems, elbows, flanges, 180 degree return bend, and support nut shall be carbon steel. Hose and braid shall be type 304 stainless steel.

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- F. Where expansion loops are connected to copper piping systems, elbows, flanges, 180 degree return bend, and support nut shall be copper. Hose and braid shall be bronze.
- G. Expansion loops shall have a factory supplied hanger/support lug located at the bottom of the 180 degree return.
- H. Expansion loops for use in domestic water systems shall be NSF 61 certified.
- I. Expansion loops shall be configured to accomodate $\pm 4"$ of pipe movement.
- J. Provide with flanged or grooved ends for piping connections to steel pipe systems. Provide with female sweat ends for connection to copper piping systems.
- K. Flange ends shall be 150 lb type.

2.02 ACCESSORIES

- A. Pipe Alignment Guides:
 - 1. Manufacturers:
 - a. The Metraflex Company; PGQ Glide Riser Guide:
www.metralflex.com/#sle.
 - 2. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor pipe to structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- C. Flexible hose loop return fittings shall be supported to allow movement.

END OF SECTION

DIVISION 22 - PLUMBING

Section 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applications.
- B. General requirements.
- C. Ball valves.
- D. Butterfly valves.

1.02 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013.
- B. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2013.
- C. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2009.
- D. ASME B16.34 - Valves-Flanged, Threaded, and Welding End; 2013.
- E. ASME B31.9 - Building Services Piping; 2014.
- F. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2014).
- G. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- H. AWWA C606 - Grooved and Shouldered Joints; 2015.
- I. MSS SP-67 - Butterfly Valves; 2011.
- J. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- K. NSF 61 - Drinking Water System Components - Health Effects; 2016.
- L. NSF 372 - Drinking Water System Components - Lead Content; 2016.

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Section 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.04 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 - 4. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.

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2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.06 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

- A. Handle large valves with sling, modified to avoid damage to exposed parts.
- B. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Provide the following valves for the applications if not indicated on Drawings:
 1. Shutoff: Ball or butterfly
- B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.
- C. Required Valve End Connections for Non-Wafer Types:
 1. Steel Pipe:
 - a. 2 NPS and Smaller: Threaded ends.
 - b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
 1. Handwheel: Valves other than quarter-turn types.

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2. Hand Lever: Quarter-turn valves [] and smaller.
- D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
 1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 2. Butterfly Valves: Extended neck.
- E. Valve-End Connections:
 1. Threaded End Valves: ASME B1.20.1.
 2. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
 3. Grooved End Connections: AWWA C606.
- F. General ASME Compliance:
 1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 2. Building Services Piping Valves: ASME B31.9.
- G. Valve Materials for Potable Water: NSF 61 and NSF 372.
- H. Bronze Valves:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- I. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE BALL VALVES

- A. Two Piece, Full Port with Stainless Steel Trim:
 1. Comply with MSS SP-110.

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2. SWP Rating: 150 psig.
 3. CWP Rating: 600 psig.
 4. Body: Bronze.
 5. Ends: Threaded.
 6. Seats: PTFE or ____.
 7. Stem: Stainless steel.
 8. Ball: Stainless steel, vented.
- B. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
 2. SWP Rating: 150 psig.
 3. CWP Rating: 600 psig.
 4. Body: Bronze.
 5. Ends: Threaded.
 6. Seats: PTFE or ____
 7. Stem: Stainless steel.
 8. Ball: Stainless steel, vented.

2.04 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug type: Bi-directional dead-end service without use of downstream flange.
1. Comply with MSS SP-67, Type I.
 2. CWP Rating: 200 psig.
 3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
 4. Stem: One or two-piece stainless steel.

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- 5. Seat: EPDM.
- 6. Disc: Coated ductile iron.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

END OF SECTION

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Section 22 05 33 - HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Self-regulating parallel resistance electric heating cable.
- B. Cable outer jacket markings.
- C. Connection kits.
- D. Accessories.
- E. Controls.

1.02 RELATED REQUIREMENTS

- A. Section 22 05 53 - Identification for Plumbing Piping and Equipment

1.03 REFERENCE STANDARDS

- A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2012.
- B. ITS (DIR) - Directory of Listed Products; current edition.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.
- B. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.
- C. Coordinate the work with other trades to provide circuit breaker ratings suitable for installed circuit lengths.

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Section 22 05 33 - HEAT TRACING FOR PLUMBING PIPING

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for electric heat tracing.
- C. Shop Drawings: Indicate electric heat tracing layout, electrical terminations, thermostats, controls, and branch circuit connections.
- D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.
- E. Field Quality Control Submittals: Indicate test reports and inspection reports.
- F. Project Record Documents: Record actual locations of electric heat tracing lines and thermostats.
- G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide two year manufacturer warranty for cables, connection kits, accessories, and controls.

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PART 2 PRODUCTS

2.01 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

A. Manufacturers:

1. Chromalox, Inc; _____: www.chromalox.com.
2. Pentair; _____: www.pentairthermal.com.
3. Thermon Manufacturing Company; _____: www.thermon.com.

B. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ).

C. Factory Rating and Testing: Comply with IEEE 515.1.

D. Heating Element:

1. Provide pair of parallel No.16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
3. Capable of crossing over itself without overheating.

E. Insulated Jacket: Flame retardant polyolefin.

F. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.

G. Maximum Power-On Operating Temperature: 150 degrees F.

H. Maximum Power-Off Exposure Temperature: 185 degrees F.

2.02 CABLE OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

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- C. Month and year of manufacture, date coding, applicable serial number, or equivalent.
- D. Agency listing or approval.

2.03 CONNECTION KITS

- A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.
- B. Provide with NEMA 4X rating for prevention of corrosion and water ingress.

2.04 ACCESSORIES

- A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
 - 1. High temperature, glass filament tape for attachment of heating cable to metal piping.
 - 2. Heat-conductive putty.
 - 3. Cable ties.
 - 4. Silicone end seals and splice kits.
 - 5. Installation clips.
 - 6. Warning labels for attachment to exterior of piping insulation. Refer to Section 22 05 53.

2.05 CONTROLS

- A. Pipe Mounted Thermostats:
 - 1. Remote bulb unit with adjustable temperature range from 30 to 50 degrees F.
 - 2. Remote bulb on capillary, resistance temperature device (RTD) or thermistor for direct sensing of pipe wall temperature.
 - 3. Control Enclosure: Corrosion resistant and waterproof.

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- B. Provide minimum 30 ampere contactor to indicate operational status and on/off control.

PART 3 EXECUTION

3.01 APPLICATION

- A. Provide heat tracing for the following systems and components:
 - 1. Domestic water piping in outdoor/exterior/unheated locations, including valves & expansion joints in piping system.
 - 2. Post hydrants - Heat trace from connection to domestic water piping to at least 6" past "freeze proof" section of hydrant assembly.

3.02 EXAMINATION

- A. Verify that piping and equipment are ready to receive work.
- B. Verify field measurements are as indicated on shop drawings.
- C. Verify required power is available, in proper location, and ready for use.

3.03 PREPARATION

- A. Clean exposed surfaces prior to installation.
- B. Prepare surfaces using approved methods as recommended by manufacturer.

3.04 INSTALLATION

- A. Install in accordance with manufacturer's written installation instructions.
- B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.
- C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.
- D. Comply with applicable local building codes and requirements of authorities having jurisdiction.

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- E. Grounding: Refer to Division 26. Comply with NEC requirements.
- F. Identification:
 - 1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft including cladding over each valve or other equipment that may require maintenance.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Perform start-up by factory technician or factory representative as per Owner's requirements.
- C. Field Testing and Inspections:
 - 1. Commission system in accordance with installation and operation manual.
 - 2. Inspect for sources of water entry and proper sealing.
 - 3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
 - 4. Insulation Resistance: Greater than 20 megohms at a test voltage of 2500 VDC for polymer insulated trace heaters.
 - 5. Test heating cable integrity with megohmmeter at the following intervals:
 - a. After cable has been installed onto the piping.
 - b. Prior to initial start-up (commissioning).
 - 6. Measure voltage and current at each unit.
 - 7. Controls:
 - a. Verify control parameters are set to the application requirements.
 - 8. Submit written test report showing values measured on each test for each cable.

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Section 22 05 33 - HEAT TRACING FOR PLUMBING PIPING

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstrate operation of controls.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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Section 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tags.
- B. Pipe markers.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Piping: Tags.
- B. Valves: Tags.

2.02 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving; _____: www.advancedgraphicengraving.com.
 - 2. Brady Corporation; _____: www.bradycorp.com.
 - 3. Brimar Industries, Inc.; _____: www.pipemarker.com/#sle.
 - 4. Kolbi Pipe Marker Co.; _____: www.kolbipipemarkers.com.

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5. Seton Identification Products; _____: www.seton.com.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

2.03 PIPE MARKERS

- A. Manufacturers:
 1. Brady Corporation; _____: www.bradycorp.com.
 2. Brimar Industries, Inc; _____: www.pipemarker.com/#sle.
 3. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com.
 4. MIFAB, Inc; _____: www.mifab.com.
 5. Seton Identification Products; _____: www.seton.com.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- C. Color code as follows:
 1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install tags with corrosion resistant chain.
- B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

END OF SECTION

DIVISION 22 - PLUMBING

Section 22 07 19 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

DIVISION 22 - PLUMBING

Section 22 07 19 - PLUMBING PIPING INSULATION

- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 - 1. Aeroflex USA, Inc; www.aeroflexusa.com.
 - 2. Armacell LLC; www.armacell.us.
 - 3. K-Flex USA LLC; www.kflexusa.com.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.

DIVISION 22 - PLUMBING

Section 22 07 19 - PLUMBING PIPING INSULATION

- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.03 JACKETS

- A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 - 1. Thickness: 0.025 inch sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Fittings: 0.024 inch thick die shaped fitting covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- E. Insulation Thickness:
 - 1. Insulation thickness shall be per the Washington State Energy Code.

DIVISION 22 - PLUMBING

Section 22 07 19 - PLUMBING PIPING INSULATION

- a. Domestic cold water piping shall be considered to be in the 40-55 degree temperature range.
 - b. Increase insulation thickness 1/2" (minimum) for piping in exterior/outdoor locations.
- F. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches diameter or larger.
 - 2. Shields: 316 stainless steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- H. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- I. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

END OF SECTION

DIVISION 22 - PLUMBING

Section 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steel pipe and fittings.

1.02 REFERENCE STANDARDS

- A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.
- B. American Society of Mechanical Engineers (ASME)
 - 1. B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300
 - 2. B16.5 – Pipe Flanges and Standard Fittings: NPS ½ through 24
- C. American Society for Testing and Materials (ASTM)
 - 1. A47 – Standard Specification for Ferritic Malleable Iron Castings
 - 2. A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. A105 – Standard Specification for Carbon Steel Forgings for Piping Applications
 - 4. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 5. A234 – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
 - 6. A536 - Standard Specification for Ductile Iron Castings
 - 7. D2000 - Standard Classification System for Rubber Products in Automotive Applications
- D. American Welding Society (AWS)
 - 1. A5.8 - Specification for Filler Metals for Brazing and Braze Welding

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Section 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

- E. American Water Works Association (AWWA)
 - 1. C651 - Disinfecting Water Mains
 - 2. C652 - Standard for Disinfection of Water-Storage Facilities
- F. International Association of Plumbing and Mechanical Officials (IAPMO)
 - 1. Uniform Plumbing Code (UPC)

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01 60 00 for product requirements.

1.06 CLOSEOUT REQUIREMENTS

- A. Refer to Section 01 70 00 for closeout submittal procedures.
- B. Refer to Section 01 70 00 for demonstration and training requirements.

1.07 WARRANTY

- A. Provide a (minimum) 5-year parts warranty for unions and similar components.

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Section 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

PART 2 PRODUCTS

2.01 STEEL PIPE AND FITTINGS

- A. Pipe: Carbon steel, ASTM A53 Grade B, Schedule 40, pipe: Carbon steel, black, no galvanizing.
- B. Fittings:
 - 1. Black, no galvanizing.
 - 2. Pipe sizes 2" and smaller, screwed fittings, malleable iron, 150lb Class, ASME B16.3.
 - 3. Pipe sizes 2½" and larger, welded or grooved fittings, Schedule 40.
 - 4. Mechanical Grooved Couplings: Installation ready without field disassembly. Shall consist of two ductile iron (ASTM A536, Grade 65-45-12) or malleable iron (ASTM A47, Grade 32510) housing segments. Gasket shall be pressure responsive elastomeric type (ASTM D2000). Bolts shall be zinc-electroplated steel track head type. Shall be for use on pipe and fittings grooved to the Manufacturer's Specifications. Couplings and fittings to be of the same manufacturer.
 - 5. Welded Fittings: Steel, schedule to match pipe.
 - a. Flanged Fittings: Cast iron 125lb Class ASTM A126.
 - b. Welded Fittings: Schedule to match pipe, cast steel, ASTM A234 or forged steel, ASTM A105N.
 - c. Flanges: Forged steel slip on or weldneck, ANSI B16.5, Class-150.

PART 3 EXECUTION

3.01 GENERAL PIPING INSTALLATION

- A. General: Install per the State of Oregon Plumbing Specialty Code (OPSC).
- B. Preparation:
 - 1. Clean off scale and dirt inside and outside before assembly. Cut pipes and tubes square and ream to remove all burrs.

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Section 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

2. Cut pipe accurately to field measurements so work can be placed without springing or forcing.

C. Installation:

1. Install so piping is free to expand, provide for all expansion with offsets or loops where necessary. Branch connections shall have three elbow spring pieces to allow for expansion.
2. All changes in direction shall be made with fittings. All radius; shall be long radius.
3. Arrange piping so as not to interfere with access or removal of other equipment or devices, block access to doors, windows, manholes or other access openings.
4. Arrange piping to facilitate the removal of tube bundles, coils, etc. Provide unions ahead of screwed valves, traps or strainers on each side of each piece of equipment and wherever needed to dismantle piping.
5. All piping shall be properly pitched and graded to drain moisture and/or vent air.
6. Each low point shall have an accessible blind flange or screwed plug or cap.
7. Route pipe to avoid liquid or air pockets throughout the work. Provide at high points of closed systems, collecting chambers and automatic air vents.
8. Make reductions in pipe size using eccentric reducing fittings installed to provide drainage and venting.
9. Nipples shall be of the same material as pipe. Close nipples shall not be used.
10. Install pipe in neat and workmanlike manner, in accordance with best trade practice. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls unless otherwise shown. Where possible, group runs and rises.
11. Install concealed pipes in walls with clearance around piping to prevent contact with structure.

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Section 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

12. Pipes passing through concrete or masonry construction shall be fitted with sleeves. The inside diameter of pipe sleeves shall be at least 1/2" larger than the outside diameter of the pipe or pipe covering. See Section 22 05 00, Common Work Results for Plumbing, for sleeve fabrication and installation instructions.
13. At all connections between ferrous and non-ferrous pipe:
 - a. Small Bore Pipe: Provide dielectric waterway fittings that maintain external electrical continuity while maintaining internal isolation.
 - b. Large Bore Pipe: Provide dielectric flanges.
14. Rated Penetration Seals: Per Chapter 15, "Firestop Protection", of the Uniform Plumbing Code.

3.02 STEEL PIPING

A. Threaded Joints:

1. Use full cut standard taper pipe threads. Screw together with an approved pipe compound.
2. Once a joint has been made up, do not back off and remake unless threads are cleaned and new compound applied.

B. Welding:

1. Welding shall be done by qualified welders, certified by either the American Welding Society or the American Society of Mechanical Engineers. Welders making additions to an ASME stamped product in the field; shall be an ASME Qualified Welder.
2. Pipes may be joined by butt welding; only if, of the same diameter and running in the same straight line. Use standard welding fittings and flanges in welded lines at valves, branches, changes of direction and changes of size. In branch takeoffs, where the branch connection is less than half the size of the main, Weldolets, Thredolets, or Sockolets may be used in lieu of reducing tees.

C. Mechanical Couplings:

1. Install in accordance with manufacturer's recommendation including field grooving and gasket lubrication.

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Section 22 11 13 - FACILITY WATER DISTRIBUTION PIPING

2. On-site training required by grooved fitting manufacturer.
3. Use roll grooves, except when pipe wall thickness does not permit. When galvanized pipe is field grooved, paint worked area with zinc chromated aluminum paint to repair galvanizing.
4. Manufacturer's representative shall submit a written report to the Architect, noting work progress, areas and items reviewed, and an evaluation of the installation. The contractor shall pay all costs for the manufacturer's review & report. The contractor shall remove & replace any work deemed improper or defective by the manufacturer's representative or by the Architect.

3.03 PRESSURE TESTS

- A. Test systems at 1.2 to 1.5 times system operating pressure. Hold test for two-hours without loss of pressure.
- B. Tests may be witnessed by the Architect, and any defects corrected until no pressure loss is observed.

3.04 PREPARATION FOR SERVICE

- A. General: New or repaired water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority or water purveyor having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652, or as described in this section. This requirement shall apply to "on site" or "in plant" fabrication of a system or to a modular portion of a system.
 1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
 2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24-hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3-hours.
 3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.

DIVISION 22 - PLUMBING**Section 22 11 13 - FACILITY WATER DISTRIBUTION PIPING**

4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

END OF SECTION

DIVISION 22 - PLUMBING

Section 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strainers
- B. Dielectric Connections
- C. Backflow Preventers
- D. Post Hydrants

1.02 REFERENCE STANDARDS

- A. International Association of Plumbing and Mechanical Officials (IAPMO)
 - 1. Uniform Plumbing Code (UPC)

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data components, including performance and materials specifications. Provide manufacturers catalog information.
- C. Project Record Documents: Record actual locations of valves, trap primers, & backflow preventers.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01 60 00 for product requirements.

1.06 CLOSEOUT REQUIREMENTS

- A. Refer to Section 01 70 00 for closeout submittal procedures.
- B. Refer to Section 01 70 00 for demonstration and training requirements.

DIVISION 22 - PLUMBING

Section 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

1.07 WARRANTY

- A. Provide a (minimum) 5-year parts warranty for strainers, unions, dielectric unions, and similar components.

PART 2 PRODUCTS

2.01 STRAINERS

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Water: Strainers shall be wye-type with easily removable cover and brass strainer basket.
- C. Body: Smaller than 80mm (3"), brass or bronze; 80mm (3") and larger, cast iron or semi-steel.
- D. Accessories:
 - 1. Provide blowdown valves for strainers. Blowdown valves shall be ball valves with 3/4" hose connection and thread-on hose cap.

2.02 DIELECTRIC CONNECTIONS

- A. Union Type
- B. Flange Type

2.03 BACKFLOW PREVENTERS

- A. Install backflow preventers per the requirements of the Uniform Plumbing Code; Article 603 "Cross Connection Control". All backflow preventers shall be listed by the State of Washington, Department of Health, as an approved cross-connection control device.
- B. Reduced Pressure Backflow Preventer: ASSE 1013.

2.04 POST HYDRANTS

- A. Non-Freeze Post Hydrant with Galvanized Casing and Adjustable Flow Wheel Lock Handle.

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Section 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 3 EXECUTION

3.01 STRAINERS

- A. Provide blowdown valves with 3/4" hose connections at all strainer locations.

3.02 DIELECTRIC CONNECTIONS

- A. Provide dielectric connections at all connections between ferrous and non-ferrous pipe:
 - 1. Small Bore Pipe: Provide dielectric waterway fittings that maintain external electrical continuity while maintaining internal isolation.
 - 2. Large Bore Pipe: Provide dielectric flanges.

3.03 BACKFLOW PREVENTERS

- A. Provide isolation valves and strainers for all backflow preventer assemblies.

END OF SECTION

DIVISION 26 – ELECTRICAL

Section 26 01 26 – Maintenance Testing for Electrical Systems

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Perform tests of the electrical system to assure code compliance and proper system operation according to the intent of the contract documents. Retain the services of approved testing agency(s) to comply with the ground fault protection systems and medium voltage testing requirements of this section.
- B. 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. State and Local Codes and Ordinances
 - 8. Insulated Cable Engineers Associate - ICEA
 - 9. Association of Edison Illuminating Companies - AEIC

1.02 CIRCUIT TESTS

- A. The Contractor shall perform routine insulation resistance, continuity and grounding tests for all distribution and utilization equipment prior to their connection and energization. A standard megger-type instrument shall be used to demonstrate that insulation values are acceptable, ground system is continuous and the neutral system is isolated from the grounding system except at the systems' single ground point.
- B. System defects, indicated by the circuit tests, shall be corrected. Tests shall be repeated until satisfactory results are obtained.

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Section 26 01 26 – Maintenance Testing for Electrical Systems

1.03 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; and then provide corrective measures as required to reduce ground resistance to less than 10 ohms.

1.04 MOTOR AND EQUIPMENT TESTS

- A. Verify proper rotation of all motors before placing into service.
- B. 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
- C. Motor controller overload heaters shall be sized to the actual motor nameplate full load current; do not oversize overload heaters.

1.05 PHASE BALANCE TESTS

- A. Verify the balance of the electrical system's phase currents. Reassign load connections if necessary to obtain a balance that is acceptable to the Engineer.

1.06 GROUND FAULT PROTECTION SYSTEMS TEST

- A. Visual and Mechanical Inspection
 - 1. Inspect neutral main bonding connection to assure:

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Section 26 01 26 – Maintenance Testing for Electrical Systems

- a. Zero sequence is grounded upstream of sensor.
 - b. Ground connection is made ahead of neutral disconnect link.
2. Inspect control power transformer to insure adequate capacity for system.
3. Monitor panels (if present) shall be manually operated for:
 - a. Trip test
 - b. No trip test
 - c. Non-automatic reset

Proper operation and sequence shall be recorded.

4. Zero sequence systems shall be inspected for symmetrical alignment of core balance transformers about all current carrying conductors.
5. Ground fault device circuit nameplate identification shall be verified by device operation.
6. Pickup and time delay settings shall be set in accordance with Overcurrent Protective Device Coordination Study.

B. Ground Fault System Electrical Tests

1. System neutral insulation resistant shall be measured to insure no shunt ground paths exist, neutral-ground disconnect link shall be removed, neutral insulation resistance measured and link replaced.
2. The relay pickup current shall be determined by current injection at the sensor and the circuit interrupting device operated.
3. The relay timing shall be tested by injecting one hundred fifty percent (150 %) and three hundred percent (300 %) of pickup current into sensor. Total trip time shall be electrically measured.
4. System operation shall be tested at fifty five percent (55%) rated voltage.
5. Zone interlock systems shall be tested by simultaneous sensor current injection and monitoring zone blocking function.

C. Test Parameters

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Section 26 01 26 – Maintenance Testing for Electrical Systems

1. System neutral insulation resistance shall comply with applicable industry standards.
 2. Relay pickup current shall be within ten percent (10%) of device dial or fixed setting.
 3. Relay timing shall be in accordance with manufacturer's published time-current characteristic curves.
- D. For Ground Fault System Testing, Contractor shall retain the services of a National Electrical Testing Association member firm, or a firm approved by the Engineer.
- E. Apply label certifying satisfactory test completion in accordance with NETA Labeling Procedure.

1.07 CABLE TESTS - MEDIUM VOLTAGE

A. Visual and Mechanical Inspections

1. Inspect exposed section for physical damage.
2. Verify cable is supplied and connected in accordance with single line diagram.
3. Inspect shield grounding, cable support, and termination.
4. Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radius.
5. Inspect for proper fireproofing in common cable areas.

B. Electrical Tests

1. Perform D.C. Hypotential Test
 - a. Each conductor shall be individually tested with all other conductors grounded. All shields shall be grounded.
 - b. Terminations shall be properly corona suppressed by guard ring, field reduction sphere, or other suitable methods such as bagging.
 - c. A D.C. hypotential shall be applied in at least eight (8) equal increments until maximum test voltage is reached. D.C. leakage current shall be recorded at each step after a constant stabilization time consistent with system charging

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Section 26 01 26 – Maintenance Testing for Electrical Systems

current decay.

- d. A graphic plot shall be made of leakage current (X axis) versus voltage (Y axis) at each increment.
 - e. The test conductor shall be raised to a maximum test voltage and held for a total of ten (10) minutes. Readings of leakage current (Y axis) versus time (X axis) shall be recorded and plotted on thirty (30) second intervals for the first two 2 minutes and every minute thereafter.
 - f. The applied conductor test potential shall be slowly reduced to zero (0) and grounds applied for a period adequate to drain all stored potential.
 - g. Maximum test voltages shall be in accordance with the values given in paragraph 1.07.D.
2. Perform a shield continuity test by ohm meter method. Ohmic values shall be recorded.

C. Test Values

1. D.C. hypotential test results:
 - a. Step voltage slope should be reasonable linear.
 - b. Absorption slope should be flat or negative. In no case should slope exhibit positive characteristics.
 - c. Maximum leakage current shall not exceed I_1 corrected to 60 degrees F.

where $I_1 = E (K \log D/d)$

D = diameter over insulation

d = Diameter under insulation

E = maximum test voltage

K = insulation specific resistance Megohm/MFT
at 60 degrees F.

D. Test Voltage Table

ACCEPTANCE TEST MAXIMUM D.C. VOLTAGE

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Section 26 01 26 – Maintenance Testing for Electrical Systems

Cable Type	Standard	
Rubber	ICEA S-19-81	Table 6-17
Varnish Cambric	ICEA S-65-375	Table 3-4*
Thermoplastic	ICEA S-61-402	Table 6-10
Cross Linked P.E.	ICEA S-66-524	Table 6-9
Ethylene Propylene (EPR)	ICEA S-68-516	Table 6-9
Armored Cable	ICEA S-67-401	80% of factory

* for D.C. tests multiply values by 2

PART 2 - PRODUCTS

2.01 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.

2.02 TEST REPORT(S)

- A. Furnish electronic PDF and four (4) bound copies of test reports, as specified herein, 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

PART 3 - EXECUTION

3.01 TESTING PROCEDURE

DIVISION 26 – ELECTRICAL**Section 26 01 26 – Maintenance Testing for Electrical Systems**

- A. Submit a copy of test procedure(s) to the Engineer prior to testing.
- B. All tests shall be conducted according to applicable industry standards.

3.02 SCHEDULING

- A. Notify Engineer and Owner at least five (5) working days prior to performance of any test.

3.03 TRANSMITTAL OF REPORTS

- A. Transmit test reports to the Engineer per Section 16010, "FINAL ACCEPTANCE".

END OF SECTION 26 01 26

DIVISION 26 – ELECTRICAL

Section 26 05 00 – Common Work Results for Electrical

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The provisions and intent of the Contract, the General and Supplementary Conditions, and Division 1 Specification Sections, apply to the Work as if specified in this section.

1.02 DEFINITIONS:

- A. NEC means National Electrical Code.
- B. The term "code" as used herein shall mean all applicable National, State and local codes.

1.03 WORK INCLUDED:

- A. The Electrical work consists of furnishing, installing, testing and placing in satisfactory operation all equipment, materials, devices and appurtenances, necessary to provide a complete electrical system 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. All metal fabrications are to be 316 stainless steel. The work shall consist of furnishing all materials, labor, and equipment for fabricating and/or repairing, PVC coating, painting, and erecting metal fabrications, all in accordance with the Drawings, notes, and this specification.
- C. General requirements for materials and installation methods.

1.04 INTENT OF DRAWINGS:

- A. The Electrical Drawings are intended to serve as working Drawings for general layout. Equipment, pull boxes, switches, panels, disconnects and raceway locations are partially diagrammatic and do not necessarily indicate actual routings or all appurtenances required for a complete installation.
- B. Minor changes in the locations of pull boxes, raceways, outlets and the like, from those shown on the Drawings, shall be made without extra charge if so directed before installation.
- C. Contractor is required to take all working dimensions from civil drawings and field measurements. Do not scale Electrical Drawings.

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Section 26 05 00 – Common Work Results for Electrical

1.05 MANUFACTURERS' RECOMMENDATIONS:

- A. Make all installations in strict accordance with manufacturers' published recommendations and details. All equipment, materials and installation methods recommended by manufacturers' shall be considered as part of this contract.

1.06 RELATED WORK:

A. TEMPORARY CONSTRUCTION POWER & LIGHTING:

1. Arrange with the serving Utility Clallum County PUD (360) 963-2223 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 service meter.
3. Provide, maintain and remove, when no longer required, temporary electrical construction wiring from the construction service meter to 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 and maintain construction lighting with portable wiring and temporary energization of the permanent site wiring, complete with lamps. Suitable construction lighting shall be provided. See NEC ARTICLE 305. Temporary Wiring.
5. Provide adequate feeders, circuit breakers and duplex 15-ampere 120-volt receptacles. Provide 120 volt construction receptacles with 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. The Contractor shall assume all responsibility for safety, Electrical and Safety Code compliance, performance and adequacy of the construction power and lighting installation. The 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 project.

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B. EQUIPMENT FURNISHED BY OTHERS:

1. All equipment furnished for this project shall be coordinated with the Drawings to ensure 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 as required by code.
2. Control Voltages shall not exceed 120 volts. Provide control transformers for higher line voltages. Control transformers shall be connected from phase to neutral.

1.07 SUPERVISION AND COORDINATION:

- A. Coordinate work with Clallum County PUD to ensure compliance with their specific requirements. Before starting work, contact Clallum County PUD, (360) 963-2223 and make arrangement for their services to this project.
- B. Contact Electrical Inspection, Washington State Labor and Industries, obtain and pay for permit before starting work.
- C. Contractor shall have a responsible person in charge at the site any time work is in progress or when necessary for coordination with other trades.

1.08 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
WAC	Washington State Administrative Code
NESC	National Electrical Safety Code
NEMA	National Electric Manufacturers Association
NETA	National Electrical Testing Association
NFPA	National Fire Protection Association
UL	Underwriters Laboratories, Inc.
ICEA	Insulated Cable ENGINEERs Associations
CBM	Certified Ballast Manufacturers
IBC	International Building Code

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ETL Electrical Testing Laboratories

- 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 contractor shall not connect the equipment to the electrical system until receiving written approval by the electrical authority having jurisdiction.

1.09 PERMITS AND 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.

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 ITEMIZED COST BREAKDOWN:

- A. Furnish an electrical schedule of values for engineers use to evaluate construction progress pay requests.

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.

1.13 AS-BUILT RECORD DRAWINGS:

- A. See Specification Section 01 70 00.

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1.14 ELECTRICAL EQUIPMENT OPERATION AND MAINTENANCE (O & M) MANUALS:

- A. See Specification Section 01 70 00.

PART 2 - PRODUCTS

2.01 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 manufacturer's rated life in the prevailing environmental conditions where installed. Materials and equipment shall be listed by Underwriter's Laboratories or a Washington Administration Code (WAC) 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.

2.02 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 using this information in no way implies having tested or otherwise verified the results of published manufacturer's information.

2.03 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.
- B. 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."

2.04 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 additional materials required by the manufacturer, installation methods, codes and performing all labor required to provide a complete and operable system.

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2.05 SUBMITTALS:

- A. Submittal items: Submittals shall include, but not be limited to the following items:
- Switchgear
 - Panels
 - Raceways
 - Wires (600V and 15KV)
 - Grounding Equipment
 - Wiring Devices
 - Nameplates
 - TVSS Equipment
 - Dry Type Transformers
 - Overcurrent Protective Device Coordination Study
 - Light Fixtures
 - Light Fixture Computer Generated Photometric Plans to Scale with Initial and Maintained Light Levels.
 - 15KV Cable Termination Installer Qualifications
 - Items Requested by the Engineer

PART 3 - EXECUTION

3.01 PROTECTION OF WORK:

- A. Protect all work, wire, 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. Equipment shall be kept covered or enclosed to exclude moisture, dust, dirt, 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 plugs or caps during construction to prevent entrance of dirt, moisture, concrete or foreign objects. Pull a properly sized mandrel through each conduit prior to installation of wire or pull string for empty conduits and within 24 hours of concrete placement (duct tape not acceptable). Raceways shall be clean and dry before installation of wire and at the time of acceptance.
- 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 nor pulled into conduit embedded in concrete until after the concrete is placed and forms are removed.

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- E. Empty conduits shall be provided with distance labeled pull taps, labels at source and destination matching plans and filled with removable foam.

3.02 CUTTING AND PATCHING:

- A. Obtain permission from the Engineer prior to cutting. Locate cuttings so they will 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. All construction materials damaged or cut into during installation must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.03 PAINTING:

- A. Equipment scratched or marred in shipment or installation shall be refinished to the satisfaction of the Engineer.

3.04 LABELING:

- A. Clearly and properly label the complete conduit only and electrical system, as specified herein, to indicate the loads served or the function of each item of equipment connected under this contract. All labels shall be stamped Brass/Aluminum type. Seton or equal.
- B. Stamped Brass/Aluminum tags shall have source end point, circuit breaker, fused switch, equipment name or equipment ID. Labels shall be provided in switch gear and all power and signal pull boxes for all wires, cables and pull ropes provided under this contract.

END OF SECTION 26 05 00

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Section 26 05 13 – Medium Voltage Cables and Accessories

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The provisions and intent of the Contract, the General and Supplementary Conditions, and Division 1 Specification Sections, apply to the Work as if specified in this section

1.02 WORK INCLUDED:

- A. Provide 15KV medium voltage cable, splices, terminations and equipment.

1.03 QUALIFICATION AS ACCEPTABLE INSTALLER:

- A. The subcontractor installing the materials specified in this section shall meet the following qualifications:
 - 1. Organization has installed similar primary voltage systems for 5 years as a principal business, not just occasionally.
 - 2. Organization has proper tools for medium voltage work.
 - 3. Above information shall be submitted for Engineer's review and approval as part of the shop drawing review process.

PART 2 - PRODUCTS

2.01 CONDUCTORS - 15KV POWER CABLE, COPPER, UL TYPE MV105:

- A. Quality Assurance
 - 1. Single-Source Responsibility: All medium-voltage cable and accessories shall be the product of a single manufacturer.
 - 2. Manufacturer Qualifications: Firm with 10 years experience in manufacturing medium-voltage cable with triple extrusion of EPR insulation and accessories similar to those indicated for this Project, with a record of successful in-service performance and having ISO-9000 approval certification.
 - 3. Manufacturer Warranty: Provide 20-year design service life statement.
 - 4. Listing and Labeling: Provide medium-voltage cable and accessories Listed and Labeled as defined in NFPA 70, Article 100,

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by a testing agency acceptable to the Authority Having Jurisdiction, marked for intended use for the location and environment in which they are installed.

a. Cable shall comply with UL Standard 1072.

5. Comply with the following standards:

a. NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

b. ANSI C2 “National Electrical Safety Code” for components and installation.

c. Insulated Cable Engineers Association (ICEA) for components and installation.

d. Association of Edison Illuminating Companies (AEIC) for components and installation.

e. ASTM for components and installation.

f. National Electrical Manufacturers Association (NEMA) for Components and Installation

6. Identification: Cable shall be new and of recent manufacture (no more than 12 months old) and shall have label showing the name of cable manufacturer, size, plant location, insulation type, insulation thickness, voltage rating, insulation level, sequential footage, year of manufacture and UL designations.

7. Installer Qualifications: Engage an experienced and certified cable splicer to install, splice, and terminate medium-voltage cable.

B. SUBMITTALS

1. General: Comply with the Conditions of the Contract and Division 01 Sections.

2. Product data for cables and cable accessories, including splices and terminations.

3. Product certificate signed by product manufacturer stating the product(s) supplied comply with the specified requirements.

4. Qualification data for firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Engineers and Owners, and other information specified.

5. Product Test Reports: Certified reports of Manufacturers’ design and production tests indicating compliance of cable and

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accessories with referenced standards. Cables with the manufacturing date exceeding 12 months prior to the date of delivery to the Project site will not be accepted.

6. Schedule of cable pulls showing calculated pulling tension and sidewall pressure values.
7. Field test reports indicating and interpreting test results relative to compliance with performance requirements specified. Include certified copies of field test records.
8. Maintenance data for cables and accessories to include in the "Operations and Maintenance Manual" specified in Division 01.

C. DELIVERY, STORAGE, AND HANDLING

1. Deliver medium-voltage cable on factory reels conforming to NEMA WC 26.
2. Store cables on reels on elevated platforms in a dry location.

D. MANUFACTURERS

1. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cables:
 - 1) BICC Cables.
 - 2) The Okonite Co.
 - 3) Kerite.
 - 4) Southwire
 - 5) Pirelli
 - 6) General Cable
 - 7) Approved Equal
 - b. Cable Splicing and Terminating Products and Accessories:
 - 1) Elastimold.
 - 2.) 3M Company; Electrical Products Division.
 - 3) Raychem Corp.; Energy Division.
 - 4) Cooper Power Systems, Inc., RTE Components.
 - 5) Thomas & Betts Corp.
 - 6) Adalet-PLM, Scott Fetzer Co.
 - 7) Approved Equal

E. 15kV CABLES

1. Type: MV-105 (UL Standard 1072).

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2. Conductor: Copper single-conductor.
3. Conductor Stranding: Compact Class B conductor stranding.
4. Insulation: Ethylene-propylene rubber (EPR) conforming to AEIC CS6.
5. Insulation: Shielded Power Cables 5-46kV.
 - a. Voltage Rating: 15 kV.
 - b. Insulation Thickness: 133 percent insulation level with thickness per manufacturer's standard.
6. Shielding: 5-mil uncoated copper tape with minimum 25% overlap.
7. Jacket: Sunlight-resistant polyvinyl chloride (PVC).

F. SPLICE KITS

1. Connectors: IEEE 404, compression type, as recommended by cable or splicing kit manufacturer for application.
2. Splicing Products: As recommended in writing by the splicing kit manufacturer for the specific sizes, ratings, and configurations of cable conductors and splices specified. Include all components required for complete splice, with detailed instructions.
 - a. Taped splice kit.
 - b. Combination tape and cold-shrink rubber sleeve kit with re-jacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
 - c. Heat-shrink splicing kit of uniform cross-section polymeric construction with outer heat-shrink jacket.
 - d. Premolded, cold-shrink rubber, inline splicing kit.
 - e. Premolded ethylene propylene diene monomer (EPDM) splicing body kit with cable joint sealed by interference fit of mating parts and cable.

G. SOLID TERMINATIONS

1. Conductor Terminations: Comply with IEEE Standard 48, as indicated. Insulation class equivalent to that of the cable. Terminations for shielded cables shall include a shield grounding strap.
 - a. Class 1 Termination for Shielded Cable: Modular type, furnished as a kit, with stress-relief tube, multiple molded silicone rubber insulator modules, shield ground strap, and compression-type connector.

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- b. Class 1 Termination for Shielded Cable: Heat-shrinkable type with heat-shrinkable inner stress control and outer non-tracking tubes, multiple molded non-tracking skirt modules, and compression-type connector.
- c. Class 1 Termination for Indoor Shielded Cable: Kit with stress-relief tube, non-tracking insulator tube, shield ground strap, compression-type connector, and end seal.
- d. Class 2 Termination for Shielded Cable: Kit with stress-relief tube, non-tracking insulator tube, shield ground strap, and compression-type connector. Include silicone rubber tape, cold-shrink rubber sleeve, or heat-shrink plastic sleeve moisture seal for end of insulation whether or not supplied with kits.
- e. Class 3 Termination for Shielded Cable: Kit with stress cone and compression-type connector.

H. SEPARABLE INSULATED CONNECTORS

- 1. Separable Insulated Connectors: Modular system complying with IEEE 386. Disconnecting, single-pole, cable terminators and matching stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
 - a. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.
 - b. Load-Break Cable Terminators: Elbow-type units with 200 ampere load make/break and continuous current rating. Coordinate with insulation diameter and conductor size and material of cable being terminated. Include capacitively coupled test point on terminator body.
 - c. Dead-Break Cable Terminators: Elbow-type unit with 600 ampere continuous current rating, designed for de-energized disconnecting and connecting. Coordinate with insulation diameter and conductor size and material of cable being terminated. Include capacitively coupled test point on terminator body.
 - d. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals. Grounding lug and manufacturer's standard accessory stands and stainless steel mounting brackets and attaching hardware.
 - e. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.

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I. ARC-PROOFING MATERIALS

1. Tape for First Course on Metal Objects: 10-mil thick, corrosion-protective, moisture-resistant PVC pipe-wrapping tape.
2. Arc-Proofing Tape: NRTL-listed fireproofing tape, flexible, conformable, intumescent to 0.3 inch thick, and compatible with the cable jacket on which used. Scotch No. 77 or approved equal.
3. Glass Cloth Tape: Pressure-sensitive adhesive type, 1/2 inch wide.

J. SOURCE QUALITY CONTROL

1. Test and inspect cables according to NEMA WC 74 (ICEA S-93-639) before shipping.

PART 3 - EXECUTION

3.01 CABLES - GENERAL

- A. Examine and swab out raceways to receive medium-voltage cable for compliance with installation tolerances and other conditions affecting performance of the cable.
- B. Install medium-voltage cable according to manufacturer's written instructions and IEEE 576.
- C. Pull conductors simultaneously where more than one cable is indicated in same raceway.
 1. Use NRTL-listed and manufacturer-approved pulling compound or lubricant where necessary.
 2. Lubricants used to facilitate pulling of cables shall not be damaging to the cable jacket.
 3. Use pulling attachments that will not damage cables such as fish tape, cable, rope and basket-weave/cable grips.
 4. Use of trucks, forklift, or similar equipment are not acceptable for pulling of cable. Where cables are not hand pulled contractor shall use "hydraulic tugger" with tension gauge.
 5. Submit to the Engineer a schedule of cable pulls showing calculated pulling tension and sidewall pressure values. Do not

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exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

- D. Train cables around walls of cable vaults, handholes, pull boxes and junction boxes by the longest route from entry to exit and support cables at intervals adequate to prevent sag.
- E. Arrange cables in pull boxes to avoid interference with conduit entrances.
- F. Ground shields and metal bodies of shielded cable at terminations, splices and separable connectors.
- G. Arc-proof medium-voltage cable with fire taping at locations not protected by conduit, cable tray, or termination materials.

3.02 CABLE TERMINATIONS AND SPLICES

- A. Install splices at pull points and in manholes/vaults through which the cable passes using a standard kit. Conform to kit manufacturer's written instructions.
- B. Install terminations at ends of conductors. Conform to manufacturer's written instructions. Comply with classes of terminations indicated.
- C. Quantities: Provide the following quantities of components:
 - 1. Protective Cap: Install at each terminal junction, one on each terminal to which no feeder is indicated to be connected.
 - 2. Standoff Insulator: 3.

3.03 ARC-PROOFING

- A. Arc-proof medium-voltage cable at locations not protected by conduit. Apply as follows and as recommended by the manufacturer of the arc-proofing tape.
 - 1. Clean cable sheath.
 - 2. Wrap metallic cable components with 10-mil pipe wrapping tape.
 - 3. Smooth surface contours with electrical insulation putty.
 - 4. Apply arc-proofing tape in one half-lapped layer with the coated side toward the cable.

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5. Band the arc-proofing tape with 1-inch-wide bands of half-lapped adhesive glass-cloth tape 2 inches on center.

3.04 GROUNDING

- A. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated connector fittings, and hardware according to Manufacturer's written instructions.

3.05 IDENTIFICATION

- A. Label cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and at all terminations. Include operating voltage, circuit number and phase designation.

3.06 FIELD QUALITY CONTROL

- A. Testing: Upon installation of medium-voltage cable and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.3.2. Certify compliance with test parameters.
 - a) Megger all cables before hypotential testing. Use the following megger voltages:

<u>Cable Rating</u>	<u>Megger Voltage</u>
15 kV	15 kV

Determine the insulation resistance values with cables disconnected at each end. Megger cable and hypotential test only after all splices and termination's are made.

- b) Field hypotential test all cables in accordance with:
 - 1) IEEE 400.
 - 2) ICEA No. T-27-581, "Standard Test Methods for extruded dielectric Power Cables"
 - 3) 15kV EPR 133 percent insulation level grounded shielded cable tests:
Cable Size (AWG or kcmil).....1-750
Test Voltage (KV, dc).....40 (15KV Cable)
Duration Minutes.....15
 - 4) Do not test cable with an ac test set. Disconnect cables from all equipment during testing. Testing cable on reel will not be acceptable. Test cable after

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installation but before final connection of equipment.
Individually test each conductor with all other
conductors grounded. Ground all shields.

- 5) Use standard NETA test forms and record results.
- 6) Correct deficiencies and retest to demonstrate compliance.

3.07 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to Manufacturer and Installer, to prevent entrance of moisture into the cable and ensure medium-voltage cable is without damage or deterioration.

END OF SECTION 26 05 13

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Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The provisions and intent of the Contract, the General and Supplementary Conditions, and Division 1 Specification Sections, apply to the Work as if specified in this section

1.02 WORK INCLUDED:

- A. Provide all wire and terminations for a complete installation

PART 2 - PRODUCTS

2.01 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.

2.02 CONDUCTORS - 600 VOLTS:

- A. Stranded Copper, insulated for 90 degree centigrade and 600 volts.
- B. Insulation type XHHW-2. Insulation requirements may vary per the NEC where necessary to suit more stringent installation conditions.

2.03 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. Terminator lugs of No. 12 wire and smaller:

Spade, insulated type to be tool applied.
- C. Terminator lugs for No. 10 wire or larger:

Two bolt (or approved positive restraint), tool applied compression type (Burndy or equal).

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Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables

2.04 INSULATING MATERIALS:

- A. Insulating tape or heat shrink tubing shall have the equivalent rating of the applicable conductor insulation (Scotch 3M, RAYCHEM or equal).

2.05 PLASTIC CABLE TIES:

- A. Nylon, or equivalent, locking type (T&B or equal).

PART 3 - EXECUTION

3.01 GENERAL:

- A. Install all wiring in raceway.

3.02 CONDUCTOR TYPES, REFERENCED ON PLAN:

- A. Conductors shall be stranded copper.

3.03 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
- B. 480/277 volt system
 - A Phase - Brown
 - B Phase - Orange
 - C Phase - Yellow
 - Neutral -Gray
 - Grounding – Green with Yellow Trace
 - Other Colors - Switched Wires
- C. Conductors shall have colored insulation except wires larger than #8 may be black with colored tape identification at all terminations and splices.
- D. Additional colors may be used where such colors will help in identifying wires and different systems.

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Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables

3.04 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.
- 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.

3.05 MOISTURE PROTECTION:

- A. Cable and conductor ends shall be protected at all times from moisture. Provide approved heat-shrink end caps or equivalent for all unterminated cable and conductor ends.

3.06 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.

END OF SECTION 26 05 19

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Section 26 05 33 – Raceways and Boxes for Electrical Systems

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The provisions and intent of the Contract, the General and Supplementary Conditions, and Division 1 Specification Sections, apply to the Work as if specified in this section

1.02 WORK INCLUDED:

- A. Provide all raceways for a complete electrical system. Include all fittings, hangers and appurtenances required for a complete installation.
- B. All exposed to weather metal fabrications are to be 316 stainless steel. The work shall consist of furnishing all materials, labor, and equipment for fabricating and/or repairing, and erecting metal fabrications, all in accordance with the Drawings, notes, and this specification. Exposed galvanized materials are not allowed.

PART 2 - PRODUCTS

2.01 CONDUITS:

- A. Polyvinyl Chloride (PV) Coated Rigid Steel Conduit, Thick Wall (PVRSC). Use for all exposed conduits.
- B. Non-metallic, polyvinyl chloride (PVC), schedule 80. Use where encased.
- C. Flexible Metal Conduit with polyvinyl chloride jacket (only allowed where noted).

2.02 FITTINGS:

- A. PVRSC fittings shall have threaded connections.
- B. PVC Coated Flexible Metal Conduit: Thomas & Betts "Super Liquid-Tight" with external ground lug or equal.
- C. PVC Schedule 80 fittings shall be solvent welded type.
- D. Siesmic deflection coupling: Appleton or equal.
- E. PVC Coated Flexible Metal Conduit: Thomas & Betts "Super Liquid tight" with external ground lug.

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Section 26 05 33 – Raceways and Boxes for Electrical Systems

- F. All conduit elbows, bends or offsets shall be factory made, PVRSC. All 90 degree elbows shall be a minimum radius of 24" or greater.

2.03 EXPOSED RACEWAY IDENTIFICATION:

- A. Provide sign or stencil on all raceway(s) containing conductors above 240 volts. The stencil or sign by "Seton" shall have minimum ½" high red letters indicating voltage.
- B. All exposed raceway shall be PVRSC.

2.04 SPECIAL LOCATIONS

- A. For outdoor locations provide 316 stainless steel NEMA 4 or 4X boxes.

PART 3 - EXECUTION

3.01 GENERAL:

- A. Install raceways concealed in concrete or routed below trestle/pier structures.
- 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 unacceptable.
- 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. Conduits embedded in concrete shall have a mandrel pulled within 24 hours of concrete pour.
- E. All elbows shall be factory made.
- F. Field made elbows are not acceptable for PVC or PVRSC conduits.
- 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.

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Section 26 05 33 – Raceways and Boxes for Electrical Systems

- I. Any work showing inadequate planning may be ordered removed by the Engineer and shall be replaced in a neat and proper manner at no additional cost.

3.02 CONDUIT SIZING:

- A. Conduits shall be sized per code for conductors with type XHHW-2 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 conduit size shall be 3/4" trade diameter.

3.03 PVRSC:

- A. Install PVRSC for all conduits where conduit is exposed below or above the tressel/dock/pier.

3.04 FLEXIBLE CONDUIT:

- A. Provide liquid tight flexible metal conduit where noted. Provide bonding jumper when required by N.E.C.

3.05 PVC CONDUIT SCHEDULE 80:

- A. PVC conduit Schedule 80 may be used where embedded in concrete.

3.06 CONTINUITY OF CONDUIT SYSTEM:

- A. Conduits shall be assembled continuous and secured to boxes, panels, etc., with appropriate fittings to maintain electric continuity.

3.07 PULL-LINES:

- A. Provide 150 pound plastic pull-lines, with numbered distance marks at one-foot increments in all conduit-only systems and spare conduits to facilitate future conductor installation. Provide brass labels with source and end point of all pull lines

END OF SECTION 26 05 33

DIVISION 26 – ELECTRICAL

Section 26 05 73 – Overcurrent Protective Device Coordination Study

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUMMARY

- A. This section includes computer-based, fault current and overcurrent protective device coordination studies for all devices. Protective devices shall be set by the independent testing agency based on results of the protective device coordination study.
- B. This study also includes:
 - 1. An arc flash hazard analysis.
 - 2. Providing self-adhesive arc flash hazard labels.
- C. Provide an initial study and submit with the electrical gear submittals.
- D. Provide a final study prior to substantial completion. The final study shall include all installed cable lengths and changes made during construction.

1.03 SUBMITTALS

- A. Product data: Submit computer software program to be used for studies.
- B. Product Certificates: Submit coordination-study and fault-current-study computer software programs to certify compliance with IEEE 399.
- C. Other Action Submittals: The following submittals shall be made after the approval process of system protective devices has been completed.
 - 1. Coordination-study input data, protective device settings including completed computer program input data sheets.
 - 2. Study and Equipment Evaluation Reports.
 - 3. Coordination-study report.
 - 4. Submit protective equipment shop drawings simultaneously with the protective device study.

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5. Certification: Two weeks prior to final inspection, deliver to the Engineer four copies of the following certifications:
 - a. Certification by the contractor that the protective devices have been adjusted and set in accordance with the approved protective device study.
6. The Contractor will be fully responsible for all changes required to remove and replace portions of the distribution system required by the study if the study is not performed **PRIOR** to ordering the gear.

1.04 QUALITY ASSURANCE

- A. Studies shall use computer programs distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this section. Manual calculations are not acceptable.
- B. Coordination-study Specialist Qualifications: an entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices. Professional engineer, licensed in the state where project is located, or the equipment manufacturer shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

- A. Available Computer Software Developers: Subject to compliance with requirement. Companies offering computer software programs that may be used in the Work include, but are not limited to, the following:
 1. CGI CYME
 2. EDSA Micro Corporation
 3. ESA Inc.
 4. Operation Technology, Inc.
 5. SKM Systems Analysis

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2.02 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include “mandatory”, “very desirable”, and “desirable” features as listed in IEEE399
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and rating of all Overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examine project Overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.

3.02 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support coordination study:
 - 1. Product data for Overcurrent protective devices specified in other Division 26 and 33 sections and involved in Overcurrent protective device coordination studies. Use equipment designation tags consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Impedance of utility service entrance.
 - 3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following
 - a. Circuit breaker and fuse-current ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Cables: indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - e. Busway ampacity and impedance.

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- f. Motor horsepower and code letter designation according to NEMA MG1.
- 4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including stating inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capacity.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Ratings, types, and settings of utility company's Overcurrent protective devices.
 - e. Special Overcurrent protective device settings or types stipulated by utility company.
 - f. Time-current-characteristic curves of device indicated to be coordinated.
 - g. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long time adjustment range, short-time adjustment range, and instantaneous attachment adjustment range and current transformer ratio for Overcurrent relays.
 - h. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment range, and current transformer ratio for Overcurrent relays.
 - i. Panelboards, switchgear ampacity, and interrupting rating in amperes rms symmetrical.

3.03 FAULT CURRENT STUDY

- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit –breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 - 1. Medium Voltage Padmount Switch (existing)
 - 2. Distribution Switchboard
 - 3. Branch Circuit Panelboard
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for project. Include studies of system-switching configurations and alternate operations that

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could result in maximum fault conditions.

- C. Calculate momentary and interrupting duties on the basis of maximum available fault current. Show interrupting (five-cycle) and time-delayed currents (six cycles and above) on medium-voltage breakers as needed to set relays and assess the sensitivity of Overcurrent relays.
- D. Equipment Evaluation Report:
 - 1. Overcurrent Protective Devices: Ensure interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 2. Devices and Equipment Rated for Asymmetrical Fault Current: Apply multiplication factors listed in the standards to 1/2 –cycle symmetrical fault current.
 - 3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.04 COORDINATION STUDY

- A. Perform coordination study using approved computer software program. Prepare written report using results of fault-current study. Comply with IEEE 399.
 - 1. Calculate the maximum and minimum 1/2-cycle short circuit currents.
 - 2. Calculate maximum and minimum interrupting duty (five cycles to two seconds) short-circuit currents.
 - 3. Calculate the maximum and minimum ground-fault currents.
- B. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEE C57.96 if required by unusual loading or emergency conditions.

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2. Device settings shall protect transformers according to IEEE C57.12.00 for fault currents.
- C. Motors served by voltages more than 600 volt shall be protected according to IEEE 620.
- D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE-242. Demonstrate that equipment withstands the maximum short circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- E. Coordination-study Report: Prepare a written report indicating the following results of coordination study:
 1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag
 - b. Relay-current transformer ratios;
 - c. Circuit-breaker sensor rating; long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type
 - e. Ground-fault relay-pickup and time-delay settings
 2. Coordination Curves: Prepared to determine settings of Overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points
 - g. Maximum fault-current cutoff point.
- F. Completed data sheets for setting of Overcurrent Protective Devices.

3.05 ARC FLASH HAZARD ANALYSIS

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Section 26 05 73 – Overcurrent Protective Device Coordination Study

- A. Calculate the arc flash hazard category, the incident energy level and the flash hazard boundary for all electrical equipment.

- B. Provide self-adhesive labels complying with ANSI Standards Z535.4-1998.

END OF SECTION 26 05 73

DIVISION 16 – ELECTRICAL
Section 26 12 16 – Dry Type Transformers

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 WORK INCLUDED

- A. Provide dry transformers of the types and characteristics specified herein and shown on the drawings.
- B. Dry type transformer shall be included as a 316 stainless steel switchgear section.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Dry Type Distribution Transformers:
 - 1. General Electric QL
 - 2. Sorgel Quiet Quality
 - 3. Tierney
 - 4. Federal Pacific
 - 5. Approved Equal

2.02 SHOP DRAWINGS

- A. Prepare and submit for review, prior to manufacture; include dimensioned elevations, base plans, section views, wiring and connection diagrams and bolting templates. Contractor shall review shop drawings and indicate mounting methods and connection lugs required.

2.03 DRY TYPE DISTRIBUTION TRANSFORMERS

- A. Dry type transformers shall be provided to satisfy 120/240 volt requirements from the 480 volt system. Transformers shall comply with NEMA Standard ST-20, Energy Star and shall bear the UL label.

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Section 26 12 16 – Dry Type Transformers

- B. Enclosure Construction
 - 1. Dry type transformer shall be constructed as an integral component of the 316 stainless steel switchgear enclosure.
 - 2. Provide weatherproof and/or special enclosure required for salt water installation environment.
- C. Windings: - Separate primary and secondary windings shall have Class H insulation rated for continuous operation at 115 degrees C above a 40 degree C ambient, with a maximum hot spot temperature of 220 degrees C. Windings, core and coil assembly shall be treated and built to resist the effects of dirt and moisture.
- D. Connections: All dry type distribution transformers shall have a 480 volt delta connected primary and 208Y/120 volt, three phase, four wire connected secondary or 480 volt primary to 240/120 volt single phase, secondary. Provisions for external connections shall be made by means of a terminal board employing lugs compatible for the external conductors installed.
- E. Primary Taps: Provide four full capacity taps, minimum of two 2-1/2% above and two 2-1/2% below normal (rated) primary voltage. Single phase transformers, 15 KVA and smaller, shall have at least two taps below normal.
- F. Capacity: Transformers furnished shall have a continuous overload capability not less than 115% of the nominal size shown on the plans.
- G. Efficiency: Transformers shall be designed for substantially lower losses than NEMA standard transformers.
- H. Core Steel: Thin lamination for efficiency, not thicker than 9 mils.
- I. Sound Level: Transformers shall have a guaranteed sound rating. Sound level shall not exceed 36dB per IEEE C57.12.91 testing for all sizes through 300 KVA (similar to Tierney Quietran). All transformers shall be factory certified to have sound levels not exceeding those specified.
- J. Certification: Submittals shall include appropriate test and manufacturing data to show that project transformers comply with all requirements of this specification.

2.04 VIBRATION ISOLATORS

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Section 26 12 16 – Dry Type Transformers

- A. General: Isolators shall be selected according to manufacturer's recommendations.
- B. Mounting Pads: Shall be ribbed elastomeric pads for direct mounting under equipment.
- C. Spring Vibration Isolators: Shall be seismically restrained type, incorporating integral ribbed noise isolation pad.

PART 3 - EXECUTION

3.01 MOUNTING

- A. General
 - 1. Transformer shall be integral mounted in switchgear enclosure ground mounted on a concrete pad as required for the particular installation.
 - 2. All units shall be seismically restrained/braced to comply with the requirements of the International Building Code (IBC) and manufacturers seismic testing.
 - 3. Remove all shipping blocks and packing materials prior to installation.
 - 4. Provide shop drawings for approval of any special mounting brackets or hangers.

3.02 VIBRATION ISOLATION

- A. General
 - 1. All transformers shall be provided with vibration isolation as recommended by the manufacturer and sized for the specific application.
- B. Mounting Pads
 - 1. General elastomeric type mounting pads shall be used for vibration isolation. Provide pads directly under the transformer base channels or mounting brackets. Pads shall be punched to accept hold-down/anchor bolts.

3.03 GROUNDING CONNECTIONS

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Section 26 12 16 – Dry Type Transformers

- A. Dry transformers shall be considered "grounded neutral, separately derived systems;" the neutral shall be grounded per code accordingly.

3.04 VOLTAGE TAP CONNECTIONS

- A. Connect all transformers at "normal" voltage tap. Measure and record secondary voltages of all transformers and selected switchgear after the facility is completely energized. Forward a list to the Engineer for evaluation; reconnect taps as subsequently directed. All costs associated with this work shall be included in the basic bid.

END OF SECTION 26 12 16

DIVISION 26 - ELECTRICAL
Section 26 24 13 – Electrical Switchboards

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide service entrance main distribution switchboard, dry type transformer and 240V panelboard equipment complete in Nema 3R, gasketed sectionalized enclosures with, individual full height, lockable doors (except transformer and wire way sections) accessories and continuous full load ampacities as indicated.
- B. Bottom of switchgear shall be enclosed and sealed to prevent moisture intrusion. Both shall be field drilled by contractor to allow for entrance or exit of conduits and foam sealed around all conduits after installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. General Electric
- B. Square D
- C. Cutler Hammer
- D. Siemens
- E. Custom UL Fabricator using any of the above equipment manufacturers

2.02 ENCLOSURES

- A. General Description
 - 1. Switchgear shall be freestanding and utilize sectionalized construction to allow localized access without disturbing adjacent sections. Equipment shall be dead front type.
- B. Enclosure Construction
 - 1. Enclosure shall be fabricated of 316 code gauge stainless steel; minimum 12 gauge, except front panels and doors may be 14-gauge minimum.
 - 2. Steel angle and/or channel framework shall be designed to provide strength and rigidity required for the particular installation and shall be suitable for lifting support.

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Section 26 24 13 – Electrical Switchboards

3. A removable lifting angle shall be provided at the top and bottom of each shipping section.
4. Enclosure shall be front access only.
5. Enclosure type shall be:
 - a. NEMA 3R, gasketed for outdoor applications where equipment is exposed to a salt air environment.
6. Finish: The paint finish shall be factory applied, standard gray color for all exterior and interior painted surfaces. Other colors may be considered.

2.03 SWITCHBOARD DIMENSIONS

- A. Overall height of switchboards shall not exceed 90 inches (not including base channels). Length and depth shall not exceed dimensions as scaled or noted in contract documents. Manufacturers whose equipment dimensions exceed those indicated shall notify the Engineer in writing at least 10 days prior to bid date. These manufacturers may not bid the project unless they properly notify the Engineer and qualify their bid as "Not Conforming to Contract Documents". Contractor's bid shall be based only on equipment, which fully complies with the contract documents. Cost of building modifications, switchboard relocations (if permitted) and other additional work required to accommodate larger switchboard(s) than shown on the drawings shall be borne totally by the Contractor.

2.04 SWITCHBOARD BUSBARS

- A. Aluminum or copper at manufacturer's option, factory fabricated, carried to terminals for connection to service cables or busway. Brace switchboard components for symmetrical fault current shown plus asymmetrical offset (100,000 amp bracing minimum). Aluminum bus shall be tin plated over its full length.
- B. Busbar Joints and Connections:
 1. Busbar-to-busbar connections shall be lapped, bolted and silver or tin plates, to produce low contact resistance and low temperature rise joints. Aluminum bus joints shall utilize Grade 5 bolts with belleville washers.
 2. Overcurrent devices shall be bolted to busbars using Grade 5 bolts and belleville washers.

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3. Conductor connectors shall be bolted to busbars using Grade 5 bolts and belleville washers.
- C. System of Bussing shall be three phase, 4 wire, with full size neutral.
- D. Ground Bus shall be full-length ground bus bonded to frame. Minimum size shall conform to UL 891 for grounding neutral conductor.

2.05 SWITCHBOARD COMPONENTS

- A. Switchboard components shall include (but not be limited to) the following:
 1. Circuit breakers, size and quantity as shown.
 2. Space provisions for future breakers as shown, including complete bussing and hardware for mounting devices.
 3. Provisions Owner instrumentation components specified.
 4. Cleats for securing all conductors within the switchboard.
 5. Integral mounted transient Voltage Surge Suppression (TVSS) equipment. Equipment provided by the switchgear manufacturer shall have equal or better characteristics as identified in section 26 43 13.
 6. Self-regulating, 500W heaters in each section.
 7. Miscellaneous appurtenances required for a complete installation.

2.06 POWER MONITOR EQUIPMENT

- A. In each switchboard, provide a digital line Power Monitor (PM) device equal to Cutler-Hammer/Westinghouse type IQ DP-4000 (Square D Class 3020/PM 620, Siemens or General Electric equal) having the features and functions specified below. The PM shall consist of a single microprocessor-based unit capable of monitoring and displaying the functions listed below with the accuracy indicated; the PM shall auto range between Units, Kilo-units and Mega-units. The PM shall provide the capability to communicate data via twisted pair network. The PM shall be UL listed, CUL and CE certified and also meet ANSI Standard C37.90.1 for surge withstand.

METER VALUES

(Accuracy % Full Scale)

AC Phase Amperes +/- (0.3%)

AC Phase Voltage +/- (0.3%)

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Watts +/- (0.6%)

VA +/- (0.6%)

VARs +/- (0.6%)

Power Factor (+/- 1 digit)

Frequency +/- (0.1 HZ)

Watt-hours +/- (0.6%)

VAR-hours +/- (0.6%)

VA-hours +/- (0.6%)

Watt Demand with 10 minute interval

% THD (through 31st harmonic)

Voltage – min./max.

Current – min./max.

Power –min./max.

Power Factor – min./max.

Frequency – min./max.

Peak % THD

- B. Input ranges of the PM shall accommodate external current transformers with ranges from 5/5 through 12,800/5 amperes. Provide external current transformers with rating as indicated on the drawing or sized for incoming service. Potential transformers shall be included and fused for 480-Volt system.
- C. Control shall be capable of being supplied from the monitored incoming AC line without the need for a separate AC supply control circuit or separate remote power source.
- D. Provide an addressable communication card capable of transmitting all data over a compatible two-wire local area network to a central computer for storage and/or printout. Provide front accessible data plug in switchboard face for local down loading of data to a laptop. The network shall also be capable of transmitting data in RS232c format via a translator module.
- E. Power Monitor Installation
 - 1. Provide (ampere rating of switchboard) to 5 Amp current transformers (3) and (3) fused voltage circuits to each power monitor.
 - 2. Install power monitors flush in the instrument space behind weather tight doors of switchboards.
 - 3. Provide raceway access for communication wires to access the power monitors.

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Section 26 24 13 – Electrical Switchboards

2.07 NAMEPLATES AND LABELS

- A. Provide engraved phenolic nameplates per Section 26 05 00, Common work Results for Electrical, for each switchboard, instrument, protective device and disconnect device for the entire switchboard lineup. Nameplates for each switchboard shall include project name, voltage, phase and UL short circuit rating.
- B. Each protective device and disconnect nameplate shall include load designation (fuse size and type when applicable). Furnish complete list with submittal.
 - 1. Provide one job nameplate on the main switchboard with the following information:
 - a. Project Name
 - b. Electrical Consultant (Cross Engineers)
 - c. Electrical Contractor
 - d. Year of Manufacture
- C. Switchboard shall be provided with required Arc Flash and Personal Protective Equipment (PPE) labels.

2.08 RISER DIAGRAM

- A. Provide a complete electrical system riser diagram (as-built) identifying switchboard, panelboards, transformers, raceway/feeder sizes and the like. Diagram shall utilize non-fading ink and paper and be mounted to the exterior of the main switchboard in a clear plastic front frame. Submit preliminary draft to project engineer for approval prior to final fabrication.

2.09 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.

PART 3 - EXECUTION

3.01 MOUNTING

- A. All switchboards shall be provided with concrete housekeeping pads 3-1/2" high and 4" larger (length and width) than the "footprint" of the equipment.

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Section 26 24 13 – Electrical Switchboards

- B. Secure enclosures, to prevent overturning from earthquakes, with 1/2" x 8" minimum black mild steel foundation anchor J-bolts. Bolts shall be set in the sub-base decking and extend through the housekeeping pad with sufficient threads to attach the equipment.

3.02 WIRING

- A. Shall conform to applicable sections of these specifications.
- B. Shall be secured to switchboard enclosure with cleats. Maximum spacing shall not exceed 24 inches.

3.03 SPACE

- A. Verify space available with equipment sizes and code required working clearances prior to submittal of shop drawings.

3.04 GROUNDING

- A. Provide per Section 26 05 26.

3.05 ARC FLASH LABELING, SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION

- A. Provide per Section 26 01 26.

END OF SECTION 26 24 13

DIVISION 26 - ELECTRICAL
Section 26 24 16 – Panelboards

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide all panelboard equipment complete integrated with switchboard. All equipment shall be dead front type construction and shall bear the U.L. label. Load centers will not be acceptable.

1.02 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.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Siemens
- B. General Electric
- C. Square D
- D. Cutler Hammer

2.02 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 2 phase, 3 wire, 100 percent neutral, braced to match the interrupting rating of the breakers.
- C. Provide separate neutral and ground buses.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Provide thermal-magnetic type circuit breakers.
- B. The AIC rating of the panel shall be as specified on the drawings.

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Section 26 24 16 – Panelboards

- C. Provide common trip on all multiple pole breakers.
- D. Circuit breakers shall be bolt-on 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).
- G. Provide "Spare" overcurrent devices, where noted on the drawings, complete and ready for future circuit connections.
- H. Provide "Space" for future overcurrent devices, where noted on the drawings. Space shall include all bussing and device mounting hardware. Provide approved coverplates or overcurrent devices in all spaces. Open spaces in the panel are not permitted.

PART 3 - EXECUTION

3.01 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. Mount index with a transparent protective cover inside the cabinet door.

3.02 PANELBOARD NAMEPLATE

- A. Provide phenolic engraved nameplate for each panelboard.

3.03 LABELING

- A. Panelboards shall be provided with required Arc Flash and Personal Protective Equipment (PPE) labels

3.04 SPACE

- A. Verify space available with equipment sizes and code required working clearances prior to submittal of shop drawings.

DIVISION 26 - ELECTRICAL
Section 26 24 16 – Panelboards

3.05 ARC FLASH LABELING, SHORT CIRCUIT AND PROTECTIVE DEVICE
COORDINATION

- A. Provide per Section 26 01 26.

END OF SECTION 26 24 16

DIVISION 26 - ELECTRICAL
Section 26 27 26 – Wiring Devices

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The provisions and intent of the Contract, the General and Supplementary Conditions, and Division 1 Specification Sections, apply to the Work as if specified in this section

1.02 WORK INCLUDED:

- A. Provide all wiring devices and plates for a complete installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Hubbell
- B. Eaton
- C. Leviton
- D. Pass & Seymour
- E. Approved Equal

2.02 MATERIALS:

- A. Wiring devices shall be specification grade, and the product of a nationally recognized manufacturer regularly engaged in their production.
- B. All shore to ship power pedestals specified in this section shall be the product of one manufacturer. Each type shall have identical appearance and characteristics. See drawing symbol legend for Eaton Admiral SS Power Pedestal types, voltages, receptacles and accessories requirements.

2.03 SWITCHES AND RECEPTACLES:

- A. Ivory, toggle type switch, 20A, 277V.
- B. Ivory duplex receptacle 20A, 125V, specification grade, GFCI with trip indicator light with Nema 3R "In Use" type cover.

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Section 26 27 26 – Wiring Devices

- C. Mount bull rail duplex, 20A, 125V receptacles used for heat trace tape in 316 stainless steel 4 square box.
- D. All exterior switch and receptacle covers shall be clear plastic, lockable Nema 3R “In Use”.

PART 3 - EXECUTION

3.01 MOUNTING:

- A. Rigidly fasten each device to structure, non-metallic strut or painted galvanized steel strut.

3.02 RECEPTACLE GROUNDING:

- A. Provide bare bonding wire between receptacle grounding terminal and box.

END OF SECTION 26 27 26

DIVISION 26 - ELECTRICAL
Section 26 50 00 – Lighting

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes exterior pole mounted light fixtures and accessories.
- B. Provide the lighting system complete and operational. All light fixtures shall be provided complete with lamps, mounting hardware and accessories required for operation.
- C. 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.
- D. Contractor shall include in the bid all costs and documentation for lighting control commissioning. 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.
- E. Light fixture schedule series numbers are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of lamp, ballast, 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 ballasts to correspond with the number of lamps, wattage, switching and/or size specified. Refer to light fixture schedule, Architectural drawings, and schedules for additional requirements.
- F. Light fixture voltage shall match voltage of circuit serving the light fixture. Contractor as part of the billing and submittal process shall verify each light fixture and notify engineer in writing of any conflicts.

1.02 REFERENCES

- A. Shall be as follows:
 - National Electrical Manufacturer's Association (NEMA):
 - LE 5-1993 Procedure for determining luminaire efficiency ratings.
 - Underwriters Laboratories, Inc. (UL):
 - UL 496 Edison Base Lampholders
 - UL 542 Lampholders, Starter Holders for Fluorescent Lamps
 - UL 924 Emergency Lighting and Power Equipment
 - UL 935 Fluorescent Lamp Ballasts
 - UL 1029 HID Lamp Ballasts
 - UL 1570 Fluorescent Lighting Fixtures
 - UL 1571 Incandescent Lighting Fixtures

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Section 26 50 00 – Lighting

UL 1572 High Intensity Discharge Lighting Fixtures

1.03 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. Factory Mutual (FM) Compliance: Light fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.
- D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.04 SUBMITTALS

- A. Submittals shall be neatly and clearly marked to indicate the light fixture(s), lamps and ballasts 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 lighting 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 prior approval not meeting these requirements will be rejected.
- C. For modified light fixtures or linear fluorescent 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 drawing lighting fixture schedule, arranged in order of light fixture designation. Include data on features, accessories, and the following:
 - 1. Dimensions of light fixtures.

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2. Certified results of independent laboratory tests for light fixtures and lamps for electrical ratings and photometric data.
 3. Emergency lighting unit battery and charger.
 4. Fluorescent and high-intensity-discharge ballasts.
 5. Types of lamps.
- 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.

1.05 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. Light Fixtures Utilizing LED Lamp Technology: Provide manufacturer's warranty for a period of not less than 5 years from date of final acceptance including parts and labor for full replacement of defective product.

PART 2 - PRODUCTS

2.01 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 relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping 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.

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- 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.
- F. Electromagnetic Interference Filters: Integral to lighting fixture assembly. Provide one filter for each ballast. Suppress conducted electromagnetic interference filters as required by MIL-STD-461.

2.02 FLUORESCENT LAMP BALLASTS

- A. General Requirements: Unless otherwise indicated, provide products manufactured by one of the following; Motorola, Energy Savings, Magnetec/Triad, or Advance, with features that include the following:
 - 1. Electronic integrated circuit, solid-state, full-light-output, energy efficient type, compatible with lamps and lamp combinations to which connected.
 - 2. Certifications: Underwriters Laboratories (UL) listed Class P, Certified Ballast Manufacturer (CBM), Electrical Testing Laboratory (ETL).
 - 3. Operating Frequency: 20 kHz or higher.
 - 4. Power Factor: 95 percent, minimum.
 - 5. Total Harmonic Distortion Rating: Less than 10 percent.
 - 6. Flicker: Less than 5 percent.
 - 7. Lamp Current Crest Factor: Less than 1.7.
 - 8. Sound Rating: A.
 - 9. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
 - 10. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.

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11. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.03 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects, suitable for installation in a salt water environment.
 2. Metallic Finish: Corrosion resistant, suitable for installation in a salt water environment.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fixtures: Set level, plumb, and square with trestle/pier walkways according to manufacturer's written instructions and approved submittal materials.
- 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.

3.02 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.

3.03 FIELD QUALITY CONTROL

- A. Inspect each installed light fixture for damage. Replace damaged light fixtures and components.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Verify proper operation, switching (photocell/timeclock) and phasing of each light fixture after installation.
- E. Malfunctioning Light Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.04 CLEANING AND ADJUSTING

- A. Clean light fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

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- B. Adjust aimable light fixtures to provide required light intensities.

3.05 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 26 50 00

DIVISION 31 - EARTHWORK
Section 31 00 00 – Earthwork

PART 1 - GENERAL

1.01 SUMMARY

- A. Extent of Work: The work includes the requirements for excavating, backfilling, grading and disposing of surplus or unsuitable excavated material for construction of roadways, structures, buried utilities and associated work. The extent and location of the “Earthwork” is indicated on the Plans.

1.02 REFERENCES

- A. Washington State Department of Transportation (WSDOT): Standard Specifications for Road, Bridge, and Municipal Construction, 2012.

1.03 DEFINITIONS

- A. Excess Material: Soil material that is geotechnically suitable for backfill, but cannot be reused on site due to lack of fill space, and shall be disposed of off site.
- B. Geotechnically Suitable Material for Fill or Backfill: Excavated soils that do not contain objectionable material or stones greater than 3-inches in any dimension, and which have strength and stability with a moisture content that will allow compaction to specified density.
- C. Geotechnically Unsuitable Material for Fill or Backfill: Excavated soils that do not comply with the requirements for satisfactory material, that have insufficient strength characteristics or stability, and/or material that contains debris, trash, roots, wood, scrap materials, vegetation or other organic matter, refuse, frozen, or other objectionable deleterious materials.
- D. Native Fill / Backfill: Excavated soil material that is geotechnically suitable for reuse as fill or backfill.
- E. Select or Structural Fill: Shall be imported borrow material and meet the requirements of Select Fill / Backfill of this Section.

1.04 QUALITY ASSURANCE

- A. Inspection and Testing: Sampling and testing of materials and installations shall be in accordance with Division 1 of these specifications and shall be performed by the Contractor at no cost to the Port. Tests, testing methods, and results shall be as specified in the pertinent sections of the WSDOT Standard Specifications.

1.05 SUBMITTALS

- A. Submit test reports for the following:
 - 1. Select Fill material sieve analysis.
 - 2. Pipe Bedding material sieve analysis.

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3. Compaction Control Testing for subgrade and backfill as required per this Section.
4. CDF - mix design and compressive strength results based on actual test results from the proposed mix design
5. Soil Handling and Stockpiling Plan - Submit a description of the proposed plan for excavations, handling and stockpiling. Include description of intended location(s) of stockpiles relative to the sequencing and scheduling of work in the Contractor's work area throughout construction. This submittal is for the Engineer's general information and in no way relieves the Contractor of complete responsibility for the successful performance of the work.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All granular materials shall meet the applicable requirements of WSDOT Standard Specifications for Road, Bridge, and Municipal Construction, 2012 edition.
- B. Other materials shall be of the quality, size, shape, gradation, or equal to the manufacturer as specified herein.

2.02 NATIVE FILL/BACKFILL

- A. Fill/backfill material shall be native, in-situ excavated material that is geotechnically suitable for reuse. Backfill shall be free from organic matter or other deleterious substances.

2.03 PIPE ZONE BEDDING MATERIAL

- A. Utilities bedding shall meet all the appropriate requirements of Section 9-03 of WSDOT Standard Specifications and shall meet the grading requirements of Section 9-03.12(3) – Gravel Backfill for Pipe Zone Bedding, including conformance to Sand Equivalent requirements. Where sand is called out on drawings for pipe zone bedding, material shall be washed sand in accordance with WSDOT Section 9-03.1(2)B, Class 1.

2.04 UNDERGROUND MARKING TAPE

- A. Underground marking tape shall consist of inert polyethylene plastic, 4-mil thickness, 6 inches wide, and is impervious to all known alkalis, acids, chemical reagents, and solvents likely to be encountered in the soil, with a metallic foil core to provide the most positive detection for pipeline locators.
- B. The tape shall be color-coded and shall be imprinted continuously over its entire length in permanent black ink. The message shall convey the type of line buried below and shall also have the word "Caution" prominently shown. Color-coding

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and width of the tape shall be consistent with WSDOT Standard Specifications, Section 9-15.18.

2.05 CONTROLLED DENSITY FILL (cdf)

- A. Controlled Density Fill (also may be referred to as lean concrete) shall meet the requirements of the WSDOT Standard Specifications, section 2-09.3(1)E, except mix shall have a minimum 28-day strength of 300 psi and a maximum 28-day strength not to exceed 1000 psi.

2.06 MATERIAL BENEATH UTILITY STRUCTURES

- A. A minimum thickness of 6-inches of compacted base course aggregate shall be used beneath upland utility structures. Refer to Specification Section 32 11 24 for base course material.

2.07 SELECT FILL/BACKFILL

- A. Select Fill/Backfill Material shall be in accordance with WSDOT Standard Specifications Section 9-03.14(2), and shall be clean, free-draining, sandy gravel or gravelly sand obtained from natural deposits. Individual particles shall be free from all objectionable coating. The material shall contain no organic matter or soft friable particles in quantities considered objectionable by the Engineer.

2.08 QUARRY SPALLS

- A. Where bottom of excavation encounters groundwater for utility structures, over excavate and place a minimum thickness of 2-feet of Quarry Spalls beneath standard base material. Materials shall meet the requirements of WSDOT Standard Specifications, Section 9-13.6 for Quarry Spalls.

PART 3 - EXECUTION

3.01 GENERAL

- A. Clearing, grubbing, and cleanup shall be in accordance with WSDOT Section 2-01.
- B. Excavating and grading of naturally occurring materials, whether native to the site or imported, which is made a part of this Contract, shall be removed or placed within the tolerances established or within reasonably close conformity to the alignment grade and cross sections indicated on the Plans or as established by the Engineer.
- C. All materials excavated for trenching or structures, and meeting the requirements of geotechnically suitable material, shall be returned to the excavation as directed by the Engineer. All geotechnically unsuitable excavated material shall be properly disposed of off-site. All pavements and concrete slabs removed and

disposed of as a part of trenching and structure excavation shall be considered part of Demolition.

3.02 EXCAVATION

- A. Excavation: Shall be the removal of naturally occurring earth, sand, gravel, clays, pavement or mixtures of the above, required to be moved, which is not otherwise designated as Excess Soil or Geotechnically Unsuitable Soil, which may appear in the Schedule of Prices. Excavation material shall be moved with the use of mechanical equipment, such as shovels, loaders, bulldozers, graders, etc., but shall not require drilling and blasting or drilling and line breaking. Excavation by sluicing method is not permitted. The excavation shall be accomplished in accordance with the specification requirements and may include incidental work including, but not limited to, removal of structures or portions thereof; construction and subsequent removal of shoring; pumping or dewatering of excavated areas; protection of excavated materials from the weather; and placement and compaction of excavated material as backfill.
- B. Protecting Stockpiles: Excavated material stockpiled for later use as backfill material shall be protected from weather damage by covering with waterproof sheeting or other means as necessary. See the Plans and Section 31 32 11 for further requirements.
- C. Separation of Stockpiles: Geotechnically unsuitable material shall be stockpiled separately from material considered to be geotechnically suitable for reuse..
- D. Unsuitable Excavation: Shall consist of excavation, removal, disposal, and replacement of geotechnically unsuitable / unstable materials. Unsuitable materials beneath pavements and adjacent to structures shall be removed to the depth required to meet compaction requirements. Excavated unsuitable material shall be replaced with suitable excavated Native Backfill material to the extent there are sufficient quantities of excavated Native Backfill material available, and imported Select Fill otherwise.
- E. Trench and Structure Excavation: Shall be accomplished to the lines and grades shown on the Plans or as designated by the Engineer. Trench excavation shall consist of the removal, placement, or disposal of all formations as described above in "Excavation." Prior to placing any utility piping, conduit, concrete structures, etc., the trench shall be cleaned of all unsuitable material, backfilled as shown on the Plans with the specified bedding material, and compacted as defined herein.
- F. The Contractor shall maintain at all times during execution of this work, safe and stable excavations using OSHA required trench safety shoring systems.
- G. Trenches and excavations shall not be greater in width than is necessary to permit construction in accordance with the Plans and these Specifications. Trenches for piping, conduit or utility structures 4-feet or deeper shall have shoring, such as trench boxes, to minimize amount of existing pavement and soil disturbance. Refer to Part 4 for measurement and payment.

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3.03 BACKFILL

- A. Placement and compaction of fill and/or backfill shall be made with material from the excavation, and shall be considered a necessary part of, and incidental to, the excavation, except where specifications provide for the backfill material to be imported / obtained from a designated source.
- B. Water existing in the excavated area shall be removed by pumping or other means before backfilling. Backfill material shall not be placed on surfaces that are muddy or “pumping.”
- C. Subgrade shall be compacted prior to backfilling. Backfill lifts shall not be placed over subgrade without prior approval of the Engineer.
- D. Place backfill materials in horizontal layers not exceeding 8 inches in loose thickness and compact each layer to 95 percent of the maximum dry density as determined by the modified Proctor (ASTM D 1557) test procedure. Grade the backfill to meet the requirements shown on the drawings.
- E. Do not place backfill against any concrete structure until the concrete has achieved a minimum strength of 0.75 f'c or has set and cured at least 7 days, whichever occurs last, or longer if specified in Section 03300 and related sections.
- F. Backfill around utilities in trenches with utilities bedding material. Fine-grade the bedding material to the required slope and excavate to accommodate bell and spigot joints so the entire length of each pipe will be uniformly supported. Bedding material shall be placed in horizontal layers not to exceed eight inches in loose thickness and carefully compacted by the use of small vibratory or mechanical compactors until the required cover above the top of the pipe is achieved. Subsequent layers of trench backfill shall not exceed eight inches in loose thickness and may be compacted by any method that will not exceed the allowable stresses for the pipe. Each layer shall be compacted to 95% of the material's maximum dry density as determined by the Modified Proctor Compaction Test (ASTM D 1557). CDF shall be used as trench backfill where indicated on the drawings or as directed by the Engineer.
- G. All backfill placed within excavations shall be Native Backfill or imported Select Fill borrow material.

3.04 UNDERGROUND MARKING TAPE

- A. The Contractor shall provide an approved underground marking tape to mark all underground upland utility and conduit lines installed as part of this Contract. The underground marking tape shall extend the full length of each such line and shall be placed 1 foot above each utility line.

3.05 COMPACTION

- A. Compaction shall be performed with approved compaction equipment suited to the soil being compacted. Overcompaction or excess vibration shall be avoided. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact the total area of backfill in uniform passes. In areas of limited access, as determined by the Engineer, compact the backfill by using hand or hand-operated power tampers. While backfill is being placed in layers, operate the compaction equipment continuously. Each lift of material placed shall be uniformly compacted to the density indicated for the specific material and use set forth in these Specifications. The percent of density required is in relation to the maximum density obtainable at optimum moisture content (Compaction Control Density).

3.06 COMPACTION CONTROL TESTS

- A. Laboratory and field tests shall be performed by the Contractor to determine compliance with these specifications using an Independent Testing and Inspection Service.
- B. Compaction control density shall be the maximum density at optimum moisture content as determined by ASTM D 1557, Standard Methods for Moisture-Density Relationships of Soil and Soil Aggregates, Methods B, C or D as applicable. Tests shall be performed for each type of material or source of material to determine the optimum moisture and laboratory maximum density values. This includes testing of excavated material to be used as backfill. The number of tests shall be dependent on the variation of materials with location and shall be approved by the Engineer. It is anticipated that multiple tests will be required. Additional tests shall be performed when any change in material occurs that may affect the optimum moisture content or laboratory maximum density.
- C. Field tests to determine in-place compliance with required densities as specified, shall be performed in accordance with ASTM D 1556, D 2167, or D 2922.
 - 1. In-Place Densities of Subgrades: shall be checked by a qualified geologist, geotechnical engineer, or testing lab using a T-probe to verify the conditions of the subgrade and ability of the subgrade to support the backfill and superimposed loads.
 - 2. In-Place Density of Backfills: One test per 1,000 square feet or fraction thereof of each lift for backfill areas compacted by other than hand or hand-operated machines. The density for each lift of backfill materials for trenches or areas less than 6 feet in width, which are compacted with hand or hand-operated machines, shall be tested as follows: One test per each area less than 200 square feet for each lift, or one test for each 25 linear feet or more in length per lift. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows: One check per lift for each 100 linear feet of long narrow backfills, and a minimum of two

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checks per lift for other backfill areas. At the Engineer's option, the number of tests may be reduced if consistent conditions and compaction efforts are demonstrated, or increased if necessary.

- D. Compaction control density shall be based on the maximum density at optimum moisture content as determined by ASTM D1557, Standard Methods for Moisture-Density Relationships of Soil and Soil Aggregates, Methods B, C or D as applicable.

3.07 GRADING AND LEVELING

- A. The finished subgrade profiles of the entire area shall be graded within a tolerance of plus or minus 0.05 foot in 10 feet, ready for crushed rock base wherever pavement is to be furnished.
- B. Do not place any structure, reinforcing steel, or pavement on subgrade without Engineer's prior approval of subgrade compaction.

3.08 PREPARATION FOR BASE COURSE OR GRAVEL SURFACING

- A. Preparation of Subgrade: Immediately prior to placement of surfacing materials, clean the entire width of the area of all debris and dispose of as directed by the Engineer. All depressions or ruts that contain storm water shall be drained. Shape the entire subgrade to a smooth uniform surface, true to line, grade, and cross section. Compact subgrade material for a depth of 6 inches below the top of subgrade to 95% of the maximum density as determined by compaction tests ASTM Designation D1557. If soft or spongy material underlying the upper 6 inches of the area being prepared precludes satisfactory compaction of the upper 6 inches, loosen, aerate, or excavate, replace and compact to the required density as directed by the Engineer. Remove and dispose of excess material. Subgrade areas deficient in materials shall be brought to grade by importing suitable materials from other excavation areas, or by importing select fill material when directed by the Engineer. Materials added to subgrade areas deficient in materials shall be watered and compacted as necessary to yield a true finished subgrade as described above. Once it is prepared, maintain the subgrade for surfacing in the finished condition until the first course of surfacing has been placed.
- B. Finishing Base Courses: Before any paving material is placed, the base course shall be brought to the proper line, grade, and cross section. The base course shall be so maintained until the paving is placed.
 - 1. Compact the base course for pavement to 95 percent of maximum density as defined for Compaction Control Density, in Article 3.06 "Compaction Control Tests" of this Section, to a minimum depth of 6 inches and to a width that will accommodate the paving equipment.
- C. Base Course Protection: Take all precautions necessary to protect the base course from damage; hauling over the finished base course shall be limited to that

which is essential for construction purposes. Equipment used for hauling over the prepared base course which, in the opinion of the Engineer, is causing undue damage to the prepared base course or to the underlying materials, shall be removed from the work at the request of the Engineer. Repair at the Contractor's expense all cuts, ruts, and breaks in the surface of the base course prior to placing surfacing, treated base, or paving materials. Protect the prepared base courses from both the Contractor's traffic and terminal traffic and maintain the base course by blading and rolling as frequently as may be necessary to preserve the base course in a completely satisfactory condition.

1. No measurement or payment will be made for the work involved in protection of the base course.

3.09 SUBGRADE PREPARATION FOR PAVED AREA

- A. Preparation of Subgrade: Immediately prior to placement of surfacing materials, clean the entire width of the area of all debris and dispose of as directed by the Engineer. All depressions or ruts that contain storm water shall be drained. Shape the entire subgrade to a smooth uniform surface, true to line, grade, and cross section in accordance with the plans and to the satisfaction of the Engineer. Compact the subgrade material to a depth of 12 inches to 95% of the material's maximum dry density as determined by the Modified Proctor Compaction Test, ASTM Designation D1557. If soft or spongy material underlying the subgrade precludes satisfactory compaction, loosen, aerate, or excavate, replace and compact to the required density as directed by the Engineer.
- B. Materials added to subgrade areas deficient in materials shall be watered and compacted as necessary to yield a true finished subgrade as described above. Once it is prepared, maintain the subgrade for surfacing in the finished condition until the first course of surfacing has been placed.
- C. Finished Subgrades: Before any paving material is placed, the base shall be brought to the proper line, grade, and cross section and shall be so maintained until the paving is placed.

3.10 RECONDITIONING OF SUBGRADES

- A. Where approved compacted subgrades are disturbed by the Contractor's subsequent operations or adverse weather, scarify the subgrades and compact to the required density prior to further construction thereon.

3.11 SURFACE MAINTENANCE

- A. Leave the surface free of stones or debris and wet as necessary for dust control. Maintain the surface until the final surface treatment is applied.

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3.12 Excess Material disposal

- A. The Contractor shall be responsible for the disposal of soils that the Engineer confirms to be Excess Material. The excess soils shall be disposed of away from Port-owned property at a location permitted to receive the type of excess soils to be disposed.

3.13 UNSUITABLE soil disposal

- A. The Contractor shall be responsible for the disposal of soils confirmed to be geotechnically unsuitable by the Engineer. The unsuitable soils shall be disposed of away from Port-owned property at a location permitted to receive the type of unsuitable soils to be disposed.

PART 4 - MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. Quantities shown on the Schedule of Unit Prices related to this section are based upon an anticipated quantity needed to complete the Work. Unit prices for these items shall be used regardless of the quantities of work actually performed. The anticipated quantities and prices for these items shall be included in the total price for determining the successful bidder. The Port reserves the right to use all, none, a portion thereof, or any amount in excess of the quantities listed in the Schedule of Prices

4.02 MEASUREMENT

- A. Items identified for measurement by the ton and transported by truck to the site or removed by truck from the site to approved disposal sites shall be weighed on certified scales. Present certified truck weight tickets to the Engineer at the time of delivery.
- B. No separate measurement or payment shall be made for earthwork related to demolition activities or installation of utility pipes, manholes, vaults, and other new infrastructure except as specified elsewhere in these Specifications. The cost shall be considered incidental to and included in the payment for the applicable bid items in the Schedule of Unit Prices.
- C. No separate measurement or payment shall be made for CDF backfill. CDF backfill shall be considered incidental to, and included in, the payment for the items in the Schedule of Unit Prices that require CDF backfill.
- D. Payment for Soil Removal and Disposal will constitute full compensation for all labor, materials, equipment, and incidentals required for excavation, stockpiling, covering, loading, transporting, disposing and payment of disposal fees for all such materials.

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- E. No separate measurement or payment shall be made for any other earthwork not described in Articles A through D above in this Section. The cost for all other earthwork shall be incidental to, and included in other bid items in the Schedule of Unit Prices.
- F. No separate measurement or payment shall be made for the excavation, removal, stockpiling, and re-use of on-site fill. This cost shall be viewed as incidental to all other bid items, included in the Schedule of Unit Prices.
- G. If required, measurement for Select Import Fill to the site shall be by the ton.
- H. No separate measurement or payment shall be made for costs to furnish, place and compact backfill material beyond the limits defined on the plans unless otherwise directed by the Engineer.

4.03 PAYMENT

- A. No separate payment will be made for any other earthwork described in this Section, such as Pipe Zone Bedding Material, Underground Marking Tape, Controlled Density Fill, Select Fill and Backfill, Quarry Spalls, etc. The cost for all other earthwork, including but not limited to the items above shall be incidental to, and included in other bid items in the Schedule of Unit Prices.
- B. No payment will be made for material that has become contaminated by the Contractor's action, or lack of action, or which has been removed without approval by the Engineer beyond limits or elevations indicated on the Plans or established by the Engineer. All such material shall be replaced at no additional cost to the Port. Replacement shall be made with material acceptable to the Engineer.

END OF SECTION

DIVISION 31 - EARTHWORK

Section 31 32 11 - Temporary Erosion and Sediment Control

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. This item shall consist of planning, installing, inspecting, maintaining, and removing temporary erosion and sediment control Best Management Practices (BMPs) as shown on the drawings or as ordered by the Engineer to prevent pollution of air and water, and control, respond to, and dispose of eroded sediment and turbid water during the life of the contract.
- B. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this work as if specified in this section.
- C. This work shall apply to all areas associated with contract work including, but not limited to the following:
 - 1. Work areas;
 - 2. Equipment and material storage areas;
 - 3. Staging areas;
 - 4. Stockpiles

1.02 DESCRIPTION OF WORK

- A. In order to comply with the requirements of this section, the Contractor shall:
 - 1. Develop and submit a Contractor's Erosion and Sediment Control Plan (CESCP). The CESCP shall, at a minimum, include and address the following:
 - a. Site Description and Drawings
 - b. Contractor Erosion and Sediment Control Personnel
 - c. Schedule
 - d. BMP Installation
 - e. BMP Maintenance
 - f. BMP Inspection
 - g. Record keeping
 - h. BMP Removal

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Section 31 32 11 - Temporary Erosion and Sediment Control

- i. Emergency Response
 - j. Construction Dewatering
2. Arrange an on-site meeting at a mutually agreeable date and time with the Port and the Engineer prior to beginning any site work;
3. Revise and modify the CЕСP during the life of the contract;
4. Install, maintain, and remove all erosion prevention, containment, and countermeasures BMPs during the life of the contract;
5. Contain, cleanup and properly manage or dispose of all displaced sediments and turbid water;
6. Perform other work shown on the contract plans or as directed by the Engineer.
7. Properly inspect CЕСP requirements including BMPs as required; facilitate, participate in, and implement directed corrective actions resulting from inspections conducted by others including outside Agencies and Port employees/consultants.

1.03 SUBMITTALS

- A. As part of the required Preconstruction Submittals, the Contractor shall submit the following:
 1. Contractor Erosion and Sediment Control Plan (CESCP)

1.04 ADMINISTRATIVE REQUIREMENTS

- A. The provisions of this section shall apply to the Contractor, subcontractors at all tiers, suppliers and all others who may have access to the work site by way of the contractor's activities.
- B. Failure to install, maintain, and/or remove BMPs shown on the drawings and specified herein, or by order of the Engineer; or failure to comply, implement and maintain any provisions and requirements of this section; or failure to conduct project operations in accordance with this Section will result in the suspension of the Contractor's operations by the Engineer.
- C. The Contractor shall be solely responsible for any damages, fines, levies, or judgments incurred as a result of Contractor, subcontractor, or supplier negligence in complying with the requirements of this section.
- D. Any damages, fines, levies, or judgments incurred as a result of Contractor, subcontractor, or supplier negligence in complying with the requirements of this section will be deducted from payment due by Modification.

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- E. The Contractor shall be solely responsible for any schedule impacts from damages, fines, levies, judgments, or stop work orders incurred as a result of Contractor, subcontractor, or supplier negligence in complying with the requirements of this section. The project schedule will not be changed to accommodate the time lost.
- F. Contractor shall not clear, grub, grade, or perform any earthwork after NOTICE TO PROCEED until the following has been installed per plans or as directed by the Engineer:
 - 1. Silt Fence or other perimeter barrier controls are in place;
 - 2. Areas not to be disturbed are delineated with safety fence;
 - 3. All construction entrances are stabilized;
 - 4. Catch basin inserts are installed in all catch basins that may receive drainage from the Work area;
 - 5. Materials on hand, in quantities sufficient to cover all bare soil, divert all flows, contain all sediments, and prevent turbid discharges from the site during all stages of construction. These materials include, but are not limited to the following:
 - a. Plastic sheeting
 - b. Straw
 - c. Drain pipe
 - d. Sand bags

1.05 AUTHORITY OF ENGINEER

- A. The Engineer has the authority to limit the surface area of erodible earth material exposed by demolition or removal of asphalt pavement, to limit the surface area of erodible earth material exposed by excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent watercourses or areas of water impoundment.
- B. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or are ordered by the Engineer, such work shall be performed by the Contractor at his/her own expense.
- C. The Engineer may increase or decrease the area of erodible earth material to be exposed at one time as determined by analysis of project conditions.

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- D. In the event that areas adjacent to the work area are suffering degradation due to erosion, sediment deposit, water flows, or other causes, the Engineer may stop construction activities until the situation is rectified.

PART 2 - PRODUCTS - NOT USED.

As specified in the applicable section of the Contract Documents

PART 3 - EXECUTION

3.01 GENERAL

- A. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.
- B. No discharge of water, either groundwater or surface stormwater, shall be discharged to the existing storm drain system or the Waterway. Stormwater may be reinfiltreated into the ground through a vegetated area, but only as approved by the Engineer.

3.02 CONTRACTOR'S EROSION AND SEDIMENT CONTROL PLAN (CESCP)

- A. In order to comply with these requirements, the Contractor shall include and address the following in the CESCP:
 - 1. Site Description and Drawings
 - a. Included in the CESCP shall be a written description of the construction site, including location of staging areas, stockpile areas, material storage areas, natural and constructed drainage systems within the work area and staging areas.
 - b. Drawings shall be included in the CESCP which show the location of the construction site, including location of staging areas, stockpile areas, material storage areas, natural and constructed drainage systems within the work area and staging areas.
 - c. The drawings shall show locations of BMPs during each phase of construction as identified by the Contractor in the Project Schedule.
 - 2. Contractor Erosion and Sediment Control Personnel
 - a. The Contractor shall designate one employee as the responsible representative in charge of erosion and sedimentation control.
 - b. The designated employee shall be the Contractor Erosion and Sediment Control Lead (CESCL) who is responsible for ensuring compliance with all requirements of this section.

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- c. By Notice to Proceed, the CESCL shall have successfully completed the "Stormwater: Construction Best Management Practices (BMPs) Field Training" course offered by the Associated General Contractors Education Foundation (206 284-4500), or other course approved by the Washington State Department of Ecology and as directed by the Engineer.
- d. The CESCL shall have authority to act on behalf of the Contractor and shall be available, on call, 24 hours per day throughout the period of construction.
- e. The CESCPC shall include the name, telephone number, fax number, and address of the designated CESCL.
- f. Duties and responsibilities of the CESCL shall include:
 - 1) Maintaining the CESCPC, and any associated permits and plans;
 - 2) Directing BMP installation, inspection, maintenance, modification, and removal;
 - 3) Availability 24 hours per day, 7 days per week by telephone;
 - 4) Updating all drawings with changes made to the plan;
 - 5) Keeping daily logs;
 - 6) Prepare and submit for approval a Contractor Erosion and Sediment Control Plan (CESCPC);
 - 7) Identify the points where storm water runoff, if any, potentially leaves the site, is collected in a surface water conveyance system and take corrective measures to prevent this from occurring;
 - 8) If water sheet flows from the site, take corrective measure to prevent this from occurring;
 - 9) Inspect CESCPC requirements including BMPs as required to ensure adequacy; facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies, Port employees, and Port consultants.

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3. Schedule
 - a. The CESCSP shall include:
 - 1) Schedules for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing; grading; construction; demolition; paving; structures at watercourses, saw cutting, and dewatering;
 - 2) Proposed method of erosion and dust control and a plan for disposal of waste materials;
 - 3) Estimated removal date of all temporary BMPs;
 - 4) Estimated date of final site stabilization.
 - b. Erosion control work activities consistent with the CESCSP shall be included in the Project Schedule.
4. BMP Installation
 - a. The CESCSP shall include installation instructions and details for each BMP used during the life of the Project;
 - b. Installation instructions and details shall be equivalent to the:
 - c. "Stormwater Management Manual for the Puget Sound Region," Dept. of Ecology; 2012 (Current Version)
5. BMP Maintenance
6. The CESCSP shall include a description of the maintenance and inspection procedures to be used for the life of the project.
 - a. BMPs shall be maintained for the life of the project or until removed by order of the Engineer;
 - b. BMPs shall be maintained during all suspensions of work and all non-work periods;
 - c. BMPs shall be maintained and repaired as needed to assure continued performance of their intended function and in accordance with the approved CESCSP;
 - d. Sediments removed during BMP maintenance shall be placed away from natural and constructed storm water conveyances and disposed of off site.

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7. BMP Inspection
 - a. At a minimum, inspect all TESC BMPs:
 - 1) Weekly and after any measurable rain event (0.5 inch or greater) between April 1st and September 31st;
 - 2) Daily and after any measurable rain event (0.5 inch or greater) between October 1st and March 31st.
 - b. Deficiencies identified during the inspection shall be corrected within 24 hours or as directed by the Engineer.
 - c. Note repairs or improvements needed, if any, and notify CESCL or site project superintendent to implement improvements;
 - d. Observe site during storms to ensure runoff is not leaving the site, and take corrective measures to prevent it from continuing if it is.;
 - e. Implement additional BMPs, if needed, to address site-specific erosion control;
 - f. Inspect streets surrounding site for dirt tracking;
 - g. Inspect for dust during dry periods.
8. Record keeping
 - a. Reports summarizing the scope of inspections, the personnel conducting the inspection, the date(s) of the inspection, major observations relating to the implementation of the CЕСSCP, and actions taken as a result of these inspections shall be prepared and retained as a part of the CЕСSCP;
 - b. All inspection reports shall be kept on-site during the life of the project and available for review upon request of the Engineer.
9. BMP Removal
 - a. Before project closeout, all sediment shall be removed from temporary and permanent drainage conveyances, ditches, culverts, channels, to maintain operation;
 - b. Sediment removed shall be placed away from drainage conveyances and disposed of off site.
 - c. All temporary BMPs shall be removed upon permanent stabilization or as directed by the Engineer;

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- d. Areas disturbed during removal of temporary BMPs shall be permanently stabilized;
- e. Permanent stabilization shall occur upon installation of concrete or asphalt pavement.

10. Emergency Response

- a. The CЕСSCP shall contain information on how the Contractor shall control and respond to turbid water discharges, sediment movement, and fugitive dust. At a minimum, the Contractor's employee responsible for, or first noticing, the discharges shall take appropriate immediate action to protect the work area, private property, and the environment (e.g., diking to prevent pollution of state waters). Appropriate action includes but is not limited to the following:
 - 1) Hazard Assessment-assess the source, extent, and quantity of the discharge.
 - 2) Securement and Personal Protection- If the discharge cannot be safely and effectively controlled, then immediately notify the CESCL and the Engineer. If the discharge can be safely and effectively controlled, proceed immediately with action to protect the work area, private property, and the environment.
 - 3) Containment and Elimination of Source- Contain the discharge with silt fence, pipes, sand bags or a soil berm down slope from the affected area. Eliminate the source of the discharge by pumping turbid water to a controlled area, building berms, piping clean water away from the area or other means necessary.
 - 4) Cleanup-when containment is complete, chemically treat turbid water, remove sediment and stabilize on site, or other methods to prevent future discharge.
 - 5) Notification-report all discharges immediately to the Engineer.

11. Construction Dewatering

- a. Storm water and construction dewatering operations shall not discharge to the Storm Drain System (SDS) at any time, regardless of the pollutant concentration. Before discharge to approved locations, water shall be measured and tested to meet the requirement of the receiving location.

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3.03 CONSTRUCTION REQUIREMENTS

A. Saw cutting

1. Saw cut slurry and cuttings shall be vacuumed during cutting operations;
2. Saw cut slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight;
3. Saw cut slurry and cuttings shall not drain to SDS, IWS, or any other natural or constructed drainage conveyance;
4. Collected slurry and cuttings are the responsibility of the Contractor and shall be disposed of off site in a manner that does not violate groundwater or surface water quality standards.

B. Soil and Construction Debris Stockpiles

1. Soils and construction debris, including broken concrete and asphalt paving, shall be stockpiled within the work site or off site;
2. Stockpiles shall be covered with plastic and secured from blowing wind;
3. Plastic shall be a minimum thickness of 6 mil;
4. Materials to be stockpiled on pavement shall be placed on plastic and contained within a bermed area;
5. Clean storm water runoff from the plastic covering shall be directed away from bare soil using pipes, sandbags, or other temporary diversion devices. Clean storm water runoff shall not be discharged to the storm drainage system or the Duwamish West Waterway.

C. Construction Roads, Entrances, and Exits

1. Before leaving project site, all trucks and equipment shall be inspected for mud and debris;
2. All mud and debris shall be removed;
3. If mud or debris is tracked from the site it shall be cleaned up immediately;
4. Mud and debris shall be removed from pavement by sweeping and shoveling and transported to a controlled sediment storage or disposal area;
5. If the mud and debris are contaminated by fuels, grease, metals or other pollutants, they shall be disposed of in accordance with Hazardous Materials requirements;

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6. Use of water to wash concrete or asphalt pavement shall be allowed only after sediment has been removed by sweeping and shoveling;
 7. Water used to wash pavement shall not drain into the SDS, IWS, or any other natural or constructed storm water conveyance.
- D. Storm Drain Inlet Protection
1. All catch basins within the project limits shall be protected.
- E. Concrete Truck and Equipment Washing
1. Concrete truck shuts shall be washed out off-site, unless a location on-site is approved by the Engineer.
 2. Concrete remaining in the truck and not used shall be returned to the originating batch plant for recycling;
 3. Concrete pumps shall be washed out off-site, unless a location on-site is approved by the Engineer.
 4. Concrete remaining in the pump and not used shall be blown back into the concrete truck and returned to the batch plant for recycling;
 5. Hand tools including, but not limited to, screeds, shovels, rakes, floats, and trowels shall be washed off-site, unless a location on-site is approved by the Engineer.
 6. Equipment that cannot be easily moved, such as concrete pavers, shall only be washed in areas that do not directly drain to natural or constructed storm water conveyances;

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions, and General Requirements, apply to this Work as if specified in this Section. Work related to this Section is described in:
 - 1. Section 02 32 00 – Geotechnical Investigations
 - 2. Section 03 20 00 – Concrete Reinforcement
 - 3. Section 03 30 00 – Cast-in-Place Concrete
 - 4. Section 03 60 00 – Grouting
 - 5. Section 05 50 00 – Metal Fabrications
 - 6. Section 09 96 00 – High Performance Coatings

1.02 DESCRIPTION OF WORK

- A. The extent and location of the driven pile work is indicated on the Drawings. The Work includes the requirements for furnishing, transporting, handling, and installing steel pipe piling (including steel pipe fender piling). It also includes the requirements for pile cut-offs, pile concrete and dowel installation, pile dynamic testing, and restriking piles (both with and without associated pile dynamic testing).

1.03 REFERENCES

- A. Geotechnical report: See Section 02 32 00 – Geotechnical Investigations
- B. American Petroleum Institute (API), Specification for Line Pipe (API 5L), 2012
- C. American Society for Testing Materials (ASTM), Standard Specifications and Standard Test Methods, designated by basic reference in this section (use the most current edition at the time of bid unless otherwise indicated)
- D. American Welding Society (AWS) D1.1 – 2015, Structural Welding Code – Steel

1.04 QUALITY ASSURANCE

- A. Provide at least one qualified person with a minimum of 5 years' experience with marine conditions, all piling types, piling lengths, and installation methods to be used on the project, to supervise and direct all work performed under this Section.
- B. Provide at least one qualified person with a minimum of 5 years of experience in marine piling inspection to observe all steps of the pile-driving operation and record detailed driving records of each pile installed, from the time the pile is

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picked until installation is complete. A sample pile-driving log is provided at the end of this Section.

- C. Drive piling to the criteria in paragraph 3.02.
- D. Mark all steel piling at 1-foot intervals beginning at the tip and provide callouts of the length at 5-foot intervals. Do not mark steel pipe fender piles.
- E. Pile Driving Analyzer (PDA) Testing Firm: Use an independent agency demonstrating at least 5 years of experience with pile dynamic testing, including PDA instrument installation, PDA testing, PDA results interpretation, and analyses using the Case Pile Wave Analysis Program (CAPWAP). Supervise the PDA work with at least one (1) person from the PDA testing firm who is a licensed professional engineer in Washington State.
- F. Install piling in a satisfactory and undamaged manner and make pile inspections as necessary to ensure that this is done.
- G. Inspect all piles after driving. Perform a visual inspection from mudline to top of each pile. Immediately report any damaged pile or pile coating to the Owner. Furnish a written report to the Owner stating the scope and results of the inspection for each structure. Furnish these reports to the Owner prior to erection of formwork for the concrete portions of the structures.
- H. The Owner, at its discretion, will inspect the above-water and underwater portions of piling. Make available the site, or portions thereof, to meet the Owner's inspection schedule, and at no additional cost to the Owner. A report will be prepared by the Owner and be made available for review. Any discrepancy between the Owner's and the Contractor's inspection reports shall be resolved by a joint inspection. Inspection by the Owner will be performed at no cost to the Contractor.

1.05 SUBMITTALS

- A. Joint welding procedures for pipe pile splices.
- B. Order and coating lengths for steel piling.
- C. List of proposed equipment and procedures to be used in pile driving, including crane capacities, lead lengths, lead types, hammer types, rated energies, helmet materials, modulus of elasticity, etc., for each pile type.
- D. A wave equation analysis (WEAP) for each proposed hammer and pile type indicating all input parameters and resulting pile stresses.
- E. Detailed pile plan and driving schedule showing the location of each pile to be driven. Include dimensions and field-verified measurements relative to the trestle abutment.

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- F. Pile-driving analyzer (PDA) work plan and schedule, including test methods, equipment descriptions, instrumentation, PDA agency credentials, PDA agency personnel resumes, PDA test results, interpretations, and report.
- G. Daily pile-driving logs: A driving record form is provided at the end of this Section. Submit records daily and include the date, pile location, length, type and size of pile, hammer used, rated hammer energy, pile cushion used (if any), hammer stroke near the end of driving, and other data as required on the pile-driving log provided by the Owner.
- H. Restrike data on piles not associated with PDA work.

1.06 SITE CONDITIONS

- A. Existing Facilities and Driving Restrictions:
 - 1. Drive piles at the designated locations and be prepared to encounter subsurface obstructions.
 - 2. The dock and trestle are above the same location as the existing facility to be demolished. All existing timber piles are planned to be extracted but some may be cut off below mudline if they fracture during the pulling process.
 - 3. Drive piles between the hours of 8 a.m. and 6 p.m., unless otherwise stipulated in the project permits. Perform pile driving in accordance with applicable provisions of local, state, and federal codes along with all environmental permits covering this work. Applicable permits are included with the contract documents.
- B. Subsurface Conditions:
 - 1. Subsurface conditions have been reviewed at the project site. See Section 02 32 00 – Geotechnical Investigations.
 - 2. The Contractor shall make its own determinations and conclusions regarding the nature of the materials and the methods and procedures to be used in performing the pile-driving work. Additional payment will not be made by the Owner and the Contractor shall not make any claim for extra payment for subsurface conditions which, in the opinion of the Contractor, are different from conditions indicated by the plans, specifications, geotechnical report, or previously referenced geotechnical reports.

PART 2 - PRODUCTS

2.01 STEEL PIPE

- A. Fabricate pipe from steel plate with diameters and wall thicknesses as indicated on the Drawings. Conform to the requirements of ASTM A 252, Grade 3, welded

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or seamless, with a modified minimum yield strength of 50 ksi, and the additional requirements in this paragraph.

- B. Do not allow the outside circumference of the pipe piling to vary by more than 0.375 inch from the corresponding diameter shown on the Drawings.
- C. Limit the variation in edge alignment for abutting steel pipe pile ends to 0.1875 times the wall thickness, with a maximum allowable variation of 0.063 inch.
- D. Conform to the requirements of API 5L, Section 7.6, for steel pipe pile straightness.
- E. Perform welds to make pipe at a permanent manufacturing facility using either an automatic fusion weld process or an electric resistance weld process. Provide complete joint penetration welds only.
- F. Perform non-destructive testing (NDT) on 100 percent of each longitudinal, circumferential, and spiral welds made at the permanent manufacturing facility. Use either radiographic, radiosopic, real-time imaging systems, or ultrasonic methods of NDT that are in conformance with the requirements of AWS D1.1 or API 5L. Provide records of this testing to the Owner prior to delivery of pipe. For repairs, conform to the requirements of AWS D1.1, Section 6, for cyclically loaded non-tubular connections subject to tensile stress. If repairs are required in a portion of the weld, perform additional NDT on 100 percent of the repairs. Perform additional NDT on both sides of the repair for a length equal to 10 percent of the length of the pipe outside circumference. After all NDT is performed on the repair, and if more repairs are required that have a cumulative length equal to or more than 100 percent of the length of the pipe outside circumference, perform NDT on the entire splice weld.

2.02 STEEL PILING

- A. Fabricate piling from steel pipe meeting the requirements of paragraph 2.01.
- B. Limit the number of splices to a maximum of three per pile.
- C. Provide a square and blunt end at the ends of each pipe pile.
- D. Perform welding at splices in accordance with AWS D1.1 using certified welders, welding operators, and qualified joint welding procedures. Provide splices with complete penetration butt welds using the reviewed welding procedure. Test all pile splices in accordance with AWS D1.1 procedures.
- E. Coat the piles as specified in Section 09 96 00 – High Performance Coatings, to the lengths indicated on the Drawings.
- F. For reinforcing steel, see Section 03 20 00 – Concrete Reinforcement and for concrete see Section 03 30 00 – Cast-in-Place Concrete.

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2.03 PILE ORDER LENGTHS

- A. Structural pile order lengths shall be a minimum of the length indicated on the drawings between cutoff and pile tip plus 5 feet for overdrive allowance and plus 2 feet for damaged pile tolerance.
- B. Fender and guide pile order lengths shall be a minimum of the length indicated on the drawings between cutoff and pile tip plus 2 feet for damaged pile tolerance.

PART 3 - EXECUTION

3.01 GENERAL

- A. The maximum driving stresses for steel pipe piles shall not exceed 90 percent of the specified yield strength.
- B. Do not drive piles within 100 feet of concrete that has cured 3 days or less, unless otherwise approved by the Owner.
- C. Drive each steel pile to the minimum tip elevation and required ultimate load capacity shown on the Drawings unless otherwise indicated on the Drawings or in this Section. Driving deeper in order to obtain the required ultimate load capacity may be required.
- D. Drive each steel pipe fender pile to the minimum tip elevation shown on the Drawings.
- E. Once driving has started, drive pile continuously until reaching the minimum tip elevation, even if the required ultimate load capacity has been achieved. Do not pause voluntarily or interrupt driving unless instructed by marine mammal, marbled murrelet, or archaeological monitors.
- F. Drive piles in the designated locations, remove obstructions as necessary to obtain the required penetration and pile alignment tolerances.
- G. Survey as-driven locations of piling and provide a written record of plan location, tip elevation, and top elevation for each pile to the Owner within 48 hours of driving each pile. If not submitted within the specified time frame, the Owner may retain a surveyor to record such information and will deduct the cost of such survey work from the contract. Do not erect falsework on piles without Owner approval of the as-driven locations of piling.
- H. Driving Tolerances:
 - 1. Plan Locations (except fender piles): Locate the top work points within 3 inches of the indicated plan locations.
 - 2. Plan Locations (fender piles): Locate the top work points within 2 inches of the indicated plan locations.

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3. Plumb Piles (including fender piles): Maximum deviation from plumb equal to 1 inch per 10 feet of pile length.
4. Cut-off Elevations: Maximum deviation from elevations indicated on the drawings equal to 1/4 inch.
5. Manipulation to move a pile into position within the specified tolerances will be permitted, however, no pile shall be manipulated more than 1/8 inch per foot of the exposed pile length above mudline.

I. Rejected Piles:

1. Any pile damaged during handling or driving, as indicated by bends, buckling, cracks, splits, or other damage that adversely affects the capacity, or coating the pile.
2. Any pile not meeting the driving tolerances listed above.
3. Any pile that does not reach the prescribed tip elevation shown on the drawings or refusal criteria provided by the Owner.
4. The Owner may direct that a rejected pile be removed and redriven in a location determined by the Owner, removed and replaced with a new pile driven in a location determined by the Owner, or that a new pile be driven adjacent to the rejected pile and be incorporated into the structure. The Owner may direct that rejected piles be cut off at the mudline. Rejected, broken, and cut off piles shall be removed and disposed of at no additional cost to the Owner. The Owner shall not incur any design and construction costs resulting from rejected piling, including cost of rejected piles, cost of new piles, or modifications to pile caps.

- J. Daily Pile-Driving Records: For each pile driven, submit a record of the rate of penetration during vibratory driving and number of blows per foot of penetration and number of blows for the last 6 inches of penetration for impact driving. As a minimum, supply all the information in the sample driving record provided at the end of this section. Record all proof and restrike data and unusual occurrences during driving. Submit within 24 hours of driving.

3.02 HANDLING, PILE DRIVING, AND PILE REPAIRS

A. Handling and Storage:

1. Handle steel piling by the use of bridles, strong backs, or other rigging, which will prevent permanent deformations and coating damage. Store piling on level ground or timber blocking so that the axis of each pile is maintained in a straight line and the coating system is not damaged.

B. Driving:

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1. Drive steel piling in true line and position. Prior to driving steel piles, submit to the Owner complete details of driving equipment, templates, and falsework to be used to place piling and provide complete assurance that plumbness and prescribed alignment can be achieved. Remove obstructions before proceeding with pile driving; do not use crooked alignment to avoid interference from obstructions.
2. Initially drive steel piling with a vibratory hammer to the final tip elevation. The Contractor shall select a diesel, steam, or air-driven impact hammer sufficient to mobilize and drive the piles for the required restrike piles based on the WEAP analysis performed for each hammer proposed. Do not impact drive steel pipe fender piles. Halt vibratory driving on piles scheduled for restrikes above the indicate pile cutoff elevations as directed by the Owner.
3. Marine mammal monitoring shall be conducted during all vibratory hammer driving. Pile driving will be stopped if marine mammals are identified within the zones identified in the monitoring plan (attached as Appendix C to these specifications) meters of the pile driver. Additional requirements related to pile driving and the potential presence of marbled murrelets are provided in the attached marbled murrelet monitoring plan (Appendix D to these specifications).
4. The Owner reserves the option, based on the results of the pile driving, to modify either, or both, final driving resistance or tip penetration criteria.
5. Redrive (restrike) every fourth pile as directed by the Owner and at locations selected by the Owner. These piles are in addition to the piles designated for dynamic pile-driving analysis. Finish driving of steel piling with a diesel, steam, or air-driven impact hammer with sufficient energy to drive the piles to the tip elevations shown on the Drawings. Provide a hammer equipped with a suitable “driving head,” “driving cap,” or “helmet” fabricated of forged or cast steel, or approved alternate material, shaped to fit the particular pile being driven and designed for the particular hammer being used. The hammers to be used for driving steel piles are not directly specified. Redrive each restriking pile and drive to the tip elevations indicated on the drawings. Redrive each restriking pile after waiting a minimum of 72 hours after initial vibratory driving unless otherwise directed by the Owner. Conduct all re-driving in a manner such that full and consistent energy from the hammer is imparted to the piles and use the hammer at sufficient energy as to mobilize the pile and remain below the allowable driving stresses.
6. The number of impact hammer blows per day shall not exceed 800. A bubble curtain shall be used at all times during impact driving of steel piles. Marine mammal and marbled murrelet monitoring shall be conducted during all impact hammer driving. Pile driving will be stopped if marbled murrelet are identified within 42 meters of the pile driver and/or if marine mammals

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are sighted within the action area defined in the monitoring plan. Additional requirements related to pile driving and the potential presence of marbled murrelets are provided in the attached marbled murrelet monitoring plan (Appendix D to these Specifications).

7. Remove any pile damaged in the driving, improperly driven, or driven at an incorrect location and drive another pile in its place at no additional cost to the Owner.
8. Piles failing to meet the design capacity at the designated tip elevation may be redriven at the option of the Owner after a minimum set-up period of 72 hours.

C. Cutoff:

1. Cut off piles level and true, at the elevations indicated on the drawings. Do not allow pile cutoffs to fall into the water.

D. Pile Coating Repair:

1. Repair coating damaged during handling, storage, driving, redriving, cutoffs, or connection installation (piles to pile caps) in accordance with Section 09 96 00 – High Performance Coatings. Repair galvanized piles using zinc-based alloys as specified in Section 05 50 00 Metal Fabrications.

E. Dynamic Pile-Driving Analyses:

1. Perform four (4) dynamic PDA tests in accordance with ASTM D 4945 using a pile-driving analyzer on piles selected by the Owner at no additional cost to the Owner. Perform PDA testing for both initial driving and restriking. Wait a minimum of 72 hours between initial driving and restriking the piles. Perform the tests on production piles during the first 2 days of pile installation. Two (2) PDA tests shall be performed on a trestle piling and two (2) shall be performed on a main dock piling.
2. Use PDA instrumentation consisting of transducers and accelerometers attached to the top of the pile before driving and which are connected by wires to a PDA. Initially drive each PDA test pile to within 10-foot from tip elevation with the vibratory hammer before installing instrumentation. Place instrumentation on the pile prior to driving and perform PDA testing during all impact driving of the pile. .
3. Provide a verbal description of PDA results to the Owner at the end of the day during testing on initial driving and on restriking.
4. Provide a summary written report of the PDA results to the Owner, including distribution and magnitude of driving stresses, hammer efficiency, CAPWAP analysis, and recommendations for revision to the pile tip

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elevations and order lengths if necessary. Deliver PDA reports to the Owner within 72 hours after PDA testing on a pile is completed.

5. Perform PDA testing and get approval to proceed from the Engineer prior to production driving.

3.03 OBSTRUCTIONS

- A. Where obstructions inhibit or prevent piles from being driven in the location, to the final penetration, or to the prescribed capacity, use special methods as required, including spudding, predrilling, or other proposed means approved by the Owner, at no additional cost to the Owner. A potential debris field exists under the main dock from a previous fire and collapse. Obstructions and delays due to debris are not cause for delay or compensation from the Owner. Do not jet piles.

3.04 SUPPLEMENTS

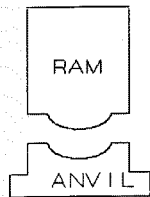
- A. The supplements, “Hammer Data Sheet” and “Pile-Driving Record” following the “END OF SECTION” marker are part of this Section.

END OF SECTION

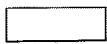
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HAMMER DATA SHEET

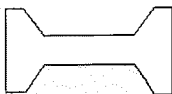
Contract No.:	Structure Name and/or No.:
Project:	
Pile Driving CONTRACTOR or Subcontractor:	
County:	Piles Driven By:



HAMMER



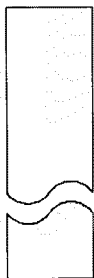
CAP BLOCK



HELMET



CUSHION



PILE

Manufacturer:		Model:	
Type:		Serial No.	
Rated Energy:		@	Length of Stroke
Modifications:			
Material:			
Thickness:		Area:	
Modulus of Elasticity - E		(psi)	
Coefficient of Restitution - e			
ALL COMPONENTS		Weight:	
Cushion Material:			
Thickness:		Area:	
Modulus of Elasticity - E		(psi)	
Coefficient of Restitution - e			
Pile Type:		Weight/ft	
Length in Leads:			
Wall Thickness:		Taper:	
Design Pile Capacity:		(Tons)	
Description of Splice:			
Tip Treatment Description:			

NOTE: If mandrel is used to drive pile, attach separate manufacturer's detail sheet(s), including weight and dimensions.

Submitted By: _____ Date: _____

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PILE-DRIVING RECORD _____ PILE NO. _____

PAGE NO. ____ OF ____

JOB NO. _____ NAME _____
 JOB LOCATION _____
 PILE LOCATION _____
 DRIVING CONTRACTOR _____

DATE _____
 JOB ENGINEER _____
 DATUM _____
 SUPT _____

Pile: Type* _____
 Length _____ Weight (lb) _____
 Penetration: _____
 Ground Elev. before Driving _____
 Ground Elev. after Driving _____
 Tip Elev. after Driving _____
 Butt Elev. after Driving Group _____

Hammer: Make and Model _____
 Stroke: Rated _____ Meas.** _____
 Weight of Ram _____ lb _____
 Strokes per Minute _____
 Steam Pressure at Boiler _____
 Driving Cap, Anvil, Helmet, etc. _____
 Weight _____ lb Description _____

(Make sketch on back)

Time: Start Driving _____ Finish Driving _____ Driving Time _____ Minutes

ft	No. of Blows	ft	No. of Blows	ft	No. of Blows	ft	No. of Blows	ft	No. of Blows	ft	No. of Blows	ft	No. of Blows	ft	No. of Blows
0		0		0		0		0		0		0		0	
1		1		1		1		1		1		1		1	
2		2		2		2		2		2		2		2	
3		3		3		3		3		3		3		3	
4		4		4		4		4		4		4		4	
5		5		5		5		5		5		5		5	
6		6		6		6		6		6		6		6	
7		7		7		7		7		7		7		7	
8		8		8		8		8		8		8		8	
9		9		9		9		9		9		9		9	

DRIVING RESISTANCE LAST FOOT

1" _____ 2" _____ 3" _____ 4" _____ 5" _____ 6" _____ 7" _____ 8" _____ 9" _____ 10" _____ 11" _____ 12" _____

Remarks*** _____

- * If wood, state kind, seasoning, and treatment. If concrete, state mix and age. If steel, state weight per foot.
- ** Note any falling off in rated speed and stroke during driving.
- *** Jetting, cause and duration of delays in driving, boulders, bark, condition of cushions, types and thickness of cushions, plumbness, twisting, banding, damage, driving shoe, wetting of pile surface, etc.

USE BACK OF SHEET

DIVISION 32 – EXTERIOR IMPROVEMENTS
Section 32 12 17 – Hot Mix Asphalt Pavement

PART 1 - GENERAL

1.01 REFERENCES

- A. Washington State Department of Transportation (WSDOT) Standard Specifications, 2016 Edition.
- B. American Association of State Highway and Transportation Officials (ASSHTO)

1.02 SUBMITTALS

- A. Submit the applicable documentation for review and approval demonstrating compliance with project requirements. Submit Manufacturer's Certificate of Compliance as applicable.
 - 1. HMA Aggregate: Gradation, source test results as defined in Section 9-03.8 of WSDOT Standard Specifications.
 - 2. Polymer Modified Asphalt Binder for HMA: Type and performance grade for binder, material, and performance history of proposed polymer modifiers.
 - 3. Tack Coat: Type and grade of asphalt.
 - 4. HMA Mix Design/Job-Mix Formula (JMF): Shall meet the requirements of WSDOT Standard Specifications Section 5-04.3(7)A1. The mix design aggregate structure and asphalt binder content shall be determined in accordance with WSDOT Standard Operating Procedure 732 and meet the requirements of Sections 9-03.8(2) and 9-03.8(6). Submit certificates of specification compliance for materials to be used. Submit certification and supporting documentation that indicates mix design has been previously approved by WSDOT for a roadway project, or used for a port container terminal project or similar within the past 12 months of when paving operations will commence. Contactor shall determine anti-strip requirements for the HMA, if any, in accordance with WSDOT Test Method T718. Recycled materials are not allowed for HMA on this project.

Formulas shall indicate physical properties of the mixes as shown by tests made by a commercial laboratory using materials identical to those to be provided on this project. JMF for each mixture shall be in effect until modified in writing by the Contractor and approved by the Engineer. Provide a new JMF for each source change. Submittal shall include all test data demonstrating the design meets the requirements of Sections 9-03.8(2) and 9-03.8(6) of WSDOT Standard Specifications. JMF submittal shall include the following.

- a. Source and proportions, percent by weight, of each ingredient of the mixture

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Section 32 12 17 – Hot Mix Asphalt Pavement

- b. Correct gradation, and the percentages passing each size sieve listed in Section 9-03.8(6) of WSDOT Standard Specifications
- c. Effective asphalt content as percent by weight of total mix
- d. Percent air voids (shall be between 3.5 – 5.0 % in lab compacted mixtures)
- e. Asphalt performance grade

1.03 QUALITY ASSURANCE

- A. HMA test requirements shall comply with the WSDOT Standard Specifications Section 9-03.8(2). Test methods for aggregates shall comply with the WSDOT Standard Specifications Section 9-03.20.
- B. Inspection and Testing: Sampling and testing of materials and installations shall be in accordance with Division 1 of these specifications and shall be performed by the Contractor at no cost to the Port. Tests, testing methods, and results shall be as specified in the pertinent sections of the WSDOT Standard Specifications, and this specification.
- C. Materials and work shall be performed in accordance with and shall meet the requirements of the pertinent sections of the WSDOT Standard Specifications, including Section 5-04.
- D. Legally dispose of all waste material produced as a result of the Contractor's operations. The cost of disposal for all waste will be considered incidental to the cost of construction and no additional payment will be made for performing this work.
- E. HMA courses shall not be constructed when the underlying course contains free surface water. Unless otherwise directed, asphalt courses shall not be constructed when the average surface temperatures are less than that specified in the table included in Section 5-04.3(16) in the WSDOT Standard Specifications, or as recommended by the polymer modified binder manufacturer.
- F. Truck tickets for HMA shall clearly state mix number or other information that corresponds directly with submittal documentation. If truck ticket cannot be related back to submittal information, asphalt will not be allowed to be placed and Contractor will return material at his own expense – no exceptions.

1.04 ENVIRONMENTAL CONDITIONS

- A. Weather limitations shall be in accordance with WSDOT Section 5-04.3(16). Place HMA only during dry weather and on dry surfaces – no exception. HMA placed on wet surfaces and/or during rainfall are subject to removal and replacement at Contractor's expense.

DIVISION 32 – EXTERIOR IMPROVEMENTS
Section 32 12 17 – Hot Mix Asphalt Pavement

1.05 CONSTRUCTION EQUIPMENT

- A. Calibrated equipment, such as scales, batching equipment, spreaders and similar equipment, shall have been recalibrated by a calibration laboratory within 12 months of commencing work. Equipment shall also be in accordance with WSDOT Section 1-05.9.
 - 1. Mixing Plant
 - a. Mixing plant shall be in accordance with WSDOT Section 5-04.3(1).
- B. Paving Equipment
 - 1. Hauling Equipment
 - a. Hauling equipment shall be in accordance with WSDOT Section 5-04.3(2).
 - 2. Hot Mix Asphalt (HMA) Pavers
 - a. Pavers shall be in accordance with WSDOT Section 5-04.3(3).
- C. Rollers
 - a. Rollers shall be in accordance with WSDOT Section 5-04.3(4).

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials shall be in accordance with WSDOT Section 5-04.2.

2.02 TACK COAT

- A. Tack coat shall be emulsified asphalt, CSS-1, in accordance with WSDOT Section 9-02.1(6).

2.03 AGGREGATES

- A. General Requirements
 - 1. General requirements shall be in accordance with WSDOT Section 9-03.8(1). Aggregates shall be HMA Class 1/2 inch.
- B. Test Requirements
 - 1. Aggregates for HMA shall be in accordance with test requirements in WSDOT Section 9-03.8(2).

DIVISION 32 – EXTERIOR IMPROVEMENTS
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- C. Grading
 - 1. Grading requirements shall be in accordance with WSDOT Section 9-03.8(3).
- D. Blending Sand
 - 1. Blending sand shall be in accordance with WSDOT Section 9-03.8(4).
- E. Mineral Filler
 - 1. Mineral filler, when used, shall be in accordance with WSDOT Section 9-03.8(5).
- F. HMA Proportions of Minerals
 - 1. Proportions of materials shall be in accordance with WSDOT Section 9-03.8(6).
- G. HMA Tolerances and Adjustments
 - 1. Job mix tolerances and adjustments shall be in accordance with WSDOT Section 9-03.8(7).

2.04 ASPHALT CEMENT BINDER

- A. Polymer-Modified Asphalt Binder shall conform to WSDOT Sections 9-2.1(4) and AASHTO MP 1a Performance Grade (PG) 70-22. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Engineer. The supplier is defined as the last source of any modification to the binder. Polymer-modified asphalt binder shall exhibit the following binder-enhancement characteristics:
 - 1. Higher stiffness at high-service temperatures, resulting in reduced levels of rutting and shoving
 - 2. Lower stiffness and faster relaxation properties at low service temperatures, resulting in reduced thermal cracking
 - 3. Increased adhesion between the asphalt binder and the aggregate in the presence of moisture, resulting in a reduced likelihood of stripping
 - 4. Improved aging characteristics, which help delay the deleterious impacts of oxidation and provide a more durable pavement

DIVISION 32 – EXTERIOR IMPROVEMENTS
Section 32 12 17 – Hot Mix Asphalt Pavement

2.05 HMA PAVEMENT CLASS

- A. HMA pavement shall meet all the applicable WSDOT requirements for HMA Class 1/2 inch. The HMA shall be designed for greater than 30M ESALs, 125 gyrations, in accordance with Section 9-03.8(2).

2.06 MIX DESIGN

- A. The mix design will be the initial JMF. The asphalt mix shall be in accordance with WSDOT Section 5-04.3(7)A.

- 1. Adjustments to JMF

- a. The JMF for each mixture shall be in effect until a new formula is approved in writing by the Engineer. Should a change in sources of any materials be made, a new mix design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the JMF within the limits specified below to optimize mix volumetric properties. Adjustments to the JMF shall be limited to plus or minus 3 percent on the 1/2 inch, No. 4, and No. 8 sieves; plus or minus 1.0 percent on the No. 200 sieve; and plus or minus 0.40 percent binder content. If adjustments are needed that exceed these limits, a new mix design shall be developed.

2.07 PROPORTIONS OF HMA MATERIALS

- A. The materials of which HMA pavement is composed shall be of such sizes, gradings, and quantities that, when proportioned and mixed together, they will produce a well-graded mixture within the requirements listed in the WSDOT Standard Specifications
- B. The actual proportions of the several components to be used in the production of the asphalt concrete mixture shall be within the WSDOT specified limits to provide a pavement having surface texture, air voids, Voids in Mineral Aggregate (VMA), and Voids Filled with Asphalt (VFA) values satisfactory to the Engineer. The proportions so fixed shall be changed only by his order.
- C. Selection of asphalt content shall achieve an air void content between 3.5 to 5 percent in laboratory compacted mixtures, which is purposely a more restrictive range than allowed by WSDOT. Asphalt content should not be arbitrarily increased in construction to facilitate compaction, minimize segregation, or for any other reason. Do not begin production until the Engineer has approved mix designs.

2.08 JOINT SEALER

- A. Joint Sealer shall be in accordance with Section 9-04.2(1).

DIVISION 32 – EXTERIOR IMPROVEMENTS
Section 32 12 17 – Hot Mix Asphalt Pavement

PART 3 - EXECUTION

3.01 GENERAL

- A. HMA construction requirements shall be in accordance with WSDOT Section 5-04.3.

3.02 SURFACE PREPARATION

- A. General: Surface preparation shall be in accordance with WSDOT Standard Specifications Section 5-04.3(5)A.
- B. Soil Residual Herbicide: Apply soil residual herbicide in landside areas to be paved in accordance with WSDOT Section 5-04.3(5)D.
- C. Clean pavement surfaces in accordance with WSDOT Standard Specifications Section 5-04.3(5)A prior to applying tack coat, placing HMA overlay, etc.
- D. Prior to placing HMA overlay, apply tack coat over asphalt pavement and/or structure surfaces as directed by the Engineer. The application rate for tack coat will be determined by the Engineer but shall not exceed 0.15 gallon per square yard. Areas to receive tack coat must be approved by the Engineer prior to application.
- E. Apply joint sealer to the edges of new paving joints, utility structures, etc., as directed by the Engineer.
- F. Pavement saw cutting shall be done as indicated on the plans and as directed by the Engineer.

3.03 PLACING HMA PAVEMENT

- A. Spreading and Finishing:
 - 1. Spreading and finishing of HMA shall be in accordance with Section 5-04.3(9) of WSDOT Standard Specifications.
- B. Compaction of Mixture:
 - 1. Compaction shall be in accordance with Section 5-04.3(10) of WSDOT Standard Specifications. .
- C. Joints:
 - 1. Joints shall be in accordance with Section 5-04.3(12) of WSDOT Standard Specifications. Vertical contact surfaces of previously constructed sections or existing pavement shall be painted with a tack coat just before placing fresh HMA.
- D. Line, Grade, and Thickness:

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1. In general, the slope of the finished grade shall match existing conditions where HMA overlay is to be placed, with the exception of transition areas where railroad track crossings are located and at the north and south ends of construction. Transition areas shall be gradually sloped to finish grade as shown on drawings such that overlay matches and is flush with existing grade at paving boundaries.

E. HMA:

1. Mix, handle, batch, haul, place, roll, and compact HMA pavement in accordance with the applicable sections of the WSDOT Standard Specifications. Place the material to the dimensions indicated on the plans and as directed by the Engineer. Minimum compacted layer thickness shall be 1.80 inches. The maximum compacted layer thickness when placed as the final wearing course shall be 3.6 inches. The maximum compacted layer thickness when placed as one of the base layers shall be 4.2 inches.

3.04 FIELD QUALITY CONTROL

- A. Contractor Sampling of Pavement and Mixture: Take field samples for thickness and density of the completed pavements. Furnish tools, labor, and material for samples and satisfactory replacement of pavement. Take samples and tests at not less than frequency specified hereinafter and at the beginning of plant operations, for each day's work as a minimum, each change in the mix or equipment, and as directed by the Engineer.
- B. Testing: Perform the following tests:
 1. Compaction/Density: WSDOT Sections 5-04.3(8)A and 5-04.3(10)A and B.
 2. Thickness: Determine thickness of core samples taken for the field density test. Samples shall be taken a minimum of one every 500 square feet of pavement area or as directed by Engineer. The maximum allowable deficiency at any point shall not be more than 1/4 inch different than the thickness for the indicated course. Average thickness of course or of combined courses shall be not less than the indicated thickness. Where a deficiency exceeds the specified tolerances, correct each such representative area or areas by removing and replacing the deficient pavement. Skin patching as a method of correcting thin/low areas is prohibited. Additional samples shall be taken to establish the extent of pavement having deficient thickness to the satisfaction of the Engineer, and additional samples shall be done at no additional cost to the Port.
 3. Smoothness: Surface smoothness shall be in accordance with Section 5-04.3(13) of WSDOT Standard Specifications.
 4. Finish Grades: Finish grades of each course placed shall not vary from the previous existing grade plus HMA overlay thickness by more than 1/4 inch. Finished surface shall be tested to ensure proper surface runoff will occur

DIVISION 32 – EXTERIOR IMPROVEMENTS
Section 32 12 17 – Hot Mix Asphalt Pavement

without ponding to the satisfaction of the Engineer. Where unacceptable low spots are identified, Contractor shall remove the asphalt section in low area and replace with adjusted grades to encourage positive drainage. Ponding areas caused by deficient pavement thickness shall be reconstructed at no additional cost.

5. Finish Surface Texture of Wearing Course: Visually check final surface texture for uniformity and reasonable compactness and tightness. Final wearing course with a surface texture having undesirable irregularities, such as segregation, cavities, pulls or streaks, indentations, ripples, or lack of uniformity shall be removed and replaced.
- C. Do not allow vehicular traffic of any type on pavement for a minimum of 48 hours or until surface temperature has cooled to at least 120 degrees F, whichever is longest. Measure surface temperature by approved thermometers or other satisfactory methods.

END OF SECTION

DIVISION 35 – WATERWAY AND MARINE CONSTRUCTION

Section 35 20 23 - Dredging

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

The provisions and intent of the Contract, including the General Conditions, Supplemental Conditions, and General Requirements, apply to this work as if specified in this section. Work related to this section is described in the following sections:

- A. Section 01 71 23 – Field Engineering
- B. Section 01 35 29 – Health, Safety and Emergency Response Procedures
- C. Section 01 45 00 – Quality Control
- D. Section 02 32 00 - Geotechnical Investigations
- E. Section 02 41 00 – Demolition
- F. Section 31 00 00 – Earthwork

G. DESCRIPTION OF WORK

The work consists of dredging approximately 208,000 cubic yards (CY) of material including the Allowable Overdredge Depth on the south side of Neah Bay, near the existing commercial fishing dock. The dredged material will be placed according to the Dredge Material Management Plan (DMMP).

All materials within the project area shall be dredged using water-borne mechanical dredging equipment. All material to be dredged has been determined suitable for shore nourishment disposal. All material shall be transported by hydraulic pipeline to the DMMP disposal site as described in Section 01 10 00 – Summary and as shown on the drawings.

The Contractor shall furnish all labor, materials, tools, equipment and supervision necessary to mechanically dredge the areas shown in the project drawings to the required elevations and grades, dispose of the materials, and dress the post-dredge slope, as described on the drawings and these specifications and in strict compliance with the permits.

H. Construction Period

The work described in the following paragraphs shall be performed during the in-water work periods described in Section 01 10 00 - Summary.

I. Dredging and Disposal

Dredging Prism: The dredge area above which the Contractor is required to remove all material, including associated side slopes that slough into the dredge area (Slough Material), as shown on the Plans. The Contractor shall be responsible for achieving the required dredge elevations at completion of the Project. Progress surveying shall be conducted by the Contractor in order to ensure the required elevations are achieved prior to final completion. Compliance

DIVISION 35 – WATERWAY AND MARINE CONSTRUCTION

Section 35 20 23 - Dredging

with required dredge elevation will be verified by the Contractor provided post-dredge surveying.

Dredging tolerance is +0/-2 feet for all dredging areas. No payment will be made for dredging beyond the 1 foot dredge allowance noted on the drawings.

The Contractor shall be responsible for dredging any deposition in the channel and bay that occurs from spillage or migration of suspended material during dredging as determined based on pre- and post-construction surveys.

The finished dredge slopes shall be configured as shown on the drawings. Over-excavating the slopes is not permitted. Excessive dredging of the slopes shall be repaired by backfilling with native materials to achieve the required slope grade at no cost to the Port.

Disposal at Dredged Material Management Program (DMMP) Disposal Site: The dredged material shall be loaded onto bottom-dump barges and transported to the Washington Department of Natural Resources (DNR) Commencement Bay Open Water Disposal Site for disposal ("DMMP site"). Refer to paragraph 1.07.A.3.b and c for limitations relative to disposal activities. Debris including old concrete pile cut offs shall not be disposed of at the DMMP Disposal Site and shall be disposed of at a Port approved upland landfill facility. Concrete pile cut offs shall be recycled at the Port recycle site.

1.02 DEFINITIONS

A. Debris:

Debris is defined as any solid waste materials other than sediment excavated as part of the dredging operations, such as logs, wire, cable, steel bands, anchors, lumber, trash, timber piles, concrete, concrete pile cutoffs, ecology blocks etc. Any dredged materials that do not pass through a grid opening 24-inches by 24-inches square are considered debris and shall not be disposed of at the DMMP disposal site. Debris shall be disposed at a Port approved upland landfill facility and in accordance with applicable local, state and/or federal regulations. Concrete pile cut offs and ecology blocks shall be recycled at the Port recycle site.

B. Required Dredge Elevation:

The minimum elevation within a dredge area that the Contractor is required to remove all material above, including associated side slopes.

C. Allowable Overdepth Dredging:

An additional increment of one (1) foot below the required dredge elevation as noted within these specifications and on the drawings will be paid for to account for equipment tolerance. The maximum allowable overdredge is 2 feet below the required dredge elevation. Dredging beyond the 1 foot allowable overdredge elevation will not be paid for.

DIVISION 35 – WATERWAY AND MARINE CONSTRUCTION

Section 35 20 23 - Dredging

D. Excessive Dredging:

Dredging of material outside of the dredging limits and/or greater than 2 feet below the required dredge elevation is excessive dredging. The contractor will not be paid for excessive dredging and will be responsible for any fees and or fines incurred as a result of disposing excessive dredge materials at the DMMP disposal site.

E. Side slope:

The side slope is the slope to be excavated between the outer edge of the dredge cut at design depth (toe) and the intersect point at original ground level (top of cut). The design configurations for side slopes are 3H:1V.

F. Pay Volume:

Pay volume is the quantity of dredged material calculated on an in-situ basis using pre- and post-dredge surveys.

1.03 PRE-CONSTRUCTION SUBMITTALS

A. DREDGING AND DISPOSAL WORKPLAN

The Contractor shall submit a detailed written Dredging and Disposal Work Plan (Workplan) prepared by a Port-approved Consultant with at least 5 years of experience preparing dredge and disposal plans for similar projects. The plan must be submitted to the Engineer at the pre-construction meeting and at least three weeks prior to proposed commencement of dredging at the project site. Dredging shall not begin until: 1) the Plan has been reviewed and approved by the Port and applicable regulatory agencies; 2) agency-required notifications have been completed in accordance with the permits; and 3) the Contractor schedules and attends a Pre-dredge conference with the U.S. Army Corps of Engineers (USACE) and other permitting agencies as required by the permits, and receives agency approval to begin dredging as a result of that conference. The Workplan must be submitted to the USACE at least two weeks prior to the pre-dredge conference.

At a minimum, the Workplan shall contain the following:

1. Work Sequence and Equipment
 - a) Order in which the work is to be performed indicating the work sequence.
 - b) A construction schedule shall be prepared that identifies the timing and sequencing of the major activities and milestones of the construction. These shall include but not be limited to mobilization, start of dredging, duration of dredging and disposal, demobilization, and cleanup.
 - c) Number, types and capacity of equipment to be used, including names of dredge(s) and other marine vessels to be used.
 - d) Hours of operation. No night disposal is allowed without the permission of USACOE and Makah Tribe of Indians.
2. Means and Methods for Dredging, Transport, Handling, and Disposal
 - a) Methods, procedures and equipment to be used for dredging.
 - b) Methods, procedures and equipment to be used for transport and disposal of sediment at the DMMP site. The Workplan shall clearly indicate whether barges will be towed or pushed to the disposal site.
 - c) Methods to be used to track the position of the barge during disposal operations.
 - d) Methods to be used for record keeping related to transport and disposal of suitable sediment at designated disposal sites, including

DIVISION 35 – WATERWAY AND MARINE CONSTRUCTION

Section 35 20 23 - Dredging

- record keeping procedures required by DNR for disposal of dredge materials at the DMMP site.
 - e) Methods, procedures and controls to protect existing Port facilities against damage.
 - f) Methods, procedures and controls to be used to segregate, handle, transport and dispose of debris to an appropriate disposal facility in accordance with applicable regulations.
3. Positioning, Surveys, Environmental Monitoring and Spill Containment
- a) Procedures and equipment for coordinating and performing hydrographic progress surveys.
 - b) Layout of the work and positioning of dredge equipment.
 - c) Procedures and equipment for positioning dump barges at the designated disposal sites. Positioning equipment must be capable of tracking the position of the barge during the tow and dumping operations if it is pushed or towed to the disposal site.
 - d) Notification procedures to United States Coast Guard (USCG) for barge disposal at the DMMP Site and other operations within the Blair Waterway.
 - e) Water quality monitoring and notification procedures when there is a water quality exceedence. This discussion will be prepared as a separate stand-alone section within the Workplan. Water Quality Monitoring Plan requirements are described in Section B.
 - f) Environmental monitoring, including procedures for emergency spill containment and removal operations.
4. Debris Removal
- a) Procedures and equipment for collecting and disposing of submerged and floating debris encountered during dredging operations.
 - b) Procedures and equipment for offloading, stockpiling (if necessary), transport, recycling and /or disposal of debris and riprap greater than 24 inches separated from the dredged material. This shall include methods to prevent spillage of material back into the water and cleanup of the barge and materials to allow for proper disposal.
5. Prevention of Interference with Navigation and Tribal Fishing
- a) Notification and procedures to be used for moving dredging equipment to accommodate inbound and outbound commercial vessel traffic using the surrounding waterway.

DIVISION 35 – WATERWAY AND MARINE CONSTRUCTION

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- b) Notification and procedures to be used for moving dredging equipment to accommodate tribal fishing activities within Neah Bay.
 - 6. Contractor Quality Control Plan
 - a) Organization chart with key personnel and supervisory chain. At a minimum, the Contractor shall identify the following key personnel: superintendent, quality assurance representative, health and safety representative, dredge operator(s), water quality monitoring lead (or firm that the Contractor has hired to conduct monitoring), hydrographic survey lead (or firm that the Contractor has hired to perform daily progress surveys), and other key personnel deemed necessary by the Contractor for the successful implementation and completion of this work.
 - b) Quality control methods and procedures
- B. Water Quality Monitoring Plan

As a preconstruction submittal, the Contractor shall submit to the Engineer a detailed, written project Water Quality Monitoring Plan, in conformance with the specifications. The Plan shall be prepared by a qualified Consultant with at least 5 years of experience preparing Water Quality Monitoring Plans for similar projects. The plan must be reviewed and approved by the Port's Engineer prior to starting any work. At a minimum, the Water Quality Monitoring Plan shall contain the following:

 - 1. The Contractor shall describe their proposed methods and procedures for monitoring the water quality that conform with the Section 401 Water Quality Certification, and procedures for notifying the Port and Department of Ecology if exceedances occur.
 - 2. The personnel and equipment that will be used to monitor the water quality during the course of the project.
 - 3. Water quality monitoring shall occur twice per day for the first week of operations of each new activity. Monitoring will occur during the peak flood and ebb tides at a distance specified by the 401 Water Quality Certification, then once per week thereafter. The water quality will be measured for the conventional parameters required in chapter 173-201A WAC.
 - 4. Water quality notification procedures if there is a water quality exceedance.
 - 5. Best management practices to prevent water quality exceedances.
 - 6. Contingency measures to be implemented if water quality violations occur.
 - 7. At a minimum, the Contractor shall submit Water Quality reports to the Port on a weekly basis.

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1.04 SITE CONDITIONS

A. Character of Materials

Subsurface investigation reports are available as reference documents including:

1. "Geotechnical Engineering Report: Proposed Commercial Dock Replacement, Port of Neah Bay, Neah Bay, Washington" by Landau Associates, Inc. dated October 17, 2013.
2. "Makah Marina Project/Neah Bay", by Northwestern Territoties, Inc., dated 18 July 1995.

The Contractor shall satisfy itself regarding the nature of materials present at the site, including review of the referenced documents as noted in items 1 and 2 above, prior to bidding. The type of materials encountered at the site may vary from the conditions described in the referenced reports. Variations in the nature of the materials at the site will not be considered as basis for claims due to differing site conditions.

Hard material in its natural state is defined as material requiring blasting, and includes boulders or fragments too large to be removed in one piece by the dredging equipment. With the exception of riprap and concrete debris, hard material in its natural state is not anticipated to be encountered under this contract.

B. Riprap and Debris

Riprap that does not pass through a grid opening 24-inches by 24-inches square and any other debris that may be encountered during the work shall be disposed of at an appropriate off-site location in accordance with applicable local, state and/or federal regulations. Costs for removal and disposal of such debris and riprap is incidental to the contract and is considered part of the bid price for dredging and disposal.

C. Man-Made Obstructions

The Contractor may encounter man-made obstructions during the dredging such as riprap slope facing, existing piles, pile cutoffs or debris as described in paragraph 1.03A above. Encountering such obstructions shall not be the basis for extra payment by the Port. See Section 02 41 00 – Demolition.

D. Environmental Protection

The Contractor shall protect the site in accordance with the applicable sections of the General Requirements presented in Division 01 of these Specifications.

E. Inherent Delays

The Contractor shall anticipate inherent delays while conducting dredging operations in the waterway or disposal operations in Neah Bay. Inherent delays

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include but are not limited to commercial shipping traffic, coast guard activities, and tribal fishing activities. Commercial shipping traffic, coast guard activities, and tribal fishing activities shall have precedence over the Contractor's activities and will require them to stop, move, adjust, and/or slow down to accommodate vessel movement. The bid prices shall include allowances for such inherent delays.

F. Interference with Navigation

1. Neah Bay is an active navigation corridor used for coast guard activities, small vessel traffic, and periodic tribal fishing activities. These activities shall take priority over the Contractor's operations. The Port's tenants and other entities using the waterway must have access through the project site for the duration of the construction contract. The Contractor shall conduct its operations in a manner that will minimize interference with those activities. In the event that the Contractor's construction equipment (dredge, dump scows, tug, barges, workboats, anchors, lines, etc.) obstructs the navigable waterway so as to hinder movement of commercial vessels, the equipment shall immediately be moved to facilitate the shipping activity.
2. The Contractor shall make allowance in its construction schedule for delays or interruptions due to vessel movement in the waterway.
3. The Contractor shall coordinate with the Port and Coast Guard in the event of interference from tribal fishing activities. The Contractor shall make allowance for inherent delays from tribal fishing in its bid.
4. Any damage to the Contractor's equipment in navigation lanes due to the Contractor's failure to move when required shall be at the Contractor's sole risk and expense.

G. Protection of Existing Facilities

1. Any damage to the existing commercial fishing dock and/or other existing facilities caused by the Contractor's operations, as determined by the Engineer, shall immediately be repaired to the pre-project condition at the Contractor's expense.
2. The Contractor's Dredging and Disposal Workplan shall include methods for the above protections.
3. Condition Survey of Existing Structures: The Contractor and Engineer shall review and verify condition of fender systems adjacent to their work areas prior to beginning work to ascertain existing conditions. Any damage documented as a result of the Contractor's activities will be repaired at no additional cost to the Port.

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H. Cultural Resource Monitoring

Cultural resource monitoring shall occur during project dredging in accordance with Section 01 10 00 – Summary. The Contractor shall coordinate with cultural resource monitors during dredging operations, and shall provide a radio for communication between the dredge operator and the cultural resource monitor. Contractor shall provide a suitable location for the monitor that ensures their safety.

I. Security Concerns

Due to heightened security concerns, the Contractor shall give notice and receive required approval from the Engineer prior to berthing at any location in Neah Bay aside from the public marina. The Contractor shall notify the Coast Guard as required to comply with Coast Guard and Port regulations for operating within Neah Bay.

1.05 MISPLACED MATERIAL

Should the Contractor, during the execution of the work, lose, dump, throw overboard, sink or misplace any material, dredge, barge, machinery, or appliance, the Contractor shall promptly recover and remove the same. The Contractor shall give immediate verbal notice, followed by written confirmation, of the description and location of such obstructions to the Engineer and shall mark and buoy such obstructions until they are removed. Should the Contractor refuse, neglect, or delay compliance with this requirement, such obstructions may be removed by the Port or its agents, and the cost of such operations may be deducted from any money due to the Contractor, or may be recovered from the Contractor's bond. The liability of the Contractor for the removal of a vessel wrecked or sunk without his fault or negligence shall be limited to that provided in Sections 15, 19, and 20 of the River and Harbor Act of 3 March 1899 (33 U.S.C. 410 et seq.). The Contractor shall be responsible for any fees, fines, penalties or other costs resulting from misplaced materials. The Contractor shall also be responsible for removing accumulated spilled dredged materials in the waterway even if the material is located beyond the project dredging limits. Surveys shall extend at least 200 feet east of the west channel line to confirm that dredged material has not been re-deposited in the channel.

1.06 DREDGING AND DISPOSAL REGULATORY COMPLIANCE

A. Permits and Compliance. The Contractor shall be responsible to adhere and conform to all applicable provisions, conditions and requirements of the permits:

1. Permits that include conditions for dredging in Neah Bay, disposal of dredged materials, and associated activities are provided in Appendix B of these Specifications.
2. The Contractor is responsible for notifying various regulatory agencies prior to commencing dredging, as required by the project permits. These

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notifications typically include the USACE and the Washington Departments of Natural Resources, Ecology and Fish and Wildlife. Examples of typical notification requirements are shown in the example permits appended to these specifications.

3. The Port will obtain Washington State Department of Natural Resources (DNR), Disposal Site Use Authorization to Utilize Open Water Disposal Site prior to the start of construction:

- a) Upon execution of this contract, the Port will endorse the DNR "Open Water Disposal Site Use Authorization" permit as "Grantee".
- b) Operational requirements prohibit discharge operations at the DMMP site from dusk to dawn on weekdays, weekends and holidays. Any proposed night time disposal operations must be coordinated with and approved by the U.S. Army Corps of Engineers' Enforcement Section, Regulatory Branch. The Contractor shall request approval to work outside the above work windows at the pre-disposal conference. Dumping at the Saltchuck site from dusk to dawn requires approval by the Port.

The Contractor is responsible for requesting approval for nighttime disposal operations from the U.S. Army Corps of Engineers (USACE). Nighttime disposal shall not commence until written approval from the USACE is obtained.

- c) Within 10 days of the commencement date, as noted in the "Notice to Proceed", the Contractor shall complete the DNR "Plan of Operation for Use of Open Water Disposal Site" certification form and submit to:

Washington Department of Natural Resources

Aquatic Resources Division

DMMP Coordinator

P.O. Box 47027

Olympia, Washington 98504

The Contractor shall comply with all DNR disposal regulations and reporting requirements, including but not limited to the following:

- 1) The Contractor shall become familiar with and adhere to DNR disposal site discharge procedures and reporting requirements.
- 2) The Contractor shall verify and record the barge location prior to each discharge, including the horizontal distance from the center of the disposal site. A positioning device must be located on the dump barge if the barge is towed to the dump

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site so the barge position can be determined at the time of dumping.

- 3) The Contractor shall complete "Disposal Site Use Reports and monthly summaries" as required by DNR.
 - 4) The DNR reporting week begins on Monday and ends the following Sunday. Site Use Report forms must be filled out in their entirety and submitted to the Engineer by 12 PM on Monday of the week following the week being reported.
 - 5) Monthly Reporting Summary forms must be completely filled out and submitted to the Engineer with a transmittal letter, no later than the 19th day of the month following the month being reported.
 - 6) Failure to provide forms in accordance with the above schedule may result in suspension or termination of the Site Use Authorization. The Contractor will be held responsible and liable for any damages, penalties, and/or delay costs incurred by the Port as a result of suspension or termination of the Site Use Authorization.
 - 7) The Contractor shall provide the Engineer with the originals of all disposal site use reports and forms to be submitted to DNR.
- d) The Port will pay directly to DNR all fees associated with the permit and dumping operation except that Contractor shall pay for any penalty or damage fees imposed by DNR for material dumped off site or other unauthorized disposal operations.

- B. Any conflicts between these contract specifications and issued permits will be brought to the attention of the Engineer. Nothing whatsoever shall be deemed to authorize violation of project permits.

1.07 ACCESS TO CONTRACTOR'S EQUIPMENT

The Contractor shall grant access to its dredge derrick, barge(s), tug(s), and all other equipment mobilized for the project for inspection purposes, to the Port or to any Port-designated representative, and to representatives of the State and Federal agencies issuing the aforementioned permits.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 ORDER OF WORK

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- A. The Contractor shall remove and dispose of sediment within the project area to the required elevations and grades as shown on the Drawings during the in-water work period described in Section 01 10 00 - Summary. All required dredging and slope protection placement shall be completed 15 days prior to the end of the in-water work period to allow sufficient time to conduct and review the post-dredge and slope protection surveys and to perform any required cleanup and/or high spot removal prior to the end of the in-water work period.
- B. Once required dredging is completed, the Contractor shall conduct its post-dredge survey and submit this survey to the Port for determination as to whether required elevations and grades have been met. If the required elevations and grades are met, then the Contractor may proceed with placement of slope protection.
- C. The pre-dredge and post-dredge surveys shall extend to a minimum of 200 feet beyond the dredging prism. The Contractor shall be responsible for maintaining existing bottom depths within the 200-foot zone and shall remove any high spots or accumulations of material and restore the area within the 200-foot zone to the pre-dredge condition, at no cost to the Port.
- D. If high spots remain above the required dredge elevations and grades on the slopes or keyways, the Contractor shall remove such high spots to the satisfaction of the Engineer, at no cost to the Port.
- E. All in-water work shall be completed by the end of the in-water work period described in Section 01 10 00 – Summary.

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3.02 SURVEYS

A. Progress Surveys

1. The Contractor shall provide daily (or less frequent as approved by the Engineer) sounding cross-sections of the previous day's work. See Section 01 71 23 for trackline and sounding spacing requirements.
2. The survey data will accompany the daily CQC report submitted to the Engineer.
3. Survey results may be used to adjust dredging procedures to assure that the configuration of the dredging site conforms to the drawings and permit requirements. The Engineer may direct the Contractor to adjust its dredging procedure to assure compliance with the drawings and permit requirements, at no additional expense to the Port.
4. For progress dredge surveys, the Contractor shall compute quantities to the nearest cubic yard based on the progress sounding lines surveyed, the pre-dredge survey, and the dredging section indicated on the contract drawings. Tabular summaries shall be submitted to show required elevation, allowable overdepth, and total dredging quantities both incremental and cumulative per 25-foot stations or less of the channel length involved.

B. Pre- and Post-Dredge Surveys

1. Pre- and post-dredge surveys shall be referenced to existing horizontal and vertical survey control monuments and survey control baselines used during project design. See Section 01 71 23 – Field Engineering for trackline and sounding spacing requirements. The pre- and post-dredge survey limits shall extend a minimum of 200 feet east of the west channel line

2. Pre-Dredge Survey

The pre-dredge survey shall be performed within 4 weeks of beginning the dredging operations. This pre-dredge survey will be the basis for payment quantities. The survey shall be provided to the Port for their review and approval no later than 7 days prior to the start of dredging activities. The survey shall be provided to the Port in AutoCAD 2016 or later format. The survey must be approved prior to the start of dredging activities. The Port will review and provide notice to the Contractor of the acceptability of the survey within 5 business days after receiving the survey. See Section 01 71 23 – Field Engineering for additional details.

The Contractor's pre-dredge survey will be compared to the Port's pre-dredge survey, and the Contractor shall perform additional spot surveys if required to resolve any significant differences. The Port will determine which survey will become the base line survey for all dredging work.

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3. Final Post-Dredge Survey

Upon completion of dredging to final grades a post-dredge survey shall be performed. The survey shall be provided to the Port for their review and approval no later than 2 days after the completion of the keyway excavation and slope dredging activities. The survey shall be provided to the Port in AutoCAD 2016 or later format. The survey must be approved prior to the start of slope protection placement activities. The Port will review and provide notice to the Contractor of the acceptability of the survey within 24 hours. The Port will review the final post-dredge survey to determine whether all dredging has been satisfactorily completed and for payment purposes. If all of the required dredging has not been satisfactorily completed, as determined by the Engineer, the Contractor shall correct the deficiencies indicated in the survey and the area(s) will be rechecked by the Engineer. The cost for Contractor re-survey will not be paid by the Port and will be performed at the Contractor's own cost. See Section 01 71 23 – Field Engineering for more details.

4. The pre- and post-dredge surveys will be used as the basis for determining final pay volumes and acceptance of the work. Final pay volumes will be calculated by the Contractor within 60 days using digital terrain modeling methods to generate pre- and post-dredged surfaces, computing pay volumes to the nearest cubic yard. The Contractor shall provide a copy of the bathymetric soundings and the quantity calculations to the Engineer for review and approval.

3.03 CONDUCT OF WORK

A. Layout of Work

1. The Contractor shall establish an accurate method of horizontal and vertical control before dredging begins.
2. The proposed method and maintenance of the horizontal control system shall be subject to the approval of the Engineer and if, at any time, the method fails to provide accurate location for the dredging operation, the Contractor may be required to suspend its dredging operations.
3. The Contractor shall layout its work from horizontal and vertical control points indicated on the drawings and shall be responsible for all measurements taken from these points. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, range markers, transponder stations and labor as may be required to layout the work from the control points shown on the drawings.
4. It shall be the responsibility of the Contractor to maintain all points established for the work until authorized to remove them. If such points are destroyed by the Contractor or disturbed through its negligence prior to an

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authorized removal, they shall be replaced by the Contractor at its own expense.

B. Positioning Equipment and Methods

The Contractor shall employ a suitable method to locate and control horizontal dredging position that may include: Differential Global Positioning System (DGPS); sextant angle triangulation; theodolite/transit angle triangulation; theodolite/transit angle EDM distance intersection triangulation; range-range electronic positioning system; or range-azimuth electronic positioning system. Observation data will be recorded in standard surveying field book format. Automated position determinations will be accomplished by standard trilateration procedures whereby lengths to two or more shore-based control points are electronically measured by either time delay or phase comparison techniques. Observed ranges are corrected for scale, calibration, and/or automatic variations when present. Accuracy of dredge position shall be within +/- 3 feet.

How to establish and maintain Vertical Control?

C. Dredging

1. Dredging shall be performed using **mechanical methods only**.
2. The Contractor shall excavate the dredge prism to the lines, grades, slopes and elevations shown on the drawings. Each pass of the clamshell bucket shall be complete and there is to be no stockpiling of sediment in the water. Leveling of the completed dredging surface by dragging a beam or sweeping the clamshell bucket will not be permitted unless approved by the Port.
3. The Contractor shall pay particular attention to the conditions of issued permits, applicable regulations and authorizations requiring minimizing turbidity and loss of resuspended sediments during dredging and transport operations and adherence to water quality requirements.
4. The Contractor shall make the cut including the slope and keyway, to the lines and grades shown on the plans. No undercutting (i.e., excessive dredging) at toes of cuts shall be allowed. Dredging from the top down is required to prevent uncontrolled slope failures that may occur as a result of excessive undercutting at the toe of the excavation.
5. Upon completion of the work, but not until final acceptance by the Engineer, the Contractor shall promptly remove the dredging plant and associated equipment, including ranges, buoys, piles, and other markers or obstructions placed by the Contractor in the water or on shore.

3.04 TRANSPORTATION AND DISPOSAL OF DREDGED MATERIALS

A. **Use of Commencement Bay DMMP Disposal Site**

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The Port will obtain a Disposal Site Use Authorization from DNR for disposal of suitable sediments at the DMMP site. Suitable material shall be loaded onto bottom-dump haul barges and transported to the DMMP Site. For DNR reporting requirements, the barge dump will be considered to start at initiation of bottom-dump or split hull opening. The end of the dump will be that time when all materials have exited the barge. No materials shall be dumped unless approved positioning equipment is operational. Overflow will not be permitted from haul barges at any time. The haul barges must have tightly sealing doors and compartments to minimize leakage of material during transit. Any barge that exhibits more than minor leakage shall be removed from the equipment utilized on this project until satisfactory repairs are made. All DNR disposal fees will be paid directly by the Port, except as noted in Section 1.07.A.3. The Contractor shall prepare a daily dredging report and daily site use report for each barge disposal. These reports shall be submitted to the Engineer with the daily construction report.

B. Vessel Traffic Service (VTS)

The Contractor must contact the USCG VTS by radio before disposal at the DMMP for positioning and verification of location within the surface target zone. Disposal may not commence until verification is received from U.S. Coast Guard. The Contractor must also report the vessel position, tug, barge, skipper's name, DNR permit number and the time dumping begins and ends.

In addition to tug mounted DGPS receiver, if the barge is to be towed, the Contractor shall provide a DGPS receiver on the barge to record its location at start and end of dump.

Signal lights shall be displayed and operations shall be conducted in accordance with the regulations of local port and harbor authorities and by the applicable regulations of Code of Federal Regulations, Title 33 - Navigation and Navigable Waters, as required by the Department of the Army and the U.S. Coast Guard.

C. Disposal Site Mapping

Within 24 hours of each dump, the Contractor shall provide a printout for each dump showing the disposal site limits and barge location within the disposal site at the time of the dump. Coordinates for the barge at the beginning and end of each dump shall also be recorded on the printout.

3.05 WATER QUALITY MONITORING

The Contractor is responsible for meeting Water Quality criteria as defined in the project 401 Water Quality Certification, and applicable local, state and federal standards. The Contractor shall have in place:

- A. Best management practices to prevent water quality exceedences, including silt curtains during dredging.
- B. Contingency measures to be implemented should water quality violations occur.

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The Contractor shall describe in its Dredging and Disposal Workplan, in a separate section of the Workplan, what type of best management practices and operations will be used to prevent water quality exceedances, and what contingency actions will be taken to meet water quality criteria should water quality exceedances occur. The Contractor shall also describe its methods and procedures for monitoring the water quality and notifying the Port and Department of Ecology when exceedances occur.

3.06 CONSTRUCTION SUBMITTALS

- A. Construction Schedule: The Contractor shall prepare weekly updates of its Construction Schedule reflecting the progress of the work. The updated schedule shall be submitted each week to the Engineer at the Weekly Construction Meeting.
- B. Daily Report: The Contractor shall keep a daily record of the area(s) dredged, the estimated quantity of material dredged, the number of dump scow trips to the disposal sites, the estimated quantity of dredged materials transported to the DMMP Site based on in-situ cubic yards, results from water quality monitoring, daily progress survey, and a summary of other details of the work. A map showing the barge position during each dump and coordinates for each dump shall be included in the daily reports. This daily record shall be submitted to the Engineer with a transmittal letter the morning following completion of work on the date of the Daily Report. The Daily Report shall be signed by the Contractor's dredging superintendent or quality control manager.
- C. Weekly Report: The Contractor shall summarize the week's work in a weekly report to be submitted to the Engineer the following Monday morning. The weekly report shall identify work completed to date, anticipated work to be completed in the present week, and present the latest progress survey.
- D. DNR Submittals: The Contractor shall prepare and submit DNR required reports as specified under Section 1.07.A.3 of these specifications.
- E. Closure Report: The Contractor shall prepare a closure report that summarizes all the weekly reports and identifies Contractor estimates of dredge volume, dredge volume disposed at the DMMP Site, and debris volume disposed at Port approved upland landfill facility.
- F. Bid Alternate. The submittal requirements described in items 3.06 A through C, and item 3.06 E also apply to placement of dredged material at the Saltchuck site.

3.07 SALVAGED MATERIAL

Anchors, chains, straps, and other articles or debris brought to the surface during the course of the dredging operations shall remain the property of the Contractor and shall be disposed of at an approved off-site location. Salvage and removal of such material will be considered incidental to the dredging work and included in the unit price therefore. Hazardous material/waste, consisting of creosote piles, batteries, PCB's and the like shall

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be disposed of in accordance with applicable Federal, State and local regulations. The Port does not expect hazardous material to be within the dredging area. If such material/waste is encountered, the Contractor shall immediately notify the Engineer to determine the course of action to be taken.

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3.08 CULTURAL RESOURCES

Cultural resource monitoring shall occur during project dredging in accordance with Section 01 10 00 – Summary. If any cultural resources, such as bones or other human remains, pottery, and/or wood structures are observed, dredging shall cease and the Engineer shall be notified immediately.

3.09 OUTFALL PROTECTION

Prior to the start of dredging south of station 101+00, the Contractor shall locate and mark the existing outfalls as shown on the plans to prevent damage during dredging and placement of slope protection. Outfalls are to remain operational throughout the dredging and slope protection operations and shall be incorporated into the new WUT Wharf as shown on the drawings.

END OF SECTION

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Section 35 51 13 – Precast Concrete Floats

PART 1 – GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions and General Requirements, apply to this Work as if specified in this Section. Work related to this Section is described in:

- A. Section 03 10 00 – Concrete Forming and Accessories
- B. Section 03 30 00 – Cast-in-Place Concrete
- C. Section 03 60 00 – Concrete Repair
- D. Section 05 50 00 – Metal Fabrications
- E. Section 05 51 36 – Metal Walkways
- F. Section 06 10 00 – Rough Carpentry
- G. Section 31 62 00 – Steel Pipe Piles

1.02 DESCRIPTION OF WORK

The extent and location of the precast concrete float work are indicated on the Drawings and in these Specifications. The work includes contractor designed and installed concrete floats adjacent to the main trestle. The Drawings are intended to indicate basic configuration and appearance criteria. Structural design of the float elements is the responsibility of the Supplier. The float Supplier will be the responsible Engineer of Record for the concrete floats.

The Work includes furnishing all design, agency permitting, materials, fabrication, transportation, labor, and installation according to the Drawings and Specifications. The Work also includes design, fabrication, and installation of the ancillary components of the concrete floats which includes, but is not limited to wales, fenders, mooring hardware, ladders, transition plates, pile collars, utility runs, and metal walkway guides.

1.03 REFERENCES

Use the most current edition at time of bid unless otherwise indicated.

- A. American Concrete Institute (ACI) Specifications and References, designated by basic reference in this section. In ACI references, the

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advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears; reference to the "Building Official," the "Structural Engineer" and the "Architect/Engineer" shall be interpreted to mean the Port.

- B. Specifications by ASTM International (ASTM), designated by basic reference in this Section
- C. Precast/Prestressed Concrete Institute (PCI) Handbooks and Manuals, designated by basic reference in this Section.
- D. American Welding Society (AWS) codes, designated by basic reference in this Section.

1.04 QUALITY ASSURANCE

- A. Precast Float Manufacturer Experience: Precast floats shall be the product of a manufacturer specializing in the design and production of precast concrete floats with a minimum of 10 years of experience in the manufacture of precast concrete floating docks.
- B. Testing: The Float Supplier shall provide testing and field or plant inspection service to the satisfaction of the owner. The Float Supplier shall provide their own ACI Certified testing laboratory, or shall hire an independent ACI Certified testing laboratory, either as approved by the owner, to provide on-site quality control services throughout the fabrication period. Sampling and testing shall be performed on-site or as otherwise approved by the owner. All concrete testing shall be performed under the direct supervision of ACI certified testing personnel and in accordance with applicable ASTM or ACI requirements, whichever is more restrictive, for the Specified tests.

At a minimum, the following sampling and testing procedures shall be performed:

1. Four compressive test cylinders shall be taken at minimum for each float produced, each ten cubic yards of concrete placed, or daily per mix. One cylinder will be tested at 7 days, one at 14 days and two at 28 days. Compressive test cylinders shall be cured in the same location and manner as the float products. Cylinders to be tested at 28 days shall be moist cured. Prepare and test compressive strength test cylinders in accordance with ASTM C39 and C31.
2. Slump, unit weight and entrained air tests shall be taken from the

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same samples used for the compressive test cylinders. Perform slump testing in accordance with ASTM C143. Perform testing in accordance with ASTM C173 or C231. Additionally, slump and air entrainment tests shall be made for each batch produced, or load of concrete delivered to the production site. Concrete found to be of non-conforming slump or air entrainment shall not be incorporated into the product. Items constructed of inferior concrete shall be rejected.

3. The approved testing laboratory shall submit all records of the test results on the same day of the test to the owner's representative.
 4. Evaluate results of compressive test cylinders in accordance with ACI 214. Not more than 10 percent of the individual tests shall have an average compressive strength of less than the specified ultimate compressive strength. Failed strength tests will be cause for non-conformance and rejection of the representative float quantities produced.
- C. PCI Quality Certifications: PCI MNL-116. At the precast manufacturer's option, in lieu of core samples, and ACI 318, full scale load tests may be performed. Perform on randomly selected precast floats, as directed by the Engineer.
- D. Materials: The Float Supplier's quality control efforts shall include verification of materials, coatings and treatment certificates against all materials supplied before issuing them to the owner. Float Supplier shall also provide documentation of piece counts, sectional dimension and other random tolerance checks such as straightness, etc. The Float Supplier's quality control efforts shall also include provision of survey control to determine theoretical versus actual positions.
- E. Welder Qualifications: All welders are required to be currently certified by AWS for structural welding. Float Supplier shall submit proof of certification prior to fabricating. All welding shall be in accordance with the American Welding Society Structural Code Steel, AWS D1.1, current edition; Reinforcing Steel, AWS D1.4, current edition. No welding shall be performed through paint, galvanized or other coatings.
- F. The Engineer will inspect precast floats at its discretion. Give notice to the Port 14 days prior to transporting floats from the fabrication facility. Provide access to the Port for these inspection(s) at any time (fabrication, installation, etc.) and at no additional cost to the Port. Neither the exercise

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nor waiver of inspection at any time affects the Port's right to enforce contract provisions after precast floats are handled, transported, or installed.

- G. Warranty: Provide a written warranty that the concrete floats and associated appurtenances furnished shall be free from defects in materials and workmanship and performance for a period of 5 year following final completion and acceptance by the owner. The written warranty shall specifically identify and emphasize coverage by the Supplier for premature cracking and spalling of concrete surfaces. The warranty shall include remedy from defects such as surface delamination, spalling, scaling, abnormal cracking and other defects attributable to inadequate design for the intended loads, poor quality concrete mixtures, placement and/or curing. The 5 year warranty period shall commence upon complete installation of the floats.

1.05 SUBMITTALS

- A. Prepare bids based on the products contained in this Section or obtain written approval of any substitution. Do not begin fabrication until submittals and substitutions have been reviewed and approved by the Port. Clearly identify and include any proposed substitutions in submittals.
- B. Incomplete submittals or submittals without appropriate references will be returned without being reviewed. Obtain approval of submittals from the Port before fabrication.
- C. List of at least 10 installations in the United States. Provide project name, owner, contact name, e-mail address, and telephone number for a minimum of 5 installations in the past 5 years.
- D. Concrete mix design, including a list of materials including type; brand; source and amount of cementitious materials and admixtures; and applicable reference specifications.
- E. Concrete test reports, showing that the mix has been successfully tested within the past six months and produces concrete with the properties specified and is suitable for the job conditions.
- F. Foam fill materials and glue, including quality control testing of foam fill material certifying that foam fill properties meet the requirements of this Section and requirements for curing glue.
- G. Ballast and supplemental floatation details, if required, including materials and methods of installation and how materials are secured.

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- H. Repair procedures for cracks, spalls, honeycombs, and other distress or damage.
- I. Precast Float Design Calculations: Submit calculations reflecting design conforming to requirements of the Drawings and these Specifications. Design calculations shall be prepared and sealed by a Washington state licensed professional engineer, and submitted for approval prior to fabrication. In addition to member and connection sizing calculations, submit calculations for the dock system which include, as a minimum, the following information.
 - 1. Design codes and references used to develop the calculations.
 - 2. Loads used in design (dead, live, wind, current, berthing, mooring, debris, handling, installation, etc.) and load combinations used in design.
 - 3. Material properties of all components of the floating dock.
 - 4. Distribution of reactions from guide pile support points and anchorage attachment points throughout the floating dock.
 - 5. Timber wales, pin connections, plates, and other hardware required to connect individual precast floats into a floating dock.
 - 6. Freeboard calculations of the designed system demonstrating the required freeboard at time of construction and also calculations showing anticipated settlement due to foam absorption and other associated items.
 - 7. Tolerances to accommodate as-constructed guide pile locations and existing abutment location.
- J. Precast Float Design Drawings: Submit drawings indicating complete information for the fabrication, handling, and erection of the precast floats. Do not use reproductions of contract drawings. Design drawings shall be sealed by a Washington state licensed professional engineer, and submitted for approval prior to fabrication. The drawings shall indicate, as a minimum, the following information:
 - 1. Floating dock layout including guide pile locations and existing abutment.
 - 2. Assembly drawings including marking of floats for assembly.

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3. Material properties of all components of the floating dock.
 4. Reinforcing steel details.
 5. Pin connections, plates, and other hardware between floats and similar connections, plates, and hardware between float and existing abutment including coatings.
 6. Location, details, and anchorage of handrails.
 7. Location, details, and anchorage of cleats.
 8. Wale sizes, splice patterns, and treatment requirements.
 9. Pile guide connections to the floating dock, including anchorage to the precast floats, tolerances to accommodate variations in guide pile locations, coating system, rub strips, and all other components.
 10. Lifting and assembly inserts and embedded items.
 11. Dimensions and surface finishes of precast floats.
 12. Installation sequence and handling requirements.
- K. Precast float and floating dock as-built (record) drawings including as-constructed guide pile locations and connections to the floating dock. Include existing abutment location.
- L. Daily concrete test reports, including compressive strength, unit weight, and entrained air. Provide to the Port within 72 hours of the test.
- M. Written warranty.

1.06 DESIGN REQUIREMENTS

- A. General: Design precast floats (including connections) for the design load conditions and spans indicated, using ACI 318 and the PCI MNL-120. Design precast floats for handling without cracking in accordance with the PCI MNL-120.
- B. Dock Loading: Design precast float and anchorage systems for the following load conditions as a minimum. Combine load cases based upon their probability of simultaneous occurrence, and in accordance with

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applicable codes and standards. Include load combinations identified in this section. Handrail design loads are also included.

1. Dead Load: for the completed float system, including all work of other trades.
2. Uniform Live Load: 40 pounds per square foot applied to any/all combination of areas on the float deck.
3. Concentrated Load:
 - i. 400 lbs., distributed over 144-square inches, placed anywhere on floats.
 - ii. When 400 lb. concentrated load is applied at 1-foot from the end of the float, the end of the float shall lose less than 4-inches of freeboard at time of installation and less than 6-inches after five years of operation.
 - iii. When 200 lbs. is applied on one outer corner of the float, there shall be no more than 2-inches in freeboard differential per 3-feet of width between the outer corners of the float at time of installation and no more than 3-inches after five years of operation.
4. Combined Current and Wave Loads:
 - i. Design wave: 1.5 feet in height, with varying wave lengths corresponding to wave periods of 2 seconds.
 - ii. Design pressure for current: 3.0 pounds per square foot
5. Wind Load: Ultimate wind speed (3-second gust) = 150 mph, Exposure D, I = 1.0. Apply wind load on exposed over-water vessel profiles. Consider both end and side loading conditions and sheltering effects acting simultaneously on the projected area of the dock and of the moored vessels without any regard for any “shadowing” effect that may occur from boats shielding floats from wind, or vice versa. For vessel area, assume an average height of 6 feet above the waterline and full occupancy. For vessel length, assume 40 feet maximum.
6. Berthing Load Forward velocity of 1.0 knots, vessel berthing angle of 10 degrees for a 40-foot vessel (20,000 pound weight) striking the precast float.

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7. Mooring Load: as a minimum, design precast float, attachment points, and all other connections for the capacity of the mooring hardware identified in this Section and on the Drawings, with a line pull acting in any direction and up to a 45 degree angle from the horizontal.
8. Load Combinations: as determined by the Washington state licensed professional engineer for precast floats, and including the following as a minimum.
 - i. Dead load plus all handling loads including transport and assembly.
 - ii. Dead load plus uniform live load, with float unsupported span length equal to the wavelength of the design wave.
 - iii. Dead load plus uniform live load, with floats in a grounded condition.
 - iv. Dead load plus concentrated live load plus wind load plus berthing load.
 - v. Dead load plus concentrated live load plus wind load plus combined current, wave and debris impact loads.

C. Performance:

1. Size precast float modules as indicated on the Drawings with a single module attaining the indicated float width (excluding wales).
2. Size precast floats to meet the following freeboard requirements.
 - i. Dead load only: between 23 inches and 25 inches. Design each precast float to float level under dead load only and to be flush with the adjacent floats. Maximum out of level tolerance for transverse and longitudinal slope shall be 1 inch per 10 feet.
 - ii. Dead load and concentrated live load: not less than 20 inches.
 - iii. Dead load and uniform live load: not less than 15 inches.
3. Provide a skid-resistant finish on all walking surfaces.

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4. Provide pile guides supported by the deck and containing solid rubbing surfaces.

1.07 WARRANTY

Furnish a written warranty stating the following.

- A. Components of the precast floats, including pile guides, shall be free of defects in material and workmanship for a minimum period of 5 calendar years from the date of project substantial completion.
- B. Design freeboard of the float system shall not lose more than 1-inch of freeboard over the life of the warranty period.
- C. All defective components evident during the warranty period shall be removed and replaced, without cost to the Port, within 90 days of notification.

PART 2 – PRODUCTS

2.01 CONCRETE MIX DESIGN

Provide a concrete mix design meeting the following requirements.

- A. Minimum compressive strength at 28 days: 4,000 psi per ASTM C 39.
- B. Minimum cement content equal to 50 percent of total mass of cementitious materials.
- C. Fly ash content not to exceed 25 percent of total mass of cementitious materials.
- D. Ground granulated blast furnace slag content not to exceed 50 percent of the mass of cement.
- E. Maximum water to cementitious materials ratio: 0.40
- F. Concrete unit weight: 120 to 150 pounds per cubic foot per ASTM C 138 or ASTM C 567
- G. Air Entrainment: 5% to 8% per ASTM C 173 or ASTM C 231

2.02 PRECAST FLOAT MATERIALS

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A. Cementitious Materials:

1. Cement: ASTM C 150, Type II or I/II, minimum 6 sacks per cubic yard, with tricalcium aluminate (C3A) content limited to not less than 6 percent and not more than 8 percent.
2. Fly Ash: ASTM C 618 Type F, except maximum allowable loss on ignition shall be 2 percent.
3. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Water: fresh, clean, and potable.

C. Aggregates: ASTM C 33 or ASTM C 330, Size 8 (3/8 inch), except as modified herein. Obtain aggregates from one source. Do not use aggregates which contain any substance which may be deleteriously reactive with the alkalis in the cement. See Section 03 30 00 – cast-in-Place Concrete for required tests to evaluate aggregate reactivity.

D. Nonshrink Grout: ASTM C 1107 and the following additional requirements.

1. Plastic height change of 0% to +4% in accordance with ASTM C 827.
2. Hardened height change of 0% to 0.3% in accordance with ASTM C 1090.
3. Fluid consistency at 25 to 30 seconds in accordance with ASTM C 939.
4. Minimum working time of 30 minutes.
5. Minimum compressive strength of 7,500 psi at 28 days when prepared in fluid consistency in accordance with ASTM C 109.
6. Contains no aluminum powder.

E. Admixtures

1. General: If admixtures are required by design, comply with the requirements shown below. Use in accordance with manufacturer's recommendations and use only where appropriate for both climatic

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conditions and construction needs. Do not use calcium chloride or admixtures containing chlorides from other than ingredient impurities.

2. Air-Entraining: ASTM C 260
3. Water Reducing: ASTM C 494, Type A, E, or F
4. High Range Water Reducing: ASTM C 494 Type F or ASTM C 1017

F. Reinforcement

1. Reinforcing Bars: ASTM A 706, Deformed Grade 60, hot-dip galvanized in accordance with ASTM A 767.
2. Welded Wire Fabric: ASTM A 1064, hot-dip galvanized in accordance with ASTM A 1060. Use flat sheets of welded wire fabric only, do not use rolled sheets.

G. Metal Components and Accessories

1. Inserts: ASTM A 47, Grade 32510 or 35018, or ASTM A 27 Grade U-60-30, unless otherwise approved by the Port.
2. Structural Steel: ASTM A 36.
3. Bolts, Nuts, and Washers: ASTM A 36, ASTM A 307, or ASTM F 1554 Grade 36; ASTM A 563, and ASTM F 844, respectively. Provide wale rods that are continuous transversely across the float, with a minimum diameter of 1 inch. Place all wale rods within PVC sleeves cast into the precast floats.
4. Cleats: ASTM A 27 Grade 65-35, heavy-duty cleat pattern, unless otherwise approved by the Port.
5. Hot-dip galvanize all metal accessories in accordance with ASTM A 123 or ASTM A 153 as applicable.

H. Handrails: see Section 05 50 00 – Metal Fabrications.

I. Foam Core

1. Closed cell, expanded polystyrene (EPS) per ASTM C 578, Type I, with additional requirements as specified in this Section. Glue foam core laminations with low solvent glue. Do not make foam core

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from more than four laminated sections. Repair delaminations prior to placement of concrete in a manner acceptable to the Port. Do not use reground material unless approved by the Port in writing.

2. Unit Weight: 1.0 to 1.10 pounds per cubic foot
 3. Flexural Strength: 25 pounds per square inch minimum.
 4. Maximum Water Absorption: 4 percent (by volume)
 5. Dimensional Tolerance: +/- 1/8 inch
 6. Low Solvent Glue: as recommended by the foam fill manufacturer for permanent installations in a marine environment.
- J. Rub Strips: “Extra-Heavy Duty Utility Fender” by Henderson Marine Supply, Inc. (800-523-1586) or equal approved by the Port prior to float installation. Attach with Type 316 stainless steel hardware.

2.03 PRECAST FLOAT FABRICATION

A. Precast Floats

Follow PCI MNL-116 unless otherwise directed in this Section. Cast precast floats monolithically. Do not use cold joints. Provide a minimum thickness of 2 inches for all float elements. Construct precast float decks to drain freely with no floodable enclosed spaces. Completely surround foam core with concrete elements.

B. Forms

Brace forms to prevent deformation. Use forms that produce a smooth, dense surface. Chamfer exposed edges 1/2 inch, unless otherwise indicated. Form tolerance shall not exceed 1/8 in. dimensions indicated on shop drawings. Reject floats that are more than 1/2 in. out of square when measure diagonally.

C. Reinforcement Placement

Follow ACI 318 for placement and splicing. Reinforcement may be preassembled before placement in forms.

D. Concrete

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1. Mixing: ASTM C 94. Mixing operations shall produce batch-to-batch uniformity of strength, consistency, and appearance.
2. Placing: Follow ACI 309R for consolidation of concrete. Vibrate concrete internally and/or externally to assure a smooth, dense finish. Follow ACI 305.1R for hot weather concreting and ACI 306.1 for cold weather concreting, unless otherwise specified. Do not place concrete while the atmospheric temperature is below 40 degrees F, unless heating equipment is used immediately after placing to maintain the concrete surface temperature at or above 45 degrees F. Do not allow the temperature of concrete to exceed 80 degrees F at the time of placement.
3. Concrete Curing: Commence curing immediately following the initial set and completion of surface finishing. Provide curing procedures to keep the temperature of the concrete between 45 degrees F and 145 degrees F. When accelerated curing is used, moist cure for four hours and then apply heat at a controlled rate and uniformly along the casting beds. Monitor temperatures at various points in a product line in different casts. Cure precast floats for a minimum of fourteen days prior to transporting, launching and assembly unless otherwise approved by the Engineer.
4. Concrete Testing: Performed by a testing agency accredited in accordance with ASTM C 1077. Take a minimum of four cylinders per day, 4-inch diameter by 8-inches long, in accordance with ASTM C 31 and ASTM C 172. Test cylinders in accordance with ASTM C 39; one each at 1 day, 7 days, and 28 days after placement, with one cylinder held in reserve. Test for unit weight and entrained air from the same material sample as used for the compressive test cylinders.

E. Surface Finish

1. Cracks, Spalls, and Honeycombs: Precast floats containing hairline cracks which are visible and are less than 0.02 inches in width, may be accepted, except that cracks larger than 0.007 inches in width for surfaces exposed to the weather shall be repaired. Precast floats which contain cracks greater than 0.02 inches in width shall be approved by Engineer for use prior to being repaired. Any precast float that is structurally impaired or contains spalls or honeycombed section(s) deep enough to expose reinforcing steel shall be rejected, as determined by the Engineer.

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2. Unformed Surfaces: Provide a steel troweled and broom finish for dock deck surface. Orient slip resistant broom finish transverse to dock orientation. Provide a 3/8 in. tooled radius with a minimum 1 1/2 in. wide, smooth, hard steel finished face at all deck edges.
3. Formed Surfaces: PCI MNL-116, provide a Standard Grade Finish for both exposed and unexposed surfaces, except repair defective areas including minor honeycombs and pits greater than one square inch surface area or 1/4 inch maximum depth. Provide edges perpendicular to the surface at defective areas and patch with nonshrink grout.

F. Precast Float Identification

Clearly identify all precast floats on one side and one end, between the bottom of the wale and the waterline. Include name of manufacturer, date of manufacture, specific float type, and job number.

2.04 PRECAST FLOAT HANDLING

Lift and support precast floats at the lifting and support points indicated on the shop drawings. Store precast floats off the ground. Separate precast floats with battens placed across the full width of each bearing point. Protect precast floats from weather, marring, damage, and overload.

PART 3 – EXECUTION

3.01 SURFACE REPAIR

Prior to erection, and again after installation, check precast floats for flaws or damage, such as cracking, spalling, and honeycombing. Repair or remove and replace precast floats that do not meet the surface finish requirements specified in the paragraph “PRECAST FLOAT FABRICATION” and provide new precast floats.

3.02 DELIVERY AND STORAGE OF PRECAST FLOATS AT THE SITE

Follow the requirements of the paragraph “PRECAST FLOAT HANDLING”.

3.03 LAUNCH AND ASSEMBLY

Precast floats may be launched after the concrete has attained the specified compressive strength, unless otherwise approved by the precast manufacturer. Assemble precast floats in accordance with the approved shop drawings. See

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PCI MNL-116 and PCI MNL-120 (Chapter 8), for tolerances. Brace precast floats, unless design calculations submitted with the shop drawings indicate bracing is not required. Follow the manufacturer's recommendations for maximum construction loads.

3.04 ANCHORAGE

Provide anchorage for fastening work in place. Conceal fasteners where practicable. Make threaded connections tight and nick threads to prevent loosening.

3.05 GALVANIZING REPAIR

Repair damage to galvanized coatings using ASTM A 780 Annex A1 for galvanized surfaces damaged by handling, transporting, cutting, welding, bolting, or acid washing. Do not heat surfaces to which repair material has been applied.

3.06 GROUTING

Clean and fill indicated areas solidly with nonshrink grout. Remove excess grout before hardening.

END OF SECTION

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Section 35 59 13 – Marine Fenders

PART 1 – GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions and General Requirements, apply to this work as if specified in this section. Work related to this section is described in:

- A. Section 03 30 00 – Cast-in-Place Concrete
- B. Section 05 50 00 – Metal Fabrications

1.02 DESCRIPTION OF WORK

- A. The work includes manufacturing, transporting, and installing all marine fenders and all necessary materials, labor, and equipment to accomplish the work.
- B. The work includes all bolts and miscellaneous connection hardware, wales, shear chains, shackles, and U-anchors.

1.03 REFERENCES

- A. American Bureau of Shipping (ABS) “Rules for Building and Classing Steel Ships, Part 2 – Materials and Welding”.
- B. American Society for Testing Materials (ASTM), Standard Specifications and Standard Test Methods, designated by basic reference in this section (use the most current edition at the time of bid unless otherwise indicated).
- C. Permanent International Association of Navigation Congresses (PIANC), “Guidelines for the Design of Fender Systems: 2002”, Report of Working Group 33 – MARCOM, and “Appendix A – Procedure to Determine and Report the Performance of Marine Fenders” (PIANC 2002).
- D. Society for Protective Coatings (SSPC) Painting Manual, Volume II, 2008 Edition, “Systems and Specifications”.

1.04 QUALITY ASSURANCE

- A. The Port will provide inspection service for all site work in this section. Tests conducted for the sole benefit of the Contractor, or before a product is approved, shall be at the Contractor's expense.

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- A. The fender manufacturer shall have a minimum of five years experience manufacturing rubber marine fenders of sizes similar to those specified and show proof thereof with installation references in accordance with this specification.
- A. Fender Testing and Reporting: Perform in accordance with the most recent PIANC Guidelines including Appendix A, "Procedure to Determine and Report the Performance of Marine Fenders."
- B. Coating System: Provide a coating system free of sags, voids, and orange peel; resistant to impact and abrasion; and suitable to protect steel from prolonged exposure to marine use in the splash-zone.

1.05 SUBMITTALS

- A. The Contractor shall prepare bids based on the products and performance requirements indicated on the drawings and in this specification. Submit all data and test reports necessary to demonstrate product equivalence and achievement of performance requirements.
- B. The fender system submittal shall be presented in, or converted to, English units. Incomplete submittals or submittals without English units and appropriate reference standards will not be reviewed.
 - 1. List of at least 5 installations in the United States within the past five years demonstrating the experience required under the paragraph, "Quality Assurance." Provide project name, owner, contact name, email address, and telephone number for a minimum of 5 installations.
- C. Submit manufacturer verification that all fenders have undergone at least one break-in cycle as described herein.
- D. Furnish a written warranty stating that each fender is free of defects in material and workmanship for a minimum period of five (5) calendar years from the date of project substantial completion, and that all defects evident during that period shall be removed and replaced, without cost to the Port, within 90 days of notification.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Fender systems shall include rubber fender, fasteners, fender piles, metal fabrications, chains, and anchor bolts in accordance with the contract documents.
- B. Each fender system assembly as depicted on the drawings is based on the performance, dimensions and material characteristics a Trelleborg AN 400 x 1000

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E2.0 fender. The system proposed shall be equivalent to the Trelleborg system. Submit all information, test reports, and product data necessary to demonstrate equivalence. The cost of all labor including any testing necessary to demonstrate equivalence shall be at the Contractor's expense.

2.02 RUBBER FENDER ELEMENTS

- A. Break-in each rubber fender before delivery to the site by subjecting it to one (1) complete compression cycle to its rated deflection. Provide manufacturer verification that all fenders have undergone at least one break-in cycle.
- B. The fender system shall meet the following requirements:
 - 1. Rubber fenders shall be compression-buckling-type "arch" elements with a minimum rated energy of 29.5 kip-ft and a maximum rated reaction per element of 57.6 kips. The maximum deflection at the rated values shall not exceed 51.5% of the total element height.
 - 2. Absorb the required energy when the fender face is compressed to its rated deflection, and skewed/rotated parallel with any approach angle between 0 and 10 degrees.
- C. Install the fenders at the locations shown in the drawings with the standoff distance as indicated. All rubber fender elements shall be identical. The fender elements shall be sized to fit within the geometric constraints shown on the drawings and shall meet the performance criteria and material requirements.

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2.03 RUBBER PROPERTIES

- A. Natural rubber or styrene butadiene rubber conforming to the following:

Property	Test Standard	Condition	Requirement
Tensile Strength	ASTM D 412, Die C	Original	16 MPa (min)
	ISO 37, 188	Aged for 96 hours at 70° C	12.8 MPa (min)
Elongation at Break	ASTM D 412, Die C	Original	350% (min)
	ISO 37, 188	Aged for 96 hours at 70° C	280% (min)
Hardness	ASTM D 2240	Original	78° Shore A (max)
		Aged for 96 hours at 70° C	Original value + 8° points increase
Compression Set	ASTM D 395, Method B	Aged for 22 hours at 70° C	30% (max)
Tear Resistance	ASTM D 624, Die B	Original	70 kN/m (min)
Ozone Resistance	ASTM D 1149	50 pphm at 20% strain at 40° C for 100 hours	No visible cracking
Seawater Resistance	DIN 86076	28 days at 95° C ± 2° C	Shore A +/-10° Vol. +10%,-5%
Abrasion Resistance	DIN 53516	Original	100 mm ³ (max)

- B. Test results furnished under different specifications than those listed above shall be accompanied by the fender manufacturer's documentation explaining how the furnished test results meet or exceed the test requirements listed above. Test results without this documentation will be considered out of compliance.

2.04 CHAINS AND SHACKLES

- C. Provide galvanized Grade 3 stud link chain in accordance with ABS Rules. Provide each chain with compatible shackles and special links to adjust the length. Provide associated hardware that conforms with ABS requirements.
- D. Provide galvanized, drop-forged shackles with a working load limit greater than the chain using a minimum safety factor of 2.0 on chain working loads. Size shackles to connect all items and include a galvanized bolt, nut, and cotter pin.
- E. Size chains, shackles, turnbuckles, U-bolts, and their anchorages to both the concrete structure and the steel panel to resist the appropriate design forces with a minimum factor of safety of 2.0. Design chains and all other components for forces based on the maximum hull pressure contained herein on the entire panel area with

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and a minimum friction coefficient equal to 0.30, for horizontal (side to side) and vertical (up and down) movement.

2.05 BOLTS AND MISCELLANEOUS HARDWARE

- A. Fasten the fender units and chains to the concrete structure with galvanized anchor bolts meeting the requirements of ASTM F 1554, Grade 55 unless otherwise specified.
- B. Design and detail fender anchor bolts and anchor assemblies to not interfere with the reinforcing steel or other attachments. Design, supply, and install any additional reinforcing steel that may be needed, locally or otherwise, to transfer forces between the frontal panel and the center platform or dolphin structures.

PART 3– EXECUTION

3.01 INSTALLATION

- A. Install fenders at the locations shown on the drawings in an undamaged condition. Supply and use wooden or steel templates to accurately locate and align all elements to be embedded in concrete, including bullrail and pile cap reinforcing steel.
- B. Do not damage, cut, or tear the rubber or the fender assembly during installation. Canvas slings, wood cradles or other protective devices as recommended by the manufacturer shall be used. Hoisting and slinging by the rubber section may be permitted only when approved by the manufacturer and the Engineer.

END OF SECTION