TECHNICAL SPECIFICATIONS

FOR

CONSTRUCTION OF

WATER TREATMENT PLANT SAND REMOVAL

FOR

CITY OF ALBANY

OCTOBER 2016

MURRAY, SMITH & ASSOCIATES, INC.
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SECTION 00 01 07

SEALS PAGE

See Table of Contents for author of each specification section, identified by author's initials as follows:

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WATER TREATMENT PLANT SAND REMOVAL IMPROVEMENTS

TECHNICAL SPECIFICATIONS
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Linn County Conditional Use Permit

SECTION 01100

SPECIAL TECHNICAL PROVISIONS

PART 1 GENERAL

These Special Provisions supplement and amplify the General Requirements of the City of Albany Standard Construction Specifications. The General Requirements of the Standard Construction Specifications shall apply except as modified herein. These Special Technical Provisions and additional technical specifications may contain occasional requirements not pertinent to the project. However, these specifications shall apply in all particulars insofar as they are applicable to this project.

1.1 Scope of Work

The work to be performed under these specifications and drawings consists of furnishing all labor, materials and equipment necessary to construct a single story extension to the existing raw water pump station for the Albany-Millersburg Water Treatment Plant, installing sand dewatering equipment in the extension and modifying piping and electrical equipment within the raw water pump station to connect the new dewatering equipment to the existing sand slurry pumps and the existing electrical and controls systems. Work includes but is not limited to the following: 1) constructing a concrete floor slab for the building extension with the slab at grade, supported on driven steel piles and doweled to the existing structure; 2) constructing a 300-square foot building extension with concrete masonry block walls, metal roof trusses and a standing seam metal roof to match the existing structure's external elevations; 3) furnishing and installing a sand dewatering unit; 4) furnishing and installing piping and valves to connect the new sand dewatering unit to existing sand slurry pumps; 5) relocating a ventilation relief louver from its current location to a new location on the exterior of the building extension; 6) extending a concrete sediment containment area; 7) performing associated site, mechanical, electrical, telemetry and instrumentation work as specified in the contract documents to provide a fully functioning sand dewatering system.

The above general outline of principal features of the work does not in any way limit the responsibility of the CONTRACTOR(s) to perform all work and furnish all equipment, labor and materials required by the specifications and drawings. The drawings and specifications shall be considered and used together. Anything appearing as a requirement of either shall be accepted as applicable to both even though not so stated therein or shown.

No attempt has been made in these specifications or drawings to segregate work covered by any trade or subcontract under one specification. Such segregation and establishment of subcontract limits will be solely a matter of specific agreement

between the CONTRACTOR and its subcontractors and shall not be based upon any inclusion, segregation or arrangement in or of these specifications.

1.2 Facility Operations Requirements

The work included in these Drawings and Specifications is to be performed on an existing raw water pump station that supplies an existing municipal water treatment plant that must continue in operation during construction. The CONTRACTOR shall cooperate fully at all times with the OWNER and the ENGINEER to insure that the production capability of the plant will continue and that any interruption to plant operations are minimized.

The specific major requirements for maintaining plant operations are listed below. These requirements are not necessarily complete in every detail:

A. CONTRACTOR shall give a minimum of two (2) business day's notice to the OWNER whenever CONTRACTOR plans any pipe tie-in, fiber optic relocation or other activity that may interrupt or modify the operation of the existing raw water pump station or communication between the raw water pump station and the water treatment plant.

B. The maximum period of time allowed for any shutdown of the raw water pump station or loss of communication between the raw water pump station and the water treatment plant is four (4) hours.

C. Activities that will result in a temporary shutdown of the raw water pump station or loss of communication between the raw water pump station and the water treatment plant shall not be scheduled for, or allowed to be undertaken, on a Friday, nor on a Wednesday or Thursday if the subsequent day is a Public Holiday.

1.3 Coordination of Drawings and Specifications

The drawings and specifications are intended to describe and provide for a complete work. Any requirement in one is as binding as if stated in all. The CONTRACTOR shall provide any work or materials clearly implied in the Contract Documents even if the Contract Documents do not mention it specifically.

Dimensions shown on the drawings or that can be computed shall take precedence over scaled dimensions. Notes on drawings are part of the drawings and govern in the order of precedence defined elsewhere in the contract documents. Notes on drawings shall take precedence over drawing details.

The intent of the drawings and specifications is to prescribe the details for the construction and completion of the work which the CONTRACTOR undertakes to perform according to the terms of the Contract. Where the drawings or specifications

describe portions of the work in general terms, but details are incomplete or silent, it is understood that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Unless otherwise specified, the CONTRACTOR shall furnish all labor, materials, tools, equipment, and incidentals, and do all the work involved in executing the Contract in a manner satisfactory to the ENGINEER.

1.4 Code Requirements

All work shall be done in strict compliance with the requirements of:

A. International Building Code
B. Uniform Mechanical Code
C. Uniform Plumbing Code
D. National Electric Code
E. National Electric Safety Code
F. Oregon State Department of Labor and Industries
G. Linn County Code

In case of disagreement between codes or these specifications, the more restrictive shall prevail.

1.5 Coordination with Other Contractors and with OWNER

Certain work within this contract may require connection to and coordination with the work of other contractors and OWNER. The CONTRACTOR under these specifications shall cooperate fully with all other contractors and OWNER and carefully fit its own work to such other work as may be directed by the ENGINEER. The CONTRACTOR shall not commit or permit any act to be committed which will interfere with the performance of work by any other contractor or the OWNER.

1.6 Site Investigation and Physical Data

The CONTRACTOR acknowledges that it is satisfied as to the nature and location of the work and the general and local conditions, including but not limited to those bearing upon transportation, disposal, handling and storage of materials, availability of water, roads, groundwater, access to the sites, coordination with other contractors, and conflicts with pipelines, structures and other contractors. Information and data furnished or referred to herein is furnished for information only. Any failure by the CONTRACTOR to become acquainted with the available information and existing conditions will not be a basis for relief from successfully performing the work and will not constitute justification for additional compensation.

The CONTRACTOR shall verify the locations and elevations of existing pipelines, structures, grades and utilities, prior to construction. The OWNER assumes no

responsibility for any conclusions or interpretations made by the CONTRACTOR on the basis of the information made available.

1.7 Temporary Utilities for Construction Purposes

The CONTRACTOR shall make all arrangements necessary to provide all temporary utilities for construction purposes and shall pay all costs associated those temporary utilities. Only non-potable water is available at the site. The CONTRACTOR shall furnish all valves, hoses, connections and other devices as necessary to obtain sufficient water for construction and for filling and testing of water lines as required. Fire hydrant use is allowed only by permission of the utility owner. Backflow protection is required on all connections to potable water systems.

1.8 Field Service by Manufacturer's Representative

The CONTRACTOR shall furnish the services of a manufacturer's or material supplier’s representative for all major equipment and materials furnished by the CONTRACTOR or OWNER under this contract, to check, place in operation and test the installation, and train operating personnel. The manufacturer's representative shall be qualified and authorized to perform repairs and maintenance on the equipment. The above gives a general scope of the services desired from the manufacturer's representative. It will be the responsibility of the CONTRACTOR and the equipment manufacturer to determine detailed requirements. Costs for services of the manufacturer's representative shall be included in the proposal of the CONTRACTOR. The operator training mentioned above shall include sufficient time during the CONTRACTOR’s operation and testing period to fully explain to the operating personnel the features of the equipment and maintenance thereof.

1.9 Private Roads and Driveways

No private road or driveway may be closed without approval of the ENGINEER unless written authority has been given by the owner whose property has been affected. Driveways shall be left open and ready for use at the end of the work shift. All expenses involved in providing for construction, maintenance, and use of private roads or driveways, shall be borne by the CONTRACTOR and the amount thereof absorbed in the unit prices of the CONTRACTOR’s bid.

1.10 Materials and Compaction Testing

OWNER shall provide the services of a licensed, independent agency to perform materials and compaction testing for this project. Materials and compaction tests will be required to show that specified concrete strengths and densities of compacted backfill and asphaltic concrete surfacing are being achieved.

1.11 Limits of the Work and Storage of Spoils

The limits of the site which may be used for construction, storage, materials handling, parking of vehicles and other operations related to the project include the project site as shown on the drawings. The limits of work also include rights of access obtained by the CONTRACTOR, subject to all public laws and regulations and rights of access by utility companies and other holders of easement rights.

1.12 Field Changes, Alignment and Grade

Changes of alignment and grade shall be made during the course of work in order to avoid interference with unforeseen obstructions. The CONTRACTOR shall locate existing utilities by potholing ahead of installation. All costs for minor field changes of alignment and grade shall be borne by the CONTRACTOR. The ENGINEER will endeavor to make prompt decisions on such matters. CONTRACTOR shall anticipate a minimum of 72 hours for any decision requiring significant piping change.

1.13 Testing and Operation of Facilities

It is the intent of the OWNER to have a complete and operable facility. All of the work under this contract will be fully tested and inspected in accordance with the specifications. Upon completion of the work, the CONTRACTOR shall operate the completed facilities as required to test the equipment under the direction of the ENGINEER. During this period of operation by the CONTRACTOR, the new facilities will be tested thoroughly to determine their acceptance.

1.14 Protection of Existing Structures and Work

The CONTRACTOR must take all precautions and measures necessary to protect all existing structures and work. Any damage to existing structures and work shall be repaired by removing the damaged structure or work, replacing the work and restoring to original condition satisfactory to the ENGINEER.

1.15 Salvage and Debris

Unless otherwise indicated on the drawings or in the specifications, all castings, pipe, equipment, demolition debris, spoil or any other discarded material or equipment shall become the property of the CONTRACTOR and shall be disposed of in a manner compliant with applicable Federal State and local laws and regulations governing disposal of such waste products. No burning of debris or any other discarded material will be permitted.

1.16 Safety Standards and Accident Prevention

The CONTRACTOR shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work.

This requirement shall apply continuously and not be limited to normal working hours. The required and/or implied duty of the ENGINEER to conduct construction review of the CONTRACTOR's performance does not, and 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 comply with the safety standards provisions of applicable laws and building and construction codes. The CONTRACTOR shall exercise every precaution at all times for the prevention of accidents and protection of persons, including employees, and property. During the execution of the work the CONTRACTOR shall provide and maintain all guards, railing, lights, warnings, and other protective devices which are required by law or which are reasonably necessary for the protection of persons and property from injury or damage.

1.17 Utility Properties and Service

In areas where the CONTRACTOR’s operations are adjacent to or near a utility and such operations may cause damage which might result in significant expense, loss and inconvenience, the operations shall be suspended until all arrangements necessary for the protection thereof have been made by the CONTRACTOR.

The CONTRACTOR shall notify all utility offices which may be affected by the construction operation at least 48 hours in advance. Before exposing any utility, the utility having jurisdiction shall grant permission and may oversee the operation. Should service of any utility be interrupted due to the CONTRACTOR’s operation, the proper authority shall be notified immediately. It is of the utmost importance that the CONTRACTOR cooperates with the said authority in restoring the service as promptly as possible. Any costs shall be borne by the CONTRACTOR.

1.18 Sanitary Facilities

The project site has no sanitary facilities. The CONTRACTOR shall provide and maintain sanitary facilities for its employees and its subcontractors’ employees that will comply with the regulations of the local and State Departments of Health and as directed by the ENGINEER.

1.19 Street Cleanup

The CONTRACTOR shall clean daily all dirt, gravel, construction debris and other foreign material resulting from its operations from all streets and roads.

1.20 Vehicle Parking

The vehicles of the CONTRACTOR’s and subcontractors’ employees shall be parked in such a manner as to maintain access by OWNER’s staff to the existing raw water pump station facilities at all times throughout construction.

1.21 Record Drawings

CONTRACTOR shall maintain at the site one set of specifications, full size drawings, shop drawings, equipment drawings and supplemental drawings which shall be corrected as the work progresses to show all changes made. Drawings shall be available for inspection by the ENGINEER. Upon completion of the contract and prior to final payment, specifications and drawings shall be turned over to the ENGINEER.

1.22 Surveys

Based upon the information provided by the Contract Documents, the CONTRACTOR shall develop and make all detail surveys necessary for layout and construction, including exact component location, working points, lines and elevations. Prior to construction, the field layout shall be approved by the OWNER's representative. The CONTRACTOR shall have the responsibility to carefully preserve bench marks, reference points and stakes, and in the case of destruction thereof by the CONTRACTOR or resulting from its negligence, the CONTRACTOR shall be charged with the expense and damage resulting therefore and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.

1.23 Erosion and Sedimentation Control

CONTRACTOR shall comply with the City of Albany's existing 1200-CN permit. CONTRACTOR shall install and maintain temporary construction site erosion control measures as needed to prevent sediment and sediment laden water from migrating from the construction site as a result of CONTRACTOR'S activities throughout the period of the Contract.

1.24 Noise Limitations

The project areas are located within a residential area. All applicable County ordinances and State and Federal regulations shall be complied with.

1.25 Storage and Protection of Equipment and Materials

A. Materials and equipment stored overnight shall be placed neatly on the job site. Unusable materials (i.e. rejected or damaged liner material, old concrete chunks, metal scraps, etc.) shall be expeditiously removed from the job site.

Provide appropriate barricades, signs, and traffic control devices in like-new condition where necessary to protect the public from any hazards associated with the storage of materials and equipment used for this project.

B. No equipment and/or materials shall be stored outside the immediate work area on public right-of-ways, in the following locations, or in the following manner:

1. In any maintained landscaped or lawn area.

2. In a manner that would totally eliminate an individual residents' street parking.

3. In front of any business.

The “immediate work area” is the area where work is taking place or will be taking place within one calendar day. The CONTRACTOR shall immediately move stored material or equipment which causes a nuisance or creates complaints.

1.26 Competent Person Designation

CONTRACTOR shall designate a qualified and experienced “competent person” at the site whose duties and responsibilities shall include enforcement of Oregon-OSHA regulations regarding excavations, the prevention of accidents, and the maintenance and supervision of construction site safety precautions and programs.

1.27 Emergency Maintenance Supervisor

The CONTRACTOR shall submit to the ENGINEER the names, addresses and telephone numbers of at least two employees responsible for performing emergency maintenance and repairs when the CONTRACTOR is not working. These employees shall be designated, in writing by the CONTRACTOR, to act as its representatives and shall have full authority to act on its behalf. At least one of the designated employees shall be available for a telephone call any time an emergency arises.

1.28 Use of Explosives

The use of explosives shall not be allowed on this project.

1.29 Special Inspections

Special inspections and testing as required by Oregon Structural Specialty Code shall be conducted by OWNER retained and approved Special Inspectors and Testing Agencies as required and as indicated in the Contract Documents.

A. Special Inspectors and Testing Agencies Responsibilities

1. Verify that manufacturers maintain detailed fabrication and quality control procedures and review the completeness and adequacy of those procedures to perform the Work.

2. Promptly notify OWNER, ENGINEER and CONTRACTOR of irregularities and deficiencies observed in the Work during performance of their services.

3. Submit certified written report of each test, inspection and similar quality control service to OWNER, ENGINEER, CONTRACTOR and jurisdictional authorities. Interpret test results and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

4. Submit final report of special inspections at Substantial Completion, including a list of unresolved deficiencies.

5. Re-test and re-inspect corrected work.

B. CONTRACTOR'S Responsibilities

1. Provide quality requirements to all subcontractors and enforce all requirements.

2. Notify OWNER, ENGINEER, Special Inspectors and Testing Agencies at least 48 hours in advance of time when Work that requires testing or special inspecting will be performed, unless otherwise indicated in the Contract Documents.

3. Pay for any CONTRACTOR requested testing and inspecting not required by the Contract Documents.

4. Pay for any re-testing or re-inspections by Special Inspectors and Testing Agencies for replacement work resulting from work that failed to comply with the Contract Documents. OWNER will deduct such costs from the Contract Price.

5. Submit copies of licenses, certifications, correspondence, records and similar documents used to establish compliance with standards and regulations that pertain to performance of the Work to the OWNER, ENGINEER and Special Inspectors.

6. Where Special Inspection requires preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

   a. Provide test specimens representative of proposed products and construction in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

b. Provide information on configurations of test assemblies, testing procedures and laboratory test records to adequately demonstrate capability of products to comply with performance requirements.

7. Cooperate with Agencies performing required tests, special inspections and similar quality control services. Notify Agencies in advance of operations to permit assignment of personnel. Provide the following:

a. Access to the Work.

b. Incidental labor, equipment and materials necessary to facilitate tests and special inspections.

c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist Agencies in obtaining samples.

d. Provide facilities for storage and field curing of test samples.

e. Deliver samples to Testing Agencies.

8. Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and special inspecting.

9. Schedule times for tests, special inspections, obtaining samples and similar activities. Distribute schedule to OWNER, ENGINEER, Special Inspectors, Testing Agencies and each party involved in portions of the work where tests and special inspections are required.

1.30 Protection and Cleanup of Existing Structures, Equipment and Facilities

A. The CONTRACTOR is responsible for taking all precautions and implementing all measures necessary to protect all existing structures, equipment, facilities and work.

B The CONTRACTOR shall protect existing equipment during construction activities. This shall include protecting all existing equipment from dust and debris generated during demolition activities, such as core drilling of concrete and cutting or grinding of concrete and concrete masonry block, in accordance with the Drawings and Specification Section 02050.

C CONTRACTOR shall provide temporary curtains as needed to separate work areas where dust and debris will be generated from existing facilities and

equipment. Curtains shall be sealed as approved by the ENGINEER at the edges to minimize the intrusion of dust into the existing building.

D The CONTRACTOR shall protect existing equipment during the moving of new equipment into the building addition.

E. CONTRACTOR shall remove all equipment and systems installed to protect existing facilities and shall cleanup the worksite, leaving it in a condition similar to or better than that when the work began. CONTRACTOR shall participate in a pre-construction survey with the OWNER to document the pre-construction condition in the raw water pump station and the expected level of cleanliness when the CONTRACTOR'S work is complete. Documentation shall include photographs, video records, and written documentation. The OWNER and CONTRACTOR shall sign the documentation agreeing to the pre-construction conditions.

F. Any damage to existing structures, equipment and facilities shall be repaired by removing the damaged structure or work, replacing the work and restoring to original condition satisfactory to the ENGINEER.

G. The CONTRACTOR shall schedule a weekly check-in meeting with the OWNER to assess the effectiveness of dust mitigation and existing facility protection measures. Conditions shall be compared to the photo records and documentation. If cleanliness and protection of existing equipment and structures is not being maintained, the CONTRACTOR shall make corrections immediately at no additional expense to the OWNER.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 Scope

A. This Section specifies submittal procedures for Shop Drawings, Product Data and Samples and other project related submittals identified and required by these Contract Documents.

B. In case of conflict, these specifications will take precedence over the General Conditions.

C. Inquiries shall be directed to ENGINEER regarding the procedure, purpose, or extent of the Submittal.

D. Requirements for Submittals are as provided in the General Conditions, as specified herein, unless specified otherwise in Division 2 through Division 17, and as may otherwise be established during the preconstruction conference.

E. OWNER'S Authorization: At any time, OWNER may authorize changes to procedures and requirements for Submittals, as necessary to accomplish specific purpose of each Submittal. Such authorization will be by Field Order or Work Change Directive.

F. Identification of Submittals:

1. Show each Submittal with numbering and tracking system approved by ENGINEER.

2. Show date of submission and dates of previous submissions.

3. Show Project title and OWNER'S contact identification and contract number.

4. Show names of CONTRACTOR, Subcontractor or Supplier and Manufacturer as appropriate.

5. Identify, as applicable, Contract Document section and paragraph to which Submittal applies.

6. Clearly identify revisions from previous submissions.

G. Number of Copies:

1. Hard Copies: At least six (6) copies of all submittals shall be provided to ENGINEER. Four (4) copies of all submittals will be kept by ENGINEER. If CONTRACTOR requests that more than two (2) copies be returned, then CONTRACTOR shall submit the appropriate quantity of submittals.

2. Digital Copies: At the discretion of the CONTRACTOR, digital copies may be provided in lieu of hard copies. Email submittals directly to the ENGINEER for review.

H. Incomplete Submittal Submissions:

1. At ENGINEER'S sole discretion, ENGINEER will either (1) return the entire Submittal for CONTRACTOR'S revision/correction and resubmission, or (ii) retain portions of the Submittal and request submission/resubmission of specified items or as noted thereon.

2. Submittals which do not clearly bear CONTRACTOR'S specific written indication of CONTRACTOR'S review and approval of Submittal or which are transmitted with an unsigned or uncertified submission form or as may otherwise be required under Contract Documents, will be returned to CONTRACTOR without review (unreviewed) for resubmission in accordance with Contract Documents.

3. Delays, change in sequencing or other impact to the Work resulting from CONTRACTOR'S submission of unchecked or unreviewed, incomplete, inaccurate or erroneous, or nonconforming Submittals, which will require CONTRACTOR'S resubmission of a Submittal for ENGINEER'S review, shall not constitute a basis of claim for adjustment in Contract Price or Times.

I. ENGINEER'S Review: ENGINEER will act upon CONTRACTOR'S Submittal and transmit a response to CONTRACTOR within the period established in the shop drawing schedule. At least 14 calendar days after receipt shall be allocated in the schedule, unless specified otherwise. Resubmittals will be subject to the same review time.

ENGINEER will review the submitted data and shop drawings, and will make notations thereon indicating "No Exception Taken", "Make Corrections Noted", "Rejected", "Revise and Resubmit", or "Submit Specified Item". ENGINEER will then return copies of the submitted data and shop drawings to CONTRACTOR. ENGINEER'S review of Submittals and Shop Drawings is

understood to be an acceptance of the character of the details and not a check of any dimension or quantity, and will not relieve CONTRACTOR from responsibility for errors of any sort in the Submittals and Shop Drawings.

Submitted data shall be sufficient in detail for determination of compliance with the Contract Documents. Color samples for all items for which colors are to be selected shall be submitted at the same time. No equipment or material for which listings, drawings, or descriptive material is required shall be installed until ENGINEER has made a determination that the submittal complies with the Project specifications.

Regardless of corrections made in or review given to the drawings by ENGINEER, CONTRACTOR shall be responsible for the accuracy of such drawings and for their conformity to the plans and specifications. CONTRACTOR shall check all Submittals and shall stamp CONTRACTOR'S approval on all copies of the Shop Drawing documents before submitting them to ENGINEER. Any Submittals received by ENGINEER which do not bear the CONTRACTOR'S approval shall be returned without review. If more than two (2) submissions are required to meet the Project specifications, the cost of reviewing these additional submissions may be charged directly against CONTRACTOR and OWNER may withhold the funds necessary to cover these costs.

1.2 Administrative Submittals

A. Description: Submittals required by Contract Documents that are not Shop Drawings or Samples, or that do not reflect quality of product or method of construction. Administrative submittals may include, but will not be limited to the Submittals identified below:

1. Construction Progress Schedule
2. Shop Drawing Submittal Schedule
3. Work Sequencing Plan
4. Erosion/Sedimentation Control Plan
5. Schedule of Values
6. Materials Certificates
7. Quality Control and Product Data Submittals
8. Manufacturer's Instructions
9. Applications for Progress Payments and Materials Invoices
10. As-Constructed Drawings
11. Proof of All Required Insurance
12. Operation and Maintenance Manuals

B. Construction Project Schedule: CONTRACTOR shall prepare and submit to ENGINEER, at the preconstruction meeting, a practicable schedule showing

the order in which CONTRACTOR proposes to carry out the Work, the dates on which the important features of Work will start, and the contemplated dates for completing the same. The schedule shall be in the form of a bar chart that outlines the Work in sufficient detail such that the time frame for each item of Work does not exceed 7 calendar days. In addition to a time-scaled bar chart schedule depicting the project critical path, CONTRACTOR shall submit a detailed CPM logic diagram. The CPM diagram and time-scaled bar chart shall include the following:

- Construction activities
- Submittal and approval of material samples and shop drawings
- Procurement of critical materials
- Fabrication, installation, and testing of special materials and equipment
- Duration of work, including completion times of all stages and their sub-phases

The activities shall be separately identifiable by coding or use of sub-networks or both. The duration of each activity shall be verifiable by manpower and equipment allocation, in common units of measure, or by delivery dates and shall be justifiable by CONTRACTOR upon the request of ENGINEER.

Detailed subnetworks will include all necessary activities and logic connectors to describe the Work and all restrictions to it. In the restraints, include those activities from the Project schedule which initiated the subnetwork as well as those restrained by it.

Include a tabulation of each activity in the computer mathematical analysis of the network diagram. Furnish the following information as a minimum for each activity:

- Event (node) number(s) for each activity
- Activity description
- Original duration of activities (in normal workdays)
- Estimated remaining duration of activities (in normal workdays)
- Earliest start date or actual start date (by calendar date)
- Earliest finish date or actual finish date (by calendar date)
- Latest start date (by calendar date)
- Latest finish date (by calendar date)
- Slack or float time (in workdays)

Computer printouts shall consist of at least a node sort and an “early start/total-float” sort.

CONTRACTOR’S attention is drawn to typical local climatic weather patterns and CONTRACTOR shall coordinate Work accordingly.

OWNER will require CONTRACTOR to submit updated schedules at regular intervals as construction progresses.

The construction schedule shall take into account the orderly, timely and efficient prosecution of the Work and identify how system constraints will be met. The construction schedule shall indicate CONTRACTOR'S plan of prosecution of the Work in sufficient detail to enable CONTRACTOR, OWNER, and ENGINEER to plan, coordinate, appraise documents, and control their respective contract responsibilities. The construction schedule shall include the ordering, delivery and installation dates of all material items critical to the substantial completion of the Project.

CONTRACTOR'S failure to provide the schedules, schedule information, progress reports, or schedule updates at the times required herein shall cause progress payments under the Contract Documents to be suspended until the required data is provided to ENGINEER unless ENGINEER waives the provisions of the subsection in writing.

C. Schedule of Values: CONTRACTOR shall, at the Preconstruction meeting, submit a complete breakdown of all lump sum bid items showing the value assigned to each part of the Work including an allowance for profit and overhead adding up to the total lump sum price for that item. Breakdown of lump sum items shall be coordinated with the unit price items in the schedule. Preparatory work, bonds, and insurance required in setting up the job will be allowed as a separate entry on the cost breakdown but shall not exceed 5% of the total base bid. Upon acceptance of the breakdown of the contract price by ENGINEER, it shall be used as the basis for all requests for payment.

D. Product Data Submittals: Where required by the specifications, the Contractor shall submit descriptive information that will enable the Engineer to assess whether the Contractor’s proposed materials, equipment or methods of work are in general conformance with the design concept and in compliance with the drawings and specifications. The information submitted shall consist of drawings, specifications, descriptive data, certificates, samples, test results, and such other information, all as specifically required in the specifications. Submittals must be legible. Unreadable submittals will be rejected. Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal.

The Contractor shall verify that the material and equipment described in each submittal conform to the requirements of the specifications and drawings. If the information shows deviations from the specifications or drawings, the

Contractor shall, by statement in writing accompanying the submittal, identify the deviations and state the reasons therefore.

The Contractor shall ensure that there is no conflict with other submittals and shall notify the Engineer in each case where a submittal may affect the work detailed in another submittal. The Contractor shall ensure coordination of all submittals among the various crafts performing the Work. The Contractor shall be responsible for all coordination and costs incurred as a result of changes caused by substitution of equipment other than that specified.

Submittal documents shall be edited to clearly indicate only those items, models or series of equipment that are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. For each item, equipment or component, Contractor shall submit for review only one manufacturer and only one model. Contractor shall not submit data from more than one manufacturer, or more than one model from a manufacturer, with the intention of selecting the manufacturer or model after submittal review is complete.

Contractor is responsible for ensuring that the material or equipment supplied or the method of work employed shall be as described in the submittal.

E. Operation and Maintenance Manual

1. Operation and maintenance instructions shall contain the following as a minimum:

   a. Approved shop drawings and submittal data
   b. Model, type, size and serial numbers of equipment furnished
   c. Equipment and driver nameplate data
   d. List of parts showing replacement numbers
   e. Recommended list of spare parts
   f. Complete operating instructions including start-up, shutdown, adjustments, cleaning, maintenance and overhaul procedures
   g. Maintenance and repair requirements including frequency and detailed instructions
   h. Name, address and phone numbers of local representative and authorized repair service

2. Operation and maintenance instructions shall be provided at a minimum for the following items and as required in individual specification sections:

   a. Grit Classifier
   b. Pinch Valves

c. Check Valves

3. Operation and maintenance instructions shall be submitted in 8-1/2 x 11-inch, heavy-duty, three-ring binder(s) in a format approved by ENGINEER. Provide title page, table of contents, vendor list and contact information for all of the supplied equipment.

4. Submit three (3) copies of the draft operation and maintenance (O&M) manual for ENGINEER'S review at least two (2) weeks prior to start-up. One copy will be returned to CONTRACTOR with ENGINEER'S comments.

5. Incorporate ENGINEER'S comments and submit six (6) copies of the final O&M manual prior to Substantial Completion. The manual will be returned to CONTRACTOR for revision if the manual data does not meet the conditions of the Contract Documents and Substantial Completion will not be issued until the final manual is accepted by ENGINEER.

6. Electronic Copies: In the final O&M Manual, enclose one electronic copy of the manual in each hard-copy version. The file and folder structure of the electronic copy is to mirror the tabbed structure of the hardcopy. Electronic documentation shall be provided on standard CD-ROM media capable of being read by standard PC CD-ROM drives. All documents shall be provided in Adobe Systems portable document format (PDF), viewable with Adobe Reader, latest version. Where possible, the PDF documents shall be produced using a printer driver engine. Documents for which no electronic form exists may be scanned at 100 percent image scaling and a resolution of 300 dpi or better. All PDF files shall be text captured, image with hidden text, optimized, searchable, and indexable using the Adobe Acrobat Catalog engine. Drawings generated in AutoCAD shall be provided as both DWG files and PDF files.

1.3 Quality Control Submittals

A. Manufacturer's Certificates of Compliance signed by the product manufacturer certifying that materials, manufacture, and product specified conforms to or exceeds specified requirements and intent for which product will be used.

B. Certificates of Compliance Testing and Inspection

Submit Certificates of Compliance Testing and Inspection when testing or inspection is required by Laws and Regulations or governing agency or specified in the individual Specification Sections.

C. Field Materials Samples

Provide as required by individual Specifications and as may be required by ENGINEER during progress of Work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01652

TESTING, TRAINING AND SYSTEM START-UP

PART 1 GENERAL

1.1 Scope

This section specifies equipment and system testing and start-up services to be provided by CONTRACTOR, training of OWNER'S personnel and final testing requirements. Additional requirements may be found in other Specification sections.

1.2 Contract Requirements

A. Testing, training and start-up services are requisite to the satisfactory completion of the Work.

B. Complete all testing, training, and start-up within the Contract Times.

C. Furnish all necessary labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.

D. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation, testing, and operator training.

1.3 Start-up Plan

A. For each piece of equipment and each system installed, CONTRACTOR shall develop and implement a start-up and testing plan. Submit a start-up plan for each piece of equipment and each system not less than eight (4) weeks prior to planned initial equipment or system start-up.

B. Provide Start-up Progress Schedule with the following activities identified:

1. Manufacturer’s services
2. Installation certifications
3. Operator training
4. Submission of operation and maintenance manuals
5. Functional testing
6. Performance testing
7. Operational testing

C. Provide summary of shutdown requirements for existing systems if required, which are necessary to complete start-up of new equipment and systems.

D. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

1.4 Equipment Installation

A. Inspect all equipment and systems following installation and prior to start-up and operational testing.

B. Provide written certification that mechanical, electrical and instrumentation systems furnished are installed to manufacturer requirements prior to start-up and testing.

1.5 General Start-up and Testing Procedures

A. Mechanical Systems:

1. Remove rust preventatives and oils applied to protect equipment during construction.

2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication systems with lubricant recommended by manufacturer.

3. Flush fuel system and provide fuel for testing and start-up.

4. Install and adjust packing, mechanical seals, 0-rings, and other seals. Replace defective seals.

5. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.

6. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.

7. Perform cold alignment and hot alignment to manufacturer's tolerances.

8. Adjust V-belt tension and variable pitch sheaves.

9. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to ensure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.

10. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.

11. Install gratings, safety chains, handrails, shaft guards and sidewalks prior to operational testing.

B. Electrical Systems

1. Perform insulation resistance tests on wiring except 120-volt lighting, wiring, and control wiring inside electrical panels.

2. Perform continuity tests on grounding systems.

3. Test and set switchgear and circuit breaker relays for proper operation.

4. Check motors for actual full load amperage draw. Compare to nameplate value.

C. Instrumentation Systems

1. Bench or field calibrate instruments and make required adjustments and control point settings.

2. Leak test pneumatic controls and instrument air piping.

3. Energize transmitting and control signal systems, verify proper operation, ranges and settings.

1.6 Functional Testing

A. Functionally test mechanical and electrical equipment for proper operation after general start-up and testing tasks have been completed.

B. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.

C. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.

D. Conduct continuous 8 hour test under full load conditions. Replace parts which operate improperly.

E. Coordinate with OWNER, equipment suppliers and manufacturer’s representatives as necessary to accommodate all OWNER pre-purchased testing assistance services.

1.7 Certificate of Proper Installation

A. At completion of functional testing, furnish written report prepared and signed by manufacturer's authorized representative, certifying equipment:

1. Has been properly installed, aligned, adjusted and lubricated.

2. Is free of any stresses imposed by connecting piping or anchor bolts.

3. Is suitable for satisfactory full-time operation under full load conditions.

4. Operates within the allowable limits for vibration.

5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.

B. Co-sign the reports along with the manufacturer's representative and subcontractors.

1.8 Training of OWNER’S Personnel

A. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment. Utilize manufacturer's representatives to conduct training sessions.

B. Coordinate training schedule with OWNER’S staff. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than two (2) sessions per week.

C. Provide operation and maintenance instructions for specific pieces of equipment or systems two (2) weeks prior to training session for that piece of equipment or system. See additional requirements for operation and maintenance instructions specified in Section 01300, Submittals.

D. Satisfactorily complete functional testing before beginning operator training.

E. OWNER may videotape the training for later use with OWNER’s personnel.

1.9 Operational Testing

A. Conduct operational test of the entire facility after all installation certifications have been provided. Demonstrate satisfactory operation of equipment and systems in actual operation.

B. Conduct operational test for continuous 3-day period.

C. OWNER will provide operations personnel, power, fuel, and other consumables for duration of test.

D. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.

E. Repeat operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

F. Provide certificate of completion for variable frequency drive training.

1.10 Minimum Service Schedule

Minimum services shall be provided by the manufacturers' representatives for certain CONTRACTOR-provided equipment in accordance with the following schedule:

		Minimum On-Site Time Requirements		
Specification Section	Equipment	1) Equipment Installation Instruction	2) Equipment Testing Assistance	3) Operator Training
11800	Grit Classifier	0.5 CWD	1 CWD	0.5 CWD

NOTE: CWD is defined as a consecutive working day consisting of an 8 hour period each day between the hours of 7:00 a.m. to 6:00 p.m. at the Project Site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02050

DEMOLITION, GENERAL

PART 1 GENERAL

1.1 Description

Work in this section shall include, but is not limited to the demolition and removal of existing facilities as shown on the plans.

1.2 Submittals

Submit to the ENGINEER a copy of written permission of private property OWNERs with copy of fill permit for said private property for disposal of any fill material.

1.3 Requirements of Regulatory Agencies

A. Protection of Persons and Property -- Meet all federal, state and local safety requirements for the protection of workmen, OWNER's personnel other persons, and property in the vicinity of the demolition work and requirements of the General Provisions.

1.4 Repair of Damage

A. Demolition procedures shall provide for safe conduct of the work, careful removal and disposition of materials and equipment, protection of facilities and property which are to remain undisturbed, coordination with existing facilities to remain in service, and timely disconnection of utility services.

B. Any damage to existing facilities to remain as caused by the CONTRACTOR's operations shall be repaired at the CONTRACTOR's expense.

C. Damaged items shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this contract.

1.5 Protection of Existing Work

A. Before beginning, the CONTRACTOR shall carefully survey the existing work and examine the Drawings and Specifications to determine the extent of the work. The CONTRACTOR shall take all necessary precautions to prevent damage to existing facilities which are to remain in place, and be responsible for any damages to existing facilities, which are caused by the operations. The CONTRACTOR shall carefully coordinate the work of this section with all other work and construction and shall provide shoring, bracing, and supports,

as required. The CONTRACTOR shall insure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract. The CONTRACTOR shall remove all temporary protection when the work is complete or when so authorized by the ENGINEER.

B. The CONTRACTOR shall carefully consider all bearing loads and capacities for placement of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, the CONTRACTOR shall consult with the ENGINEER prior to the placement of such equipment or material

1.6 Burning

Burning at the project site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing operations shall not be permitted.

1.7 Electrical and Control System Demolition

All electrical and control system demolition work shall at all times be conducted by the CONTRACTOR in a safe and proper manner to avoid injury from electrical shock to all personnel. Electrical equipment to be shut off for a period of time shall be tagged, locked out, and sealed with a crimped wire and lead seal and made inoperable. At no time shall live electrical wiring or connections or those which can become energized be accessible to any persons without suitable protection or warning signs.

1.8 Site Conditions

A. The OWNER assumes no responsibility for the actual condition of the facilities to be demolished. The CONTRACTOR shall visit the site, inspect all facilities, to get familiarized with all existing conditions and utilities.

B. Demolition drawings identify the major equipment and structures to be demolished only. Auxiliary utilities such as water, air, chemicals, drainage, lubrication oil, hydraulic power fluid, electrical wiring, controls, and instrumentation are not necessarily shown but shall also be removed at no additional cost to the OWNER.

PART 2 PRODUCTS

2.1 Ownership of Existing Materials

All materials, equipment, miscellaneous items and debris involved, occurring or resulting from demolition work shall become the property of the CONTRACTOR at

the place of origin unless otherwise specified in the Contract Documents or in writing by the OWNER.

2.2 Filler Sand

Filler sand shall meet the requirements of fine aggregate for Portland Cement concrete contained in the Oregon State Highway Division Standard Specifications for Highway Construction.

PART 3 EXECUTION

3.1 Demolition

A. All demolished exposed and/or protruding metalwork, piping, plumbing, woodwork, roofing, and mechanical equipment shall be removed to a minimum depth of 12 inches below finished grade. All exposed anchors, bolts, conduits and other concrete-embedded items to be demolished shall be drilled out 1-inch minimum below the concrete surface and then the hole filled with non-shrink grout. Chipped or damaged concrete shall be cleaned, prepared with bonding agent, and surfaces grouted smooth with non-shrink grout.

B. All demolished electrical control panels, junction boxes, motor control centers and local switches and pushbuttons shall be removed. All demolished exposed electrical conduits and cables shall be removed to a minimum depth of 12 inches below finished grade. All demolished wiring shall be removed from underground conduits that are abandoned in place, and the ends shall be capped.

C. Areas which are to be excavated for the purpose of demolition shall be cleared and stripped. All debris and vegetation in these areas shall be removed and disposal of off-site and in compliance with applicable local, state, and federal codes and requirements.

D. CONTRACTOR shall excavate around existing structures as required to perform demolition operations and to plug pipelines where shown on the plans. Backfilling with rubble material within the footprint of new structures will not be allowed.

E. Disposal of all materials shall be performed off-site and in compliance with applicable local, state, and federal codes and requirements. In areas where new construction will take place, no trace of demolished structures shall remain prior to placing of backfill.

3.2 Removal

Remove from project site all debris, materials, equipment and items found thereon and materials and debris resulting from the work of demolition except as otherwise indicated. All existing improvements designated on the plans or specified to be removed above, at, or below existing ground surface shall be included in the demolition work. Unless otherwise specified, any resulting voids shall be backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

3.4 Pipe Abandonment

A. Abandoned Pipes -- When existing pipe is removed, the CONTRACTOR shall plug any remaining piping being abandoned in place with a minimum of 2 feet of non-shrink grout. Prior to placing grout, roughen interior pipe surface and apply epoxy bonding agent.

B. Pipe Remaining in Service -- When existing piping is removed, the CONTRACTOR shall install blind flanges and restrained caps and plugs at all piping to remain in place and in service.

3.6 Asphaltic Concrete Demolition

A. Asphalt pavement shall be removed to the limits shown on the plans. The limits of the removal shall be saw cut. Asphalt pavement demolished shall be disposed of off-site.

3.7 Grading

All grading work shall be completed in accordance with Section 02200 Earthwork.

3.8 Cleanup

A. During and upon completion of work, the CONTRACTOR shall promptly remove all unused tools and equipment, surplus materials, debris, and dust and shall leave all areas affected by the work in a clean, ENGINEER approved condition.

B. Adjacent structures shall be cleaned of dust, dirt and debris resulting from demolition. Adjacent areas shall be returned to their existing condition prior to the start of work.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.1 Description

Work covered in this section includes general excavation, fill and backfill work. Earthwork shall meet the specifications of this Section and Oregon Department of Transportation, Standard Specifications for Highway Construction. In the case of conflict, the more stringent specification shall apply.

1.2 Submittals

A. Submit results of aggregate sieve analysis and standard proctor tests for all granular material.

B. Submit mix proportions for Controlled Low Strength Material (CLSM). The proposed mix design shall be strength tested in accordance with ASTM D 4832 at 7, 14 and 28 days age and results submitted to the ENGINEER. The CONTRACTOR shall submit to the ENGINEER batch weights of each batch of CLSM used during construction.

C. See Section 01300 for CONTRACTOR submittals.

1.3 Reference Specifications, Codes and Standards

A. Commercial Standards

ASTM C 94	Specification for Ready-Mixed Concrete
ASTM C 403	Test Method for Time of Setting Concrete Mixtures by Penetration Resistance
ASTM D 422	Method for Particle-Size Analysis of Soils
ASTM D 698	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-inch (304.8-mm) Drop (AASHTO T-99)
ASTM D 2487	Classification of Soils for Engineering Purposes

ASTM D 4253	Test Methods for Maximum Index Density of Soils Using a Vibratory Table
ASTM D 4254	Test Methods for Minimum Index Density of Soils and Calculation of Relative Density
ASTM D 4832	Preparation and Testing of Controlled Low Strength Material Test Cylinders
ASTM D 6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

B. Reference Standards

References herein to the "Standard Specifications for Highway Construction" shall mean The Oregon Department of Transportation, Standard Specifications for Highway Construction. References herein to "AASHTO" shall mean Association of American State Highway Transportation Officials.

1.4 Classification of Excavation

A. Unclassified Excavation

Unclassified excavation is defined as all excavation, regardless of the type, character, composition or condition of the material encountered and shall further include all debris, junk, broken concrete, and all other material. All excavation shall be unclassified unless provided for otherwise elsewhere in these specifications.

B. Classified Excavation

1. Common Excavation

Common excavation is defined, as the excavation of all material not classified as Rock Excavation.

2. Rock Excavation

Rock excavation is defined as the removal of rock by systematic and continuous drilling and blasting, if allowed, and hammering, breaking, splitting or other approved methods. Rock is defined as material including boulders, solid bedrock, or ledge rock, which, by actual demonstration, cannot be reasonably excavated with suitable power

excavation equipment. Suitable machinery is defined as a track-mounted hydraulic excavator of the 52,800 to 72,500 pound class equipped with a single shank ripper. The ENGINEER may waive the demonstration if the material encountered is well-defined rock. The term "rock excavation" shall be understood to indicate a method of removal and not a geological formation.

If material which would be classified as rock by the above definition is mechanically removed with equipment of a larger size than specified, it shall be understood that any added costs for the removal of material by this method shall be included in the unit price for common excavation. Before the removal of rock by the methods described above will be permitted, the CONTRACTOR shall expose the material by removing the common material above it and then notify the ENGINEER who, with the CONTRACTOR or his representative, will measure the amount of material to be removed.

In trench excavations, boulders or pieces of concrete below grade larger than one half (1/2) cubic yard will be classified as rock if blasting, hammering, breaking or splitting actually required and used for their removal from the trench. If material, which would be classified as rock by the definition above and elsewhere within these specifications, is mechanically removed without blasting, hammering, breaking or splitting, it will be considered common excavation. If equipment larger than the “suitable machinery” as defined above is brought on the project site for the sole purpose of rock removal without blasting, hammering, breaking or splitting, then such removal will be considered rock excavation.

CONTRACTOR shall verify if the use of explosives for excavation of rock is allowed on this project.

1.5 Quality Assurance

A. Soil Testing -- Soil sampling and testing to be by an independent laboratory approved by the ENGINEER. The frequency of testing is to be determined by the ENGINEER. All soil testing shall be paid for by the CONTRACTOR.

B. Compaction Tests -- Maximum density of optimum moisture content by ASTM D698 (AASHTO T-99). In-place density in accordance with Nuclear Testing Method ASTM D2922 and D3017.

C. Soil Classification -- All imported materials, classification in accordance with ASTM D2487.

D. Allowable Tolerances -- Final grades shall be plus or minus 0.04 foot.

E. In Place Testing of CLSM -- CLSM shall be tested in accordance with ASTM C 403.

F. Compressive Tests of CLSM -- CLSM shall be compressive tested in accordance with ASTM D 4832.

1.6 Site Conditions

A. Quantity Survey -- CONTRACTOR shall be responsible for calculations of quantities of cut and fill from existing site grades to finish grades established under this contract as indicated on the plans or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control -- Must meet Oregon State DEQ and Local requirements. Protect persons and property from damage and discomfort caused by dust. Water as necessary and when directed by ENGINEER to quell dust.

C. Soil Control -- Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers. See provisions for erosion control.

D. Existing Underground Utilities -- Protect active utilities encountered and notify persons or agencies owning same. Remove inactive or abandoned utilities from within the project grading limits to a depth at least twelve (12) inches below subgrade established under this contract. All abandoned piping to be plugged as approved by ENGINEER.

PART 2 PRODUCTS

2.1 Crushed Rock

Crushed rock with 3/4 inch-0, 1 inch-0, and 1 1/2 inch-0 gradation as shown on the plans shall meet the gradation and other requirements of the Standard Specifications for Highway Construction for Base Aggregates.

2.2 Granular Drain Backfill Material

Granular drain backfill material shall be crushed or uncrushed rock or gravel as shown on the plans and shall be clean and free-draining. Granular drain backfill material shall be the size as shown on the plans and shall meet the gradation and other requirements of the Standard Specifications for Highway Construction for such material.

2.3 Controlled Low Strength Material (CLSM)

CLSM shall be composed of cement, pozzolans, fine aggregate, water, and admixtures. CLSM shall have a low cement content, be non-segregating, self consolidating, free-flowing and excavatable material which will result in a hardened, dense, non-settling fill and a compressive strength at 28 days of 100 to 200 psi if not otherwise shown or specified.

2.4 Select Native Fill

Select native fill shall consist of approved earth obtained from on-site excavations, free of peat, humus, vegetative matter, organic matter, and rocks greater than 12 inches in diameter, processed as required to be placed in the thicknesses prescribed and at the optimum moisture content to obtain the level of compaction required by these specifications.

2.5 Imported Fill

Imported fill material shall consist of approved imported earth substantially free of organic material and foreign debris. Imported fill material shall meet the requirements for select native fill as defined above and shall be approved by the ENGINEER.

2.6 Topsoil

Top 6 to 12 inches of existing soil containing organic matter. ENGINEER's decision shall be final as to determination of what is of topsoil quality. Topsoil shall be stockpiled on site for later use in landscaping. Care shall be taken in collection of topsoil so as to preserve native seed stocks, which are valuable to restoring native species as part of finish landscaping.

2.7 Spoils

All excess material not suitable or not required for backfill and grading shall be hauled off site and disposed of at a location approved by the ENGINEER. The CONTRACTOR shall make arrangements for disposal of the material at no additional cost to the OWNER. Landfill permit to be obtained by the CONTRACTOR and provided to ENGINEER prior to commencement of disposal.

PART 3 EXECUTION

3.1 General

A. Prior to work in this section, become familiar with site conditions. In the event discrepancies are found, notify the ENGINEER as to the nature and extent of the differing conditions.

B. Do not allow or cause any work performed or installed to be covered up or enclosed prior to required tests and approvals. Should any work be enclosed or covered up, uncover at CONTRACTOR's expense.

3.2 Topsoil Stripping and Stockpiling

A. Site within clearing limits shall be stripped of topsoil to depths approved by the ENGINEER, as required to obtain additional topsoil necessary to complete work indicated on plans or specified.

B. Topsoil shall be free of sticks, large rocks, clods, and subsoils.

C. Stockpile topsoil at locations approved by ENGINEER for redistribution as specified. Grade surface of stockpiles remaining over winter months to prevent ponding of water. Cover stockpile to minimize the infiltration of water. See other provisions for erosion control.

3.3 Excavation

A. Excavate material of every nature and description to the lines and grades as indicated on the drawings and/or as required for construction of the facility.

B. Provide and maintain equipment to remove and dispose of water during the course of the work of this section and keep excavations dry and free of frost or ice.

C. Project dewatering is specified elsewhere. Coordinate drainage requirements with this work. Provide temporary drainage ditches as required and regrade as indicated at completion of project.

D. Excavated material not approved for use in the embankments or in excess of that needed to complete the work shall be hauled off site and disposed of at no expense to the OWNER.

3.4 Rock Excavation

A. Where the bottom of the excavation encounters ledge rock and/or boulders and large stones which meet the definition of “rock” as described herein, said rock shall be removed to provide 12 inches of clearance on each side and below all structures, pipe and appurtenances.

B. Excavations below subgrade in rock shall be backfilled to subgrade with approved bedding material and thoroughly compacted.

C. If explosives are allowed on this project, the CONTRACTOR shall comply with the requirements for the use and security of explosives as specified in the special provisions.

D. Wherever the use of explosives is required during the course of the work, and if the use of explosives is allowed on this project, the CONTRACTOR shall conform to the recommendations of the Manual of Accident Prevention in Construction, published by AGC, in regard to Section 5, Explosives. Prior to commencing use of explosives, the CONTRACTOR shall submit a certificate of insurance showing coverage of blasting operating and blasting product liability to the limits required by the General Conditions. Coverage for this extra hazard shall be maintained during all blasting operations.

E. The CONTRACTOR shall provide all necessary approved types of tools and devices required for loading and using explosives, blasting caps and accessories, and conform to and obey all federal, state, and local laws that may be imposed by any public authority.

F. When blasting rock, cover the area to be shot with blasting mats or other approved types of protective material that will prevent the scattering of rock fragments outside the excavation. The CONTRACTOR shall give ample warning to all persons within the vicinity before blasting, station people and provide signals of danger in suitable places to warn people and vehicles before firing any blasts. Fire all blasts with an electric blasting machine which shall be connected to the circuit immediately prior to the time for firing, and only then by the person who will operate the blasting machine.

G. The CONTRACTOR shall assume all liability and responsibility connected with or accruing from blasting, or the use of explosives or dangerous material of any kind whatsoever. Such liability shall extend to include, but not be limited to, damage to work or adjacent property, injuries, lawsuits, complaints and all other adverse results, whether actual, alleged, inferred or implied.

3.5 Grading and Filling

A. General -- Grading and filling operations shall not take place when weather conditions and moisture content of fill materials prevent the attainment of specified density. Vertical curves or roundings at abrupt changes in slope shall be established as approved by ENGINEER. Bring all graded areas to a relatively smooth, even grade and slope by blading or dragging. Remove high spots and fill depressions.

B. For areas receiving surface structures or existing paved areas to be constructed or replaced by the CONTRACTOR or by others, such as railways, roadways, driveways, parking lots, and sidewalks, place clean well-graded gravel fill material (3/4 inch – 0 inch) in 6-inch lifts and compact with vibratory equipment to 95 percent maximum density unless otherwise specified.

C. Embankment Construction -- Place fill material shown or specified in 8-inch loose lifts and compact with approved equipment. All fill material within 3 feet of top of fill elevations shall be compacted with vibratory equipment to 95 percent maximum density unless otherwise specified. All fill material below the 3-foot limit shall be compacted with vibratory equipment to 90 percent maximum density unless otherwise specified.

3.6 Topsoil Fill

A. Scarify prepared subgrade to depth of four inches immediately prior to placing topsoil.

B. Place topsoil in areas to be seeded to depths indicated, minimum depth of six inches. Place loose; do not compact, do not place in wet or muddy conditions.

3.7 Controlled Low Strength Material (CLSM)

A. At time of placement, the CLSM must be at least 40 degrees F and ambient air temperature must be at least 34 degrees F and rising. Subgrade on which CLSM is to be placed shall be free of disturbed or soft material, debris and water.

B. After CLSM is placed, further construction proceeding upon it will be permitted only after initial set is attained, as measured by ASTM C 403. No traffic or construction equipment shall be allowed on CLSM for at least 24 hours after placement.

END OF SECTION

SECTION 02221

EXCAVATING, BACKFILLING AND COMPACTING FOR STRUCTURES

PART 1 GENERAL

1.1 Description

A. Scope -- The work described in this section consists of excavating material, fill material, stockpiling, blending, material handling, dewatering, structural excavation including rock excavation, protection of excavated surfaces, base aggregate under slabs and footings, and testing necessary to construct this project as shown on the Plans and as specified.

B. Definitions

1. Rock Excavation -- As defined in Section 02200
2. Common Excavation -- As defined in Section 02200
3. Unclassified Excavation -- As defined in Section 02200

1.2 Quality Assurance

A. Compaction Requirements -- In-place dry density of compacted material shall be at least 95 percent of maximum dry density at optimum moisture content determined on the basis of ASTM Method D-698 (AASHTO T-99).

B. Testing Requirements

1. All testing to be by an independent laboratory approved by the OWNER. Initial testing will be paid for by the OWNER. Subsequent testing after failure of initial acceptance testing will be paid for by the CONTRACTOR.

2. In-place compaction tests shall be performed at 2-foot elevation increments in the fill material with a minimum of one test for each 2500 square feet of material placed. The ENGINEER shall be provided with the results of each compaction test at the time of testing.

PART 2 PRODUCTS

2.1 Structural Fill

Clean, free-draining sand, sand and gravel or crushed rock with all material passing the 3-inch sieve and no more than 5 percent by weight passing the No. 200 sieve by

the wet sieve analysis method. Material shall be generally uniformly graded from coarse to fine with enough finer material to fill the voids.

2.2 Crushed Rock

Crushed rock with gradation as shown on the plans shall meet the gradation and other requirements of the Oregon Standard Specifications for Construction for aggregate base.

2.3 Rounded Rock

Rounded rock with gradation as shown on the plans shall have at least one mechanically fractured face and shall meet the gradation and other requirements of the Oregon State Highway Department Standard Specifications for Highway Construction for base aggregates.

PART 3 EXECUTION

3.1 General

A. Prior to work in this Section, become familiar with site conditions. In the event discrepancies are found, notify the ENGINEER as to the nature and extent of the differing conditions.

B. Do not allow or cause any work performed or installed to be covered up or enclosed prior to required tests and approvals. Should any work be enclosed or covered up, uncover at CONTRACTOR's expense.

3.2 Control of Water

Excavated areas shall be kept free of water and frost. Bearing surfaces that become softened by water or frost must be re-excavated to solid bearing at CONTRACTOR's expense and backfilled with compacted crushed rock at CONTRACTOR's expense. See specifications found elsewhere in this document for dewatering requirements.

3.3 Excavation

A. General

General excavation consists of removal of all materials of any nature, including rock, required for the construction of various structures. The method of excavation shall be the CONTRACTOR's option, but care shall be exercised as final grade is approached to leave it in undisturbed condition. This may include the use of backhoe equipment using a level edged bucket or

blasting for rock if allowed. If the final grade is disturbed, it shall be restored to requirements and satisfaction of the ENGINEER.

1. Soil conditions -- If the final grade for supporting structures is disturbed or becomes wet or dried out during the course of construction, the CONTRACTOR shall remove and replace the material as indicated in this section at no cost to the OWNER. The CONTRACTOR is advised that footings should be poured as soon as possible to minimize these conditions.

2. Frozen ground -- Frost protection shall be provided for all structural excavation work. Foundation work shall not be placed on frozen ground.

3. Shoring -- Where shoring, sheet piling, sheeting, bracing, lagging, or other supports are necessary to prevent cave-ins or damage to existing structures, it shall be the responsibility of the CONTRACTOR to design, furnish, place, maintain and remove such supports in accordance with applicable ordinances and safety requirements. The design, planning, installation and removal of all sheeting, accomplished in such a manner as to maintain the undisturbed state of the soil below and adjacent to the excavation.

4. Removal of unsuitable material -- Cross-sectional dimensions and depths shown shall be subject to such changes as may be found necessary by the ENGINEER to secure foundations free from soft, weathered, shattered and loose material or other objectionable materials. The unsuitable materials encountered shall be removed and replace with materials as indicated in this section.

5. Disposal of excavated material -- Suitable excavated material shall be used in fills, backfills or removed from site. Unsuitable material as determined by the ENGINEER, shall be disposed of off site at an approved disposal site. The CONTRACTOR shall make arrangements for disposal of the material at no additional cost to the OWNER. Landfill permit to be obtained by the CONTRACTOR and provided to ENGINEER.

6. Stockpiling of excavated materials -- Construction areas and spoils areas will be available to the CONTRACTOR on the site. When work is completed, the CONTRACTOR shall leave the premises in its original condition and acceptable to the ENGINEER and OWNER. The CONTRACTOR may not have sufficient area on site to stockpile excavated material that will be required for fill later in the project. If additional stockpile area is required to complete the project on

schedule, the CONTRACTOR shall arrange off site stockpile areas. No additional payments will be made for stockpiling excavated materials off site. Stripping and stockpiling of reusable materials shall be carefully segregated into well defined stockpiles in the area designated and adequately protected against deterioration (i.e. erosion, water, etc.)

3.4 Subgrade Preparation

A. General

Excavate to firm undisturbed soil or rock. Excavation shall be conducted so that equipment traffic is kept off the exposed excavation at all times. Temporary cut slopes shall be constructed no greater than 1H:1V. Do not place any material when weather conditions and/or moisture content prevent attainment of specified density.

B. Overexcavation of Soft Areas

Replace all soft areas by overexcavation and backfill with crushed rock as directed by the ENGINEER. All material placed shall be compacted to 95 percent of maximum dry density.

3.5 Fill for Structures

A. General

Bring to required subgrade with compacted structural fill material. Place in 6-inch lifts and compact to 95 percent maximum dry density. Mechanical tampers permitted in confined areas. Do not place when weather conditions and/or moisture content prevent attainment of specified density. Place a 6-inch minimum layer of ¾-inch-0-inch crushed rock to required grade under all concrete footings. Place an 8-inch minimum layer of ¾-inch-0-inch crushed rock to required grade under all concrete slabs. All material placed shall be compacted in six-inch lifts to 95 percent of maximum dry density.

3.6 Backfill for Structures

A. General

Prior to placing backfill, remove forms, temporary construction and debris below grade. Backfill shall not be placed against poured concrete until 28 days have passed from completion of original concrete pour. Heavy compactors and large pieces of construction equipment shall be kept away from any embedded wall a distance of a least 5 feet in order to avoid the build-up of excessive lateral pressures. Compaction within 5 feet of the walls shall be accomplished using hand operated vibratory plate compactors or tamping

units. Particular care must be taken to avoid damage to the pipe connections to the structure.

B. Buried Structures

Structural fill backfill material shall be brought up on all sides of the wall footing in such a manner as to avoid adverse differential lateral earth pressures on the wall. Each 8-inch (measured loose) lift shall be uniformly compacted with a suitable compactor to at least 95 percent of the standard maximum dry density.

C. Trench backfill within 10 feet of all structural perimeters shall meet the requirements for structural fill.

3.7 Structural Fill Under Slabs and Footings

A. General

Structural fill backfill material shall be placed and compacted under cement concrete slabs, footings, pavement, and walks.

1. Minimum depth of base course below footings, walks, slabs and retaining walls shall be 6 inches.

2. Minimum depth of base course below equipment pads shall be 12 inches.

END OF SECTION

SECTION 02222

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 GENERAL

1.1 Description

A. Work covered in this Section includes trench excavation for pipe, utility vaults and other utilities, pipe and utility vault bedding, and trench and utility vault backfill. All work shall conform to City of Albany Standards except as modified herein. In the case of discrepancy the more stringent provisions shall apply.

B. Excavation for Utilities Includes

1. Work of making all necessary excavations for the construction of all contract work.

2. Furnishing, placing and use of sheeting, shoring, and sheet piling necessary in excavating for and protecting the work and workmen.

3. Performing all pumping and work necessary to keep the trenches free from water.

4. Providing for uninterrupted flow of existing rivers, treatment plant processes, drains, and sewers and the temporary disposal of water from other sources during the progress of the work.

5. Damming and coffer damming where necessary.

6. Supporting and protecting all structures, pipes, conduits, culverts, railroad tracks, posts, poles, wires, fences, buildings, and other public and private property adjacent to the work.

7. Removing and replacing existing sewers, culverts, pipelines, and bulkheads where necessary.

8. Removing after completion of the work all sheeting and shoring not necessary to support the sides of excavations.

9. Removing all surplus excavated material.

10. Performing all backfilling and rough grading of compacted backfill to limits specified or ordered by the ENGINEER.

11. Restoring all property damaged as a result of the work involved in this contract.

C. The work includes obtaining and transporting suitable fill material from off-site when suitable on-site material is not available.

D. The work includes transporting surplus excavated material not needed for backfill at the location where the excavation is made, to other parts of the work where filling is required, or disposal of all surplus material on other sites provided by the CONTRACTOR.

E. Backfill and Fill Compaction: Test consolidated backfill material in trenches around pipes and structures in conformance with “Compaction Tests” specified herein. Where tests indicate insufficient values, perform additional tests as required by the ENGINEER. Testing shall continue until specified values have been attained by additional compaction effort.

F. The work includes furnishing and installing temporary facilities to treat and dispose of any water pumped from the trench or utility vault excavations in a proper and approved manner in accordance with all laws and regulations.

1.2 Submittals

A. Submit results of aggregate sieve analysis and standard proctor tests for all granular material.

B. See Section 01300 for CONTRACTOR submittals.

1.3 Protection

A. Exploratory Test Pits -- The CONTRACTOR shall dig such exploratory test pits as may be necessary in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines, duct banks, conduits, and other obstructions which are likely to be encountered or need to be connected to and shall make acceptable provision for their protection, support, and maintenance of their continued operation.

B. Sheeting, Shoring and Bracing

1. The CONTRACTOR shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent and neighboring structures from damage by settlement or other ground movement.

2. Bracing shall be arranged so as not to place a strain on portions of completed work until the construction has proceeded far enough to

provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the CONTRACTOR shall be responsible for all damage to newly built work and adjacent and neighboring structures.

C. Construction Sheeting Left in Place

1. The CONTRACTOR shall furnish, install, and leave in place, construction sheeting and bracing when specified or when indicated or shown on the Drawings.

2. Construction sheeting and bracing, placed by the CONTRACTOR to protect adjacent and neighboring structures, may be left in place if desired by the CONTRACTOR. All such sheeting and bracing left in place shall be included in the cost for excavation.

3. Any construction sheeting and bracing which the CONTRACTOR has placed to facilitate its work may be ordered in writing by the ENGINEER to be left in place. The right of the ENGINEER to order sheeting and bracing left in place shall not be construed as creating an obligation on its part to issue such orders. Failure of the ENGINEER to order sheeting and bracing left in place shall not relieve the CONTRACTOR of its responsibility under the contract.

D. Removal of Water

1. The CONTRACTOR shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the work and shall keep said excavations dry until the pipelines to be placed therein are completed. In water bearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation dry as specified.

2. The CONTRACTOR shall dispose of water from the work in a suitable legal manner without damage to adjacent property or structures.

1.4 Definitions

A. Bedding and Pipe Zone Backfill

Bedding and pipe zone backfill is defined as the furnishing, placing and compacting of material below, around and above the top of the pipe barrel to the dimensions shown on the trench detail on the Drawings. The minimum depth for pipe bedding shall be 4 inches. The compaction requirement for the pipe bedding and pipe zone shall not be less than that required for the trench backfill above the pipe zone.

B. Trench Backfill Zone

Trench backfill is defined as the furnishing, placing and compacting of material in the trench above the pipe zone, up to bottom of the pavement base rock, ground surface or surface material.

C. Bedding, Pipe Zone and Backfill Classification

Classification not used, see City Standards.

D. Foundation Stabilization

Foundation stabilization is defined as removing unsuitable native material below the design grade of the area being excavated and replacing and compacting with crushed rock to the dimensions shown on the trench detail, as approved by the ENGINEER, or as otherwise directed by the ENGINEER. Foundation stabilization material shall be placed in lifts not to exceed eight (8) inches and compacted to 95 percent of the maximum density at optimum moisture content.

E. Classification of Excavated Material

Excavated materials are defined within Section 02200, Earthwork.

1.5 Quality Assurance

A. Compaction Requirements

In place dry density of compacted material shall be at the percent of maximum dry density specified or shown at optimum moisture content determined on the basis of the latest edition of AASHTO T-99.

B. Testing Requirements

An independent laboratory retained by OWNER will perform all soil sampling and testing. Testing locations and frequencies shall be determined by the ENGINEER. All testing will be paid for by OWNER.

1.6 References

A. Standard Specifications for Public Works, APWA, current manual, hereinafter called “APWA Standard Specifications”.

B. Oregon Department of Transportation, Standard Specifications for Highway Construction, current manual, hereinafter called “Standard Specifications for Highway Construction”.

PART 2 MATERIALS

2.1 Native Backfill Material

Native backfill material shall be select excavated native material free from roots or other organic material, trash, mud, muck, frozen material and large stones and shall comply with the select native fill specification within Section 02200, Earthwork. When native excavated material is used for backfill around the pipe, it shall be free of rocks, cobbles, stones or other debris having a dimension greater than 1-1/2 inches.

2.2 Granular Backfill Material

Unless otherwise shown on the plans or specified herein, granular backfill material shall be well graded crushed rock with a maximum aggregate size of 3/4-inch in the bedding and pipe zone, and a maximum aggregate size of 1-1/2-inch in the trench backfill zone. All gradations of crushed rock shall comply with Section 02200, Earthwork.

2.3 Foundation Stabilization Material

Foundation stabilization material shall be 6 inch - 2 inch or 4 inch - 2 inch gravel, free from clay balls and organic debris, and being well crushed gravel or crushed rock graded with less than 8 percent by weight passing the 1/4-inch sieve, as approved by the ENGINEER.

PART 3 EXECUTION

3.1 Preparation

A. The site of an open cut excavation shall be first cleared of all obstructions preparatory to excavation. Wherever paved or surfaced streets are cut, saw wheel or approved cutting devices shall be used. Width of pavement cut shall not be less than 12 inches greater than trench width. Any cut or broken pavement shall be removed from site during excavation.

B The CONTRACTOR shall maintain street traffic at all times and erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with the latest edition of Manual of Uniform Traffic Control Devices (MUTCD), Part 6, to protect the traveling public in any area applicable. Provide flaggers as required during active work in roadway areas.

C. Intent of specifications is that all streets, structure, and utilities be left in condition equal to or better than original condition. Where damage occurs and

cannot be repaired or replaced, CONTRACTOR shall purchase and install new material, which is satisfactory to OWNER. Plans and/or specifications cover and govern replacement and restoration of foreseeable damage.

D. The CONTRATOR's operations shall be confined to rights-of-way and easements provided. Avoid encroachment on, or damage to, private property or existing utilities unless prior arrangements have been made with copy of said arrangement submitted to ENGINEER.

3.2 Obstructions

This item refers to obstructions, which may be encountered and do not require replacement. Obstructions to the construction of the trench such as tree roots, stumps, abandoned piling, abandoned buildings and concrete structures, logs, rubbish, and debris of all types shall be removed without additional compensation from the OWNER. The ENGINEER may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made within the perpetual easement and right-of-way and without adversely affecting the intended function of the facility or increased costs to the OWNER.

3.3 Interfering Structures or Roadways

A. The CONTRACTOR shall remove, replace and/or repair any damage done by the CONTRACTOR during construction to fences, buildings, cultivated fields, drainage crossings, and any other properties at its own expense and without additional compensation from the OWNER. The CONTRACTOR shall replace or repair these structures to a condition as good or better than their pre-construction condition prior to commencing work in the area.

B. Where paved roadways are cut, trench backfill will be Class D as defined herein. New pavement shall be equal to or better than the existing paved surface, and shall not deviate by more than 1/4-inch from the existing finish elevation.

C. If the CONTRACTOR encounters existing structures, which will prevent construction and are not adequately shown on the plans, the CONTRACTOR shall notify the ENGINEER before continuing with the work in order that the ENGINEER may make such field revisions as necessary to avoid conflict with the existing conditions. The cost of waiting or "down time" during such field revisions shall be borne by the CONTRACTOR without additional cost to the OWNER or liability to the ENGINEER. If the CONTRACTOR fails to so notify the ENGINEER when a conflict of this nature is encountered, but proceeds with construction despite this interference, the CONTRACTOR shall do so at the CONTRACTOR's own risk with no additional payment.

3.4 Easements

A. Where portions of the work are located on private property, easements and permits will be obtained by the OWNER. Easements shall provide for the use of property for construction purposes to the extent indicated on the easements. Copies of these easements and permits will be available from the OWNER for inspection by the CONTRACTOR. It shall be the CONTRACTOR's responsibility to determine the adequacy of the easement obtained in every case. The CONTRACTOR shall confine its construction operations to within the easement limits or street right-of-way limits, or make special arrangements with the property owners for the additional area required and notify the ENGINEER of any such conditions.

B. Any damage to private property, either inside or outside the limits of the easements provided by the OWNER, shall be the responsibility of the CONTRACTOR. Before the ENGINEER will authorize final payment, the CONTRACTOR will be required to furnish the OWNER with written releases from the property owners, where the CONTRACTOR has obtained special agreements or easements or where the CONTRACTOR's operations, for any reason, have not been kept within the construction right-of-way obtained by the OWNER. Any such special agreements must be in written form and shall not involve the OWNER or ENGINEER as to liabilities in any way.

3.5 Trench and Utility Vault Excavation

A. Excavation for trenches in which pipelines are to be installed shall provide adequate space for workers to place and joint the pipe properly and safely, but in every case the trench shall be kept to a minimum width. The width of trench at the top of the pipe shall not exceed the limits specified or as shown on the Drawings. Excavation for manholes and other structures shall be wide enough to provide a minimum of 12 inches between the structure surface and the sides of the excavation.

B. Unless otherwise permitted by the ENGINEER, trenching operations shall not be performed beyond the distance which will be backfilled and compacted the same day.

C. In general, backfilling shall begin as soon as the pipe or conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

D. Where the excavation activities require the removal of portions of an abandoned pipeline, masonry plugs shall be installed in the open ends of the

pipe, unless otherwise noted on the plans or by the ENGINEER. Coordinate with ENGINEER prior to plugging. For plugs less than 36 inches in diameter, 8-inch deep masonry units shall be used. For plugs in larger pipelines, 12-inch deep masonry units shall be used.

E. Excavated material shall be placed at locations and in such a manner that it does not created a hazard to pedestrian or vehicular traffic, or interfere with the function of existing drainage facilities or system operation. The CONTRACTOR shall make arrangements for and dispose of all excess material not required elsewhere on the project at no cost to the OWNER.

F. The CONTRACTOR shall provide the materials, labor and equipment necessary to protect trenches at all times. The trench protection shall provide safe working conditions in the trench and protect the work, existing property, utilities, pavement, etc. The method of protection shall be according to the CONTRACTOR's design. The CONTRACTOR may elect to use a combination of shoring, overbreak, tunneling, boring, sliding trench shields, or other methods of accomplishing the work provided the method meets the approval of all applicable local, state and federal safety codes. Damages resulting from improper shoring, improper removal of shoring or from failure to shore shall be the sole responsibility of the CONTRACTOR.

G. The CONTRACTOR shall remove and dispose of existing abandoned sewer pipe, structures, and other facilities as necessary to construct the improvements. The cost of such removal will be considered incidental to trench excavation and backfill.

H. Trench excavation for piping, utility vaults and other utilities shall be performed to the alignment and grade as indicated on the plans or as required by the ENGINEER. Where grades are not shown, pipe or other utilities shall be laid to grade between control elevations shown on the plans. Water mains shall be installed with a minimum cover of 36 inches.

Changes in the grade and horizontal alignment of the pipeline as shown on the plans or as provided elsewhere in the specifications may be necessary due to unanticipated interferences or other reasons. No additional compensation will be allowed the CONTRACTOR for changes in horizontal alignment unless otherwise provided for within these specifications. No additional compensation will be allowed for changes in grade, which require additional depth of trench excavation and backfill up to 2 feet from those shown on the plans unless provided for within these specifications.

I. The trench at all times shall be kept free from water to facilitate fine grading, the proper laying and joining of pipe, and prevention of damage to completed joints. Adequate pumping equipment shall be provided to handle and dispose

of the water without damage to adjacent property. Water in the trench shall not be allowed to flow through the pipe while construction work is in progress unless special permission to do so has been given by the ENGINEER. An adequate screen shall be provided to prevent the entrance of objectionable material into the pipe.

J. For pipe or utility vaults to have bedding material, excavate to a depth of 6 inches minimum below the bottom of the pipe or utility vault. Care shall be taken not to excavate below depths required. If over digging occurs, the trench bottom shall be filled to grade with compacted bedding material. The width of the pipe trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench shall not exceed 12 inches on either side of the pipe. The width of the trench above that level may be as wide as necessary for sheeting and bracing and the proper performance of the work.

3.6 Excavation Below Grade

If the trench bottom is unsuitable below the depth required for bedding, the ENGINEER may require additional excavation. This extra excavation shall be backfilled with compacted foundation stabilization material. This backfill shall be placed in lifts not to exceed 8 inches and compacted to 95 percent of the maximum density at optimum moisture content.

3.7 Tunneling

The CONTRACTOR may utilize tunnel methods for installation of pipe where ground conditions are favorable and such methods will not disturb foundations under curbs, sidewalks and other structures. The ENGINEER must approve tunneling methods. Where tunneling is used, payment for the pipe installation will be made for the equivalent trench excavation and backfill as if the open cut method was used. Payment will not be made for surface restoration including pavement, curbs, sidewalks and other surface improvements whose replacement is avoided by the tunneling method.

3.8 Pipe Bedding

All pipe 4-inch nominal diameter and over, all steel pipe, all concrete sewer pipe, all plastic pipe, all pipe under existing or future structures or roadways, and all pipe at a depth greater than 6 feet shall be laid in pipe bedding material. Unless otherwise noted on the plans, pipe or conduit of less than 4-inch diameter, outside structure lines and at a depth of less than 6 feet shall be bedded in native material properly shaped as specified below, all as detailed on the drawings.

Following the excavation of the trench, compacted pipe bedding material shall be placed the full width of the excavated trench to a depth as shown on the trench detail. In lieu of a detail, the depth shall be 6 inches. The bottom of the trench shall be accurately graded and rounded to fit the bottom quadrant of the pipe to provide uniform bearing and support for each section of pipe. Depressions for jointing shall be only of such length, depth and width necessary for the proper making of the joint.

3.9 Pipe Zone and Trench Backfill

A. All backfill except CLSM shall be placed and compacted in 6 to 8-inch lifts. Backfill shall be carefully placed around the pipe and thoroughly compacted in 6 to 8-inch lifts or in a manner satisfactory to the ENGINEER so as to achieve the specified compaction requirements. When placing pipe zone backfill, the CONTRACTOR shall prevent pipe from moving either horizontally or vertically during placement and compaction of pipe zone material.

B. Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe is laid therein and necessary testing is complete, unless otherwise directed by the ENGINEER. Under no circumstances shall water be permitted to rise in open trenches after pipe has been placed.

C. Where trenches are under existing or future structures, paved areas, road shoulders, driveways or sidewalks, or where designated on the plans or specified elsewhere in these specifications, the trench backfill shall be Class D or Class E and pipe zone backfill shall be Class D. Class D backfill shall be compacted to 95 percent of maximum density at optimum moisture content.

D. Where trenches are outside existing or future structures, paved areas, road shoulders, driveways or sidewalks, or where designated on plans or specified elsewhere, the trench backfill shall be Class B or Class D and pipe zone backfill in these areas shall be Class D. For these locations, compaction of Class B backfill shall be to not less than 90 percent of maximum density at optimum moisture content. Class D backfill shall be compacted to not less than 95 percent of maximum density at optimum moisture content.

3.10 Compaction Testing

A. Compaction tests will be required to show that specified densities of compacted backfill are being achieved by the CONTRACTOR's compaction methods.

B. Tests of pipeline backfill materials shall be made on each lift of fill for every 200 feet of pipeline trench as measured along the pipe centerline. After the ENGINEER is satisfied that the CONTRACTOR's method of compaction consistently meets specified compaction requirements, the testing frequency

may be reduced to not less than one test per lift of fill for every 1,500 feet of pipeline trench. The ENGINEER may direct testing at a higher frequency at no additional cost to the OWNER upon failure to obtain specified densities or if the CONTRACTOR changes compaction equipment or methods of compaction. The ENGINEER shall determine all test locations.

3.11 Utility Crossings

A. Vertical clearance between the new pipe and existing utilities shall be 12 inches minimum unless otherwise noted on the plans or specified. Where existing utility lines are damaged or broken, the utility shall be repaired or replaced, care being taken to insure a smooth flow line and absolutely no leakage at the new joints. Unless otherwise specified herein, all expenses involved in the repair or replacement of leaking or broken utility lines that have occurred due to the CONTRACTOR's operations shall be borne by the CONTRACTOR and the amount thereof shall be absorbed in the unit prices of its bid.

B. Water Lines Crossing Sewer Lines -- Whenever water lines cross sewer lines, CONTRACTOR shall comply with Health Department requirements. Wherever possible, the bottom of the water line shall be 1.5 feet or more above the top of sewer pipe and one full length of the water line pipe shall be centered at the crossing. For clearances less than 1.5 feet, the CONTRACTOR shall replace the existing sewer pipe with ductile iron or PVC of equal size, or shall encase existing sewer pipe with concrete for a minimum of 10 feet on both sides of crossing, as directed by the ENGINEER, at no additional cost to the OWNER.

3.12 Disposal of Unsuitable and Surplus Material

A. All excavated materials which are unsuitable for use in backfilling trenches or around structures, and excavated materials that are in excess of that required for backfilling and for constructing fills and embankments as shown on the drawings, shall be disposed of by the CONTRACTOR at its own expense and at disposal sites provided by the CONTRACTOR as may be required; except that the OWNER reserves the right to require the CONTRACTOR to deposit such surplus at locations designated by the OWNER within a 2-mile radius.

B. Surplus excavated material shall be disposed of by the CONTRACTOR in a legal manner, in full compliance with applicable codes and ordinances.

3.13 Surface Restoration and Clean-Up

A. At the end of each work day, all open trenches shall be backfilled and all trenches within streets shall be temporarily paved or covered to the satisfaction

of the ENGINEER. Temporary paving shall be replaced with permanent street paving, at completion of construction within street rights-of-way or sooner if deemed necessary by the ENGINEER. No gravel-filled trenches shall be left open within the street right-of-way at the end of the workday.

B. Where trenches cross lawns, garden areas, pastures, cultivated fields, or other areas on which reasonable topsoil conditions exist, the CONTRACTOR shall remove the topsoil to the specified depth and place the material in a stockpile. The CONTRACTOR shall not mix the topsoil with other excavated material. After the trench has been backfilled, the topsoil shall be replaced.

C. CONTRACTOR shall clean up and remove all excess materials, construction materials, debris from construction, etc. CONTRACTOR shall replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. CONTRACTOR shall replace all lawns, topsoil, shrubbery, flowers, etc., damaged or removed during construction. CONTRACTOR to be responsible for seeing that lawns, shrubs, etc. remain alive and leave premises in condition equal to original condition before construction.

END OF SECTION

SECTION 02350

STRUCTURAL STEEL PILES

PART 1 GENERAL

1.1 The Requirement

A. The Contractor shall furnish and install structural steel piles, all in accordance with the requirements of the Contract Documents.

1.2 Subsurface Conditions

A. A geotechnical investigation has been performed for the site. The geotechnical report prepared by Foundation Engineering, Inc., dated November 17, 2015, is included at the end of the technical specifications as supplementary information to the contract documents.

B. The subsurface investigations and reporting are being made available solely for the convenience of the Bidder and shall not relieve the Bidder or the CONTRACTOR of any risk, duty to make examinations and investigations as required by the Contract Documents or any other responsibility under the Contract Documents.

C. It is mutually agreed to by all parties that the written reports are reference documents and are not part of the Contract Documents, that the subsurface investigations are for the purpose of obtaining data for planning and design of the project, and that the data concerning borings is intended to represent with reasonable accuracy conditions and material found in specific borings at the time the borings were made.

D. It is expressly understood and agreed that the OWNER and ENGINEER assume no responsibility whatsoever in respect to the sufficiency or accuracy of the investigation thus made, the records thereof, or of the interpretations set forth therein, or made by the OWNER in his use thereof; and there is no warranty or guarantee, either expressed or implied, that the conditions indicated by such investigations, or records thereof, are representative of those existing throughout such areas, or any part, or that unforeseen developments may not occur.

E. The Contractor shall visit the site and shall satisfy himself as to all existing surface and subsurface conditions affecting the work.

1.3 Reference Specifications, Codes, and Standards

A. Commercial Standards:

1. ASTM A 36 Specification for Structural Steel.
2. AWS American Welding Society Standards.

1.4 Contractor Submittals

A. All Contractor submittals shall be in accordance with the requirements of Section 01300, Submittals.

B. The Contractor shall provide written notification to the Engineer of its scheduled date for commencing of pile driving at the site at least one week in advance of that date.

C. The Contractor shall provide information for the pile driving hammer it proposes to use including make, model and rated driving energy, and details of collars, splices, cushion blocks and related items.

PART 2 PRODUCTS

2.1 General

A. Structural steel piles shall be steel sections of the weight, shape, and length shown. The material in steel piles, pile bracing, caps, and splices shall be structural steel meeting the requirements of ASTM A 36 or A 252, Grade B. The minimum yield stress shall be 35,000 psi.

B. Splices in steel piles shall be made by a full penetration butt weld of the entire cross section. Care shall be taken to properly align adjacent sections so that the axis of the pile will be straight. Splices in the top 10 feet of the piles will not be permitted. All welding shall be performed by qualified welding operators.

PART 3 EXECUTION

3.1 General

A. The Contractor shall furnish all tools, equipment, and incidentals necessary for satisfactory driving of piles as required by the Contract Documents.

B. Piles shall be accurately located and driven vertically. No variation greater than 4 inches in 10 feet will be permitted. Piles with greater variation and those seriously damaged in driving shall be removed or cut off, and replaced

with new piles. Any pile heaved by the subsequent driving of adjacent piles shall be redriven. Piles, after driving, shall not be out of position by more than three (3) inches in any direction. All correction costs shall be paid by the Contractor.

3.2 Driving Equipment

A. All piles shall be driven using a single or double acting air, steam or diesel hammer with a rated energy of no less than 6,500 ft-lbs per blow. Alternatively, the piles may be driven using a vibratory pile hammer with a rated drive force of at least 50 tons (e.g., an APE 50).

B. Steam or air hammers shall be furnished with boiler or air capacity at least equal to that specified by the manufacturers of the hammers being used. The boiler or compressor shall be equipped at all times with an accurate pressure gage. The valve mechanism and other parts of steam or air hammers shall be maintained in first-class condition so that the length of stroke and number of blow per minute for which the hammer is designed can be obtained at all times.

3.3 Pile Splicing

A. Splices shall be made with full penetration butt welds. All welds shall be made by a welder certified by the "Standard Qualification Procedure" of the American Welding Society (AWS) for thickness of metal and shape of pipe. In lieu of butt welds, splices may be made using an Advance Splicer, S-18000 (APF), or equal mechanical splice sleeve. Regardless of the method, the splice shall develop the full strength of the pile.

3.4 Driving

A. During driving operations the pile heads shall be protected and held in position by the use of steel combination driving heads and pilots. The driving head shall closely fit the top of the steel pile and shall extend down the side of the pile at least 4 inches.

B. Each pile shall be marked in one foot increments with each 5-foot increment numbered for reference.

C. All pile driving shall be observed by the Geotechnical Engineer. The Geotechnical Engineer shall log the piles during driving and document pile lengths, tip elevations, cutoff elevations, and driving resistances (blows per foot). Logs shall also indicate times at start and end of driving, interruptions during driving and reasons therefore, pile slope and slope direction, final pile location with respect to contract location and information about driving equipment.

D. All piles shall be driven through the fill with the tips seated in the underlying bedrock. The estimated tip elevation is El. 211. The actual tip elevations shall be determined at the time of construction based on the observed driving resistance.

3.5 Pile Capacity Evaluation

A. All piles shall be driven to an ultimate capacity of at least 105 kips. If an impact hammer is used, the required driving resistance shall be established by the Geotechnical Engineer using the FHWA Gates equation and the hammer information provided by the Contractor. If a vibratory hammer is used, the piles shall be driven until practical refusal or near practical refusal to the satisfaction of the Geotechnical Engineer.

3.6 Cutoff

A. All piles shall be cut off at the elevation shown in the plans or as otherwise required by design or as directed by the Engineer. If a cutting torch is used, the cut surface shall be made as smooth as possible. Any irregularity due to cutting or burning shall be leveled off with deposits of weld metal prior to placing bearing caps. All cut off lengths of piling shall become the property of the Contractor and shall be disposed of outside the project area.

END OF SECTION

SECTION 02505

PAVEMENT AND SURFACE RESTORATION

PART 1 GENERAL

1.1 Scope

This section covers the work necessary to replace all pavements, pavement base, curbs, sidewalks and other surface features damaged directly or indirectly during construction. All work shall meet the standards of the Oregon Department of Transportation, the City of Albany, and Linn County.

1.2 Reference Standards

A. References herein to "AASHTO" shall mean Association of American State Highway Transportation Officials.

B. Standard Specifications: Where the term "Standard Specification" is used, such reference shall mean the current edition of the Oregon Department of Transportation Standard Specifications for Highway Construction. Where reference is made to a specific part of the Standard Specifications, such applicable part shall be considered as part of this section of the Specifications. In case of a conflict in the requirements of the Standard Specifications and the requirements stated herein, the requirements herein shall prevail.

C. City of Albany Standard Construction Specifications

1.3 Quality Assurance

A. All testing to determine compliance with the specifications shall be performed by an independent testing laboratory provided by the OWNER.

B. The surface smoothness of the replaced pavement shall be such that when a 10-foot straightedge is laid longitudinally across the patched area between the edges of the old surfacing and surface of the new pavement, the new pavement shall not deviate from the straightedge more than 1/8 inch and surface drainage shall be maintained. Additionally, paving must conform to the grade and crown of the adjacent pavement and contain no abrupt edges, low or high areas or any other imperfections as determined by the ENGINEER. Pavement trench construction not meeting these requirements will be repaired by grinding the existing pavement to a 1-1/2 inch depth and replacing with a Level 3, 1/2-inch dense graded, PG 64-22 Hot Mix Asphaltic Concrete (HMAC) the full width of the previous trench patch plus 4 inches on each side at no cost to OWNER.

PART 2 PRODUCTS

2.1 Aggregate Material

Base Course and Leveling Course: The aggregate material shall be a clean, well-graded crushed base aggregate conforming to the Standard Specifications. Base course shall be 1-1/2 inches minus aggregate and leveling course shall be 3/4-inch minus aggregate, unless shown otherwise on the drawings or specified elsewhere.

2.2 Asphalt Concrete Pavement

A. Hot Mix Asphalt Concrete

Use Level 3, 1/2-inch dense graded, PG 64-22 HMAC. Conform to the requirements as specified in Section 00744 of the Standard Specification.

B. Cold Mix Asphalt Concrete

Use cold mix asphalt concrete and 1/2-inch-0-inch gradation with either MC 250 liquid asphalt, CMS-2, CMS-2S or CSS-1.

C. Asphalt Prime Coat

Liquid asphalt for use as a prime coat under asphalt concrete shall be MC 250 liquid asphalt, CMS-2S or CSS-1.

D. Seal and Cover Coat

Asphalt material shall be CRS-2 cationic emulsified asphalt. Cover stone shall conform to size 1/4-inch - #10 aggregate in Standard Construction Specifications.

2.3 Rock Surfacing

A. Rock surfacing shall be 1 ½ inches – 0 inches, or ¾ inch – 0 inches crushed aggregate, as directed.

2.4 Topsoil

Topsoil shall be imported from approved sources, and shall be approved by the ENGINEER. The topsoil shall be a sandy loam free of subsoil, grass, noxious weeds and any material deleterious to plant health.

PART 3 EXECUTION

3.1 Surface Restoration, General

A. All areas disturbed as a result of construction shall be restored to their original condition as nearly as possible, or surfaced as shown on the Plans. All excess material shall be removed from the site. Any damaged concrete walks or driveways shall be restored. All dirt and debris that accumulates from the CONTRACTOR's operations shall be removed from inlets, catch basins, connecting pipelines and similar structures. Any material entering manholes or ditch culverts from street resurfacing and trenching work shall be removed. Daily clean up of all visible mud and debris is required.

B. All open fields, unpaved public rights-of-way or easements, and other areas not used as driveways, as shown on the Plans or as directed by the ENGINEER, shall be restored by placement of 12 inches of topsoil, fine grading and hydroseeding.

1. Seeding shall be completed as specified in these Specifications.

2. Settlement of 2 inches or more within 1 year of substantial completion shall require repairs and re-seeding as directed by the ENGINEER and at the CONTRACTOR'S expense.

3. Restorations occurring on private property shall be seeded to match existing conditions.

3.2 Aggregate Pavement Base

A. Place pavement base to the depth shown on the plans or as specified in all cases, pavement base shall be compacted to a minimum depth of 6 inches. Bring the top of the pavement base to a smooth, even grade at a distance below finished grade equivalent to the required pavement depth.

B. Compact the pavement base with mechanical vibratory or impact tampers to a density of not less than 95 percent of the maximum density, as determined by AASHTO T-99.

3.3 Temporary Pavement

Where pavement is to be replaced, a temporary cold asphalt patch shall be applied within 24 hours of trench backfill. Before replacement of the permanent pavement, the CONTRACTOR shall continuously maintain the trenches in a condition acceptable to the OWNER, at no additional cost to the OWNER.

3.4 Asphalt Concrete Pavement

A. CONTRACTOR shall conform to the requirements for prime coat and tack coat in Standard Specifications. Tack coat all edges of existing pavement, manhole and clean out frames, inlet boxes and like items. When rate is not specified, asphalt will be applied at the rate of 0.1 gallon per square yard.

B. Asphalt Concrete Placement

1. Except as specifically modified herein, conform to the requirements for construction in Standard Construction Specifications. All trench cuts shall be kept in a smooth condition throughout the duration of the project.

2. The limits of the restoration shall include all damaged or undermined surfacing.

3. Provide a smooth tee cut by saw cutting the existing pavement parallel to the trench and beyond the sides of the trench excavation as shown on the plans. Remove any pavement which has been damaged or which is broken and unsound outside this area by making alternating traverse and parallel saw cuts. Parallel cuts must be a minimum of 25 feet long, unless otherwise directed by ENGINEER. Provide a smooth, sound edge for joining the new pavement.

4. Place the asphalt concrete to the specified depth on the prepared subgrade over the trench. When depth is not specified, place asphalt concrete to the depth of the adjacent pavement, up to a maximum of 6 inches, at the direction of the ENGINEER. Minimum depth of pavement shall be 3 inches. When a prime coat is specified, place asphalt concrete after the prime coat has set. Maximum thickness for any one lift of pavement shall not exceed 2 inches. Spread and level the asphalt concrete with hand tools or by use of a mechanical spreader.

5. When the utility trench is placed closer than 3 feet inside the edge of existing pavement, the remaining pavement must be removed and replaced with the trench repair. When the trench is under the existing edge of pavement, additional pavement shall be removed to allow a three foot minimum width of repair and to maintain the original street width.

6. Settlement of 1/4-inch or greater for asphalt concrete patches, occurring within one year of substantial completion, shall require repair or replacement as directed by the ENGINEER at the CONTRACTOR’S expense.

3.6 Rock Surfacing

Place rock surfacing only where shown on plans or as directed on streets, driveways, parking areas, street shoulders, and other areas disturbed by the construction. Spread the rock surfacing to conform to adjacent existing grades and surfaces as directed. Compact as directed with mechanical vibratory or impact tamper.

3.8 Dust Control

When the weather is dry and when, in the estimation of the ENGINEER, the dust becomes a nuisance, the CONTRACTOR shall sprinkle water on surface streets twice a day in order to keep the dust down. This sprinkling shall be maintained until the project is accepted. On paved streets when the backfilling has been completed, the streets shall be washed to remove all dirt and debris. If the dust becomes a nuisance before backfilling is completed, the CONTRACTOR shall wash the streets to the satisfaction of the ENGINEER.

END OF SECTION

SECTION 03100

CONCRETE WORK

PART 1 GENERAL

1.1 Description

The extent of concrete work is shown on the drawings. The work also includes providing formwork and shoring for cast-in-place concrete and installation into formwork of items such as reinforcing steel bar (rebar), anchor bolts, setting plates, bearing plates, anchorages, inserts, reveals, frames, nosings, sleeves and other items to be embedded in concrete.

1.2 Quality Assurance

A. Codes and Standards

Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified here:

ACI 301 "Specifications for Structural Concrete for Buildings"

ACI 311 "Recommended Practice for Concrete Inspection"

ACI 318 "Building Code Requirements for Reinforced Concrete"

ACI 347 "Recommended Practice for Concrete Formwork"

ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"

Concrete Reinforcing Steel Institute, "Manual of Standard Practice"

Comply with building code requirements which are more stringent than the above and all OSHA requirements.

B. American Society for Testing and Materials (ASTM)

1. C31 Making and Curing Concrete Test Specimens in the Field.

2. C33 Specification for Concrete Aggregate.

3. C39 Compressive Strength of Cylindrical Concrete Specimens.

4. C40 Organic Impurities in Fine Aggregate for Concrete.

5. C85 Cement Content of Hardened Portland Cement Concrete.

6. C88 Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.

7. C94 Standard Specifications for Ready-Mixed Concrete.

8. C131 Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

9. C136 Method for Sieve Analysis to Fine and Coarse Aggregate.

10. C143 Slump of Portland Cement Concrete.

11. C150 Standard Specification for Portland Cement.

12. C156 Water Retention by Concrete Curing Materials.

13. C173 Air Content of Freshly Mixed Concrete by the Volumetric Method.

14. C231 Air Content of Freshly Mixed Concrete by the Pressure Method.

15. C233 Standard Method of Testing Air-Entraining Admixtures for Concrete.

16. C260 Standard Specifications for Air-Entraining Admixtures for Concrete.

17. C289 Standard Test Method for Potential Reactivity of Aggregates (Chemical Method).

18. C441 Standard Test Method for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to the Alkali-Aggregate Reaction.

19. C457 Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete.

20. C494 Standard Specifications for Chemical Admixtures for Concrete.

21. C670 Preparing Precision Statements for Test Methods for Construction Materials.

22. C803 Penetration Resistance of Hardened Concrete.

C. Workmanship

The CONTRACTOR is responsible for correction of concrete work that does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as directed by the ENGINEER. The CONTRACTOR shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

D. Concrete Testing Service for Concrete Mix Design

Employ, at CONTRACTOR's expense a testing laboratory acceptable to the ENGINEER to perform material evaluation tests and to design concrete mixes.

E. Testing Requirements

Materials and installed work may require testing and retesting, as directed by the ENGINEER, at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all times. All testing, including the retesting of rejected materials and installed work shall be done at the CONTRACTOR's expense.

F. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.

3. Submit written reports to the ENGINEER, for each material sampled and tested prior to the start of work. Provide the project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

4. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing. The materials producer and the CONTRACTOR must sign certificates of compliance.

G. Allowable Tolerances

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:

   a. Variation from plumb in lines and surfaces of columns, piers, walls and rises; 1/4-inch per 10 feet, but not more than 1-inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum; 1/2-inch maximum in 40 feet or more.

   b. Variation from level or grade in slab soffits, ceilings, beam soffits, and rises 1/4-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum, and 3/4-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum and 1/2-inch in 40 feet or more.

   c. Variation from position of the linear lines and related columns, walls, and partitions, 1/2-inch in any bay or 20 feet maximum, and 1-inch in 40 feet or more.

   d. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4-inch.

   e. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls, minus 1/4-inch and plus 1/2-inch.

   f. Variations in footing plan dimensions, minus 1/2-inch and plus two (2) inches; misplacement or eccentricity, two (2) percent of the footing width in direction of misplacement but not more than two (2) inches; thickness reduction, minus five (5) percent.

   g. Variation in steps - In a flight of stairs, 1/8-inch for rise and 1/4-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.

   h. Circular structures shall be constructed in a true circular form, with maximum variation of 1/4-inch from the dimensions shown on the plans.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

3. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

H. Quality Control Testing During Construction

See Part 3 - Execution.

1.3 Submittals

A. For information only, submit six (6) copies of manufacturer's data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, chemical floor hardeners, dry-shake finish materials, and others. Bind and submit in one submittal.

B. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with the ACE 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

C. Submit shop drawings for fabrication and erection of specific finished concrete surfaces as shown or specified. Show the general construction of forms including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items which affect the exposed concrete visually. Submit form drawings for building columns, walls, fascias, and intersections, and concrete pan and joist system. Submit for typical sections only. ENGINEER's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is the CONTRACTOR's responsibility.

D. Submit six (6) copies of laboratory test reports for proposed concrete materials and mix design tests as specified. Do not begin concrete production until ENGINEER has reviewed the proposed mix design.

E. Material Certificates may be provided in lieu of materials laboratory test reports. The material manufacturer and the CONTRACTOR, certifying that each material item complies with, or exceeds, the specified requirements shall sign material certificates.

1.4 Concrete Mix Designs

A. All concrete materials shall be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier or if directed by the ENGINEER, mix proportions and concrete strength curves for regular cylinder tests, based on the relationship of 7, 14 and 28 day strengths versus slump values of two (2), four (4), and six (6) inches, all conforming to these Specifications, shall be established by an approved ready-mix supplier or an independent testing laboratory. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders. The costs for preparation of mix designs (if required by the OWNER to be performed by an independent testing laboratory) and testing of concrete and materials shall be borne by the OWNER, except when materials do not meet specified requirements, in which case such costs shall be borne by the CONTRACTOR.

C. The exact proportions by weight of all materials entering into the concrete delivered to the jobsite shall conform to the approved mix design unless specifically so directed by the ENGINEER or Laboratory for improved specified strength or desired density, uniformity and workability.

D. The proportions of such mix design shall be based on a full cubic yard of hardened concrete.

E. Ready-mix companies or jobsite batch plants shall furnish delivery tickets, signed by a Certified Weighmaster, on which each shall state the weight of aggregates, sand, cement, admixtures and water and the number of cubic yards of concrete furnished, which will be compared against the approved mix design.

F. There shall be no variation in the weights and proportions of materials from the approved mix design.

G. There shall be no variation in the quality and source of materials once they have been approved for the specific mix design.

1.5 Ready-mixed Concrete

Ready-mixed concrete shall conform to the requirements of ACI 301 and ASTM C 94. In case of conflict, ACI 301 shall govern.

1.6 Sample

CONTRACTOR shall pour and finish one 2-foot square exposed aggregate concrete sample for ENGINEER’s approval prior to construction if exposed aggregate is included on job.

1.7 Job Conditions

Maintain continuous traffic control and access for vehicular and pedestrian traffic as required for other construction activities as well as to adjoining facilities for regular operation. Utilize flagmen, barricades, warning signs and warning lights as required, to maintain a safe entrance and passage on all roads or drives abutting the project.

PART 2 PRODUCTS

2.1 Wall Forms

A. Full Height Pours: The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

B. Wall Form Ties

1. Form ties which remain in the wall of a subgrade water-retaining structure shall have waterstops and a one inch minimum breakback or cone depth.

2. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. The use of tie wires as form ties will not be permitted. Fully threaded stub bolts may be used in lieu of smooth ties with waterstops.

3. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Plugs shall be A-58 SURE PLUG as manufactured by DAYTON SUPERIOR, Santa Fe Springs, CA; phone: (714) 522-3442.

4. Ties shall positively secure the wall to the required dimension and hold the wall to that dimension prior to and during concrete placement.

C. Wall Form Stiffeners

1. Horizontal walers shall consist of structural steel channels, angles or tubing of adequate size to retain the concrete without deflecting.

2. The walers shall be rolled or welded to the proper radii or offset brackets shall be used for shaping the wall to the dimensions shown on the Drawings and shall be used both for inside and outside wall forms in direct contact with the wall panels and at vertical spacings of no more than 96 inches on center.

3. There shall be at least one such waler within 24 inches of the top and bottom of the wall.

4. The largest dimension of the steel waler shall be in the radial direction.

5. Vertical structural steel or wood members shall be used at a minimum horizontal spacing of 74 inches and shall have sufficient rigidity and strength to insure the proper vertical alignments with the aid of braces under all predictable stress conditions.

6. In lieu of the above, a different system and spacings may be used if it is satisfactorily demonstrated to the ENGINEER that it will be equally effective.

2.2 Forms for Exposed Finish Concrete

Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Finish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection. Use overlaid plywood complying with U.S. Product Standard PS-1 “B-B High Density Overlaid Concrete Form”, Class I. Use flexible spring steel forms or laminated boards free of distortion and defects to form radius bends as required.

2.3 Forms for Unexposed Finish Concrete

Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit.

2.4 Form Materials

A. Form Coatings

Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound.

Petroleum based coatings shall not be used for structures in creeks and waterways. Biodegradable coatings shall be used which will not contaminate the creeks/waterways or an alternate method for stripping the form shall be proposed.

B. Chamfers, Reveals, Drips

Provide preformed PVC or shaped wood or metal of size and profile as shown on drawings.

C. Cylindrical Columns and Supports

Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Provide units having “seamless” interior to minimize spiral gaps or seams.

D. Pan Forms

Provide forms for concrete pan-type construction complete with covers and end enclosures to form a true, clean, smooth concrete surface. Design units for easy removal without damaging placed concrete. Block adjoining pan units if required to avoid lateral deflection of formwork during concrete placement and compaction. Provide standard or tapered end forms, as shown.

If required, factory-fabricate pan form units to required sizes and shapes of the following:

1. Steel - 16 gauge minimum, free of dents, irregularities, sag and rust, or
2. Glass-Fiber Reinforced Plastic - Molded under pressure with matched dies, 0.11 inches minimum wall thickness.

E. Inserts

Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work. Provide “Parabolt” by the Molly Company, “Phillips Red-Head”, or “Burke” products. CONTRACTOR is responsible for insuring that all required anchorage not specified in the project documents is installed per current building code and applicable ICC report requirements.

2.5 Reinforcing Materials

A. Reinforcing Bar (rebar)

ASTM A615 and as follows:

Stirrups and Ties:	Grade 60 (Grade 40 may be used for #3 and smaller)
All other Uses:	Grade 60

B. Steel Wire

ASTM A82, plain, cold-drawn, steel.

C. Welded Wire Fabric (WWF)

ASTM A185, welded steel wire fabric.

D. Supports for Reinforcement

Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise specified. Wood, brick, concrete blocks and other devices will not be acceptable. For slabs-on-grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are hot-dip galvanized, after fabrication, or plastic protected or stainless steel protected.

E. Fiber Reinforcement – Collated polypropylene fiber, ¾”-inch, manufactured from 100% virgin homopolymer polypropylene, hydrophobic, in compliance with ASTM C116. Fiber reinforcement shall be ProconF fibrillated polypropylene by Nycon or approved equal. Minimum dosage rate shall be 1.5 pounds per cubic yard.

2.6 Concrete Materials

A. Portland Cement

ASTM C150, Type II, unless otherwise acceptable to ENGINEER. Use only one (1) brand of cement throughout the project, unless otherwise acceptable to the ENGINEER. The use of ground granulated blast furnace slag is not allowed.

B. Aggregates

ASTM C33 and as herein specified. Provide aggregates from a single source for all exposed concrete.

Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the ENGINEER.

1. Fine Aggregate - Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank-run sand and manufactured sand are not acceptable.

2. Coarse Aggregate - Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows:

    a. Crushed stone processed from natural rock or stone.

    b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.

    c. Maximum Aggregate Size - Not larger than one-fifth (1/5) of the narrowest dimensions between sides of forms, one-third (1/3) of the depth of slabs, nor three-fourths (3/4) of the minimum clear space between individual reinforcing bars or bundles of bars.

3. These limitations may be waived if, in the judgment of the ENGINEER, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

4. In general it is desired that normal commercial mixes using 1-1/2-inch or 3/4-inch maximum aggregate size be used.

5. Aggregate for exposed aggregate concrete shall consist of selected aggregate of washed clean river gravel in color range of medium to dark in browns and grays; material uniformly sized 5/8-inch to 3/4-inch.

C. Water - Clean, fresh, drinkable.

D. Air Entraining Admixture - ASTM C260.

E. Water-Reducing Admixture - ASTM C494, Type A.

F. Set-Control Admixtures - ASTM C494, as follows:

1. Type B, Retarding.
2. Type C, Accelerating.
3. Type D, Water-reducing and Retarding.
4. Type E, Water-reducing and Accelerating.

Calcium chloride will not be permitted in concrete, unless otherwise authorized in writing by the ENGINEER.

2.7 Related Materials

A. Waterstops

Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as shown. Size to suit joints or as shown. Provide PVC waterstops complying with Corps of Engineer's CRD-C 572. Waterstops to be Greenstreak 701 or approved equal. Split face waterstops will not be acceptable under any circumstances.

B. Bituminous and Fiber Joint Filler

Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D1751, FS HH-F-341, Type 1 and AASHTO M 213. Provide one of the following products:

1. Elastite; Philip Carey/Celotex
2. Flexcell; Celotex Corp.
3. Crane Fiber 1390; W.R. Grace & Co.
4. Fibre; W.R. Meadows, Inc.
5. Tex-Lite; J & P Petroleum Prod. Inc.
6. Sonoflex; Sonneborn/Contech, Inc.

C. Joint Sealing Compound

See Section 07920, Sealants and Caulking.

D. Moisture Barrier

Provide moisture barrier cover over all prepared base material. Use only materials that are resistant to decay when tested in accordance with ASTM E154. The moisture barrier consists of heavy Kraft papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side. Provide Moistop, St. Regis, or equal.

E. Form Ties (for forms other than wall forms)

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise shown, provide ties so portion remaining within concrete after removal is at least 1-1/2 inches inside concrete. Unless otherwise shown, provide form ties, which will not leave holes larger than 1-inch in diameter in concrete surface.

F. Concrete Curing Materials

Acrylic curing and sealing compound - Water emulsion acrylic curing and sealing compound formulated of acrylic polymers of water based carrier. W.R. Meadows, Inc. VOCOMP-20 or approved equal.

G. Epoxy Adhesive

Provide Sikadur Hi-Mod (Sikastik 370) or Sikadur Hi-Mod Gel (Sikastix 390) for application to wire-brushed and prepared existing concrete to be mated to new concrete. Apply per manufacturer's recommendations.

H. Chemical-Hardener Finish

Provide Hornolith from Tamms Industries, or approved equal.

I. Non-slip Aggregate Finish

Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

J. Nonshrink Grout

See Specification Section 03600.

2.8 Proportioning Normal Concrete

A. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1. All measurements shall be by weight. All concrete admixtures shallbe by the same supplier to insure compatibility. If different suppliers are used, a memorandum from EACH admixture supplier shall be provided stating the compatibility of their product with the other supplier's products.

B. The slump shall be between two inches and four inches when tested in accordance with ASTM Specifications C 143. Variations in the slump range may be allowed by the ENGINEER if admixtures, such as water reducers or superplasticizers, are utilized in the concrete mix. Regardless of the measured slump, the maximum allowable water-cement ratios as specified here-in, shall be strictly adhered to.

C. Compressive Strength, Water and Cement Content

Not withstanding what has been stated here-before, and unless shown otherwise on the Drawings, the concrete shall meet the following requirements. All concrete except as noted otherwise on the drawings shall have 4,000 psi 28-day compressive strength. The maximum water content per 94 pound sack of cement is 4.5 gallons. The minimum cement content for the 4,000 psi mix is 6.0 sacks (94 pound sack of cement per cubic yard of concrete). Up to a maximum of 15% of cementatious material may be fly ash in accordance with ASTM C618. The use of ground granulated blast furnace slag is not allowed.

D. Retarding Densifiers

1. All concrete (as defined in 2.9 below) used for wall construction shall also contain DARATARD-17, as manufactured by Grace Const. Products, Cambridge, MA or MBL-82, as manufactured by Master Builders, Cleveland, OH in the amounts recommended by the additive manufacturer whenever the air temperature during the pour exceeds 85° F.

2. To be considered as equal, any alternate product offered for consideration shall contain no calcium chloride, and shall be compatible with air-entrained cements and air-entraining admixtures conforming to the applicable ASTM, AASHTO, ANSI and Federal specifications.

3. CONTRACTOR shall certify that admixtures do not contain calcium chlorides or other corrosive materials.

E. Air-Entraining Agents

1. All concrete that that is specified to be air entrained or that may be exposed to freeze/thaw action either during construction or the service life of the structure must be air entrained. Sufficient air-entraining agent shall be used to provide total air content of 5 percent, +/- 1 percent.

2. Air-entraining agents shall meet ASTM C 260, ASTM C 233 and ASTM C 457.

3. The maximum total volumetric air content of the concrete before placement shall be six (6) percent plus or minus one percent as determined by ASTM C 173 or ASTM 231.

4. Subject to these Specifications, consideration will be given to the following products: PROTEX “AES,” GRACE “DAREX AEA,” MASTER BUILDERS “MB-AE10,” or SIKA CHEMICAL “AER.”

F. Water Reducing Admixtures

1. In addition to air-entrainment, approved water reducing additives, which do not affect the ultimate performance of any steel in any way, may be added to maintain the maximum water content below that specified herein. Water reducing additives shall conform to ASTM C 494, Type A or D.

2. The use of water reducing additives shall not permit a reduction in the minimum specified cement content or in the specified amount of air-entrainment.

3. Admixtures shall contain no calcium chloride, tri-ethanolamine or fly ash. All admixtures shall be from the same manufacturer.

4. Superplasticizers, if allowed by the ENGINEER, shall conform to ASTM C 494, Type F or G, batch plant added using second or third generation only.

5. Set control admixtures if allowed by the ENGINEER, shall conform to ASTM C 494, Type B (retarding) or Type C (accelerating).

G. Fiber reinforcement admixture shall be included in the ready-mix concrete design used for filling and channeling the wet well chambers. Fibers shall be used in strict accordance with the manufacturer's directions.

2.9 Concrete Mixing

Ready-Mix Concrete - Comply with the requirements of ASTM C94, and as herein specified. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required. When the air temperature is between 85°F and 90°F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90°F, reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 Forms

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formworks so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design formworks to be readily removable without impact shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Erect falsework and support; brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures.

Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

F. Forms for Exposed Concrete

Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Do not use metal cover plates for patching holes or defects in forms. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material, which will produce bow. Assemble forms so they may be readily removed without damage to exposed concrete surfaces. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

Corner Treatment - Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise indicated.

G. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings of forms at inconspicuous locations.

H. Chamfer exposed corners and edges, reveals and drips as shown using wood, metal, PVC or rubber strips fabricated to produce uniform smooth lines and tight edge joints.

I. Provisions for Other Trades - Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such ties. Accurately place and securely support items built into forms.

J. Cleaning and Tightening - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.2 Placing Reinforcement

Detail and place according to ACI Manual SP-66. Unless otherwise noted, minimum cover shall be 1-1/2 inches for No. 5 and smaller bars, two (2) inches for No. 6 and larger bars and three (3) inches when poured against earth. Unless otherwise noted, bend all horizontals reinforcing a minimum of two (2) feet at corners and wall intersections.

A. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

C. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Do not place reinforcing bars more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two (2) inches, and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.3 Joints

A. Construction Joints - Locate and install construction joints, which are not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the ENGINEER.

B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Unless otherwise specified, reinforcement shall be lapped in accordance with ACI Standards.

C. Waterstops - Provide waterstops in construction joints as shown on the drawings. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any joint.

D. Isolation Joints in Slabs-on-Ground - Construct isolation joints in slabs-on-ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

E. Control Joints in Slabs-on-Ground - Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4-inch wide by one-fifth (1/5) to one-fourth (1/4) of the slab depth, unless otherwise shown.

1. Form control joints by inserting a premolded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured, remove inserts and clean groove of loose debris.

2. Joint sealant material shall be as specified above.

3.4 Installation of Embedded Items

A. General - Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs - Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screed strips by the use of strike-off templates or accepted compacting type screeds.

C. Cast in Place Reglets - Place in straight and continuous lines as detailed to enable flashing to be applied continuously without deviation at reglet joints more than 1/8-inch. Miter corners for continuous reglet joint where outside corners occur. At inside corners extend one section 1-inch past corner. Adequately anchor or secure reglets per manufacturer's instructions prior to pouring and during construction to insure dimensional tolerances and alignment. Vibrate concrete to insure concrete cover adjacent to and around reglet. Visually inspect after pour and patch as required.

3.5 Preparation of Form Surfaces

Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Thin formcoating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Use dissipating-type form oil at surfaces to receive cement plaster finish. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.6 Concrete Placement

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work as required. Notify ENGINEER in time for inspection prior to pouring.

2. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.

3. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

4. Concrete Curbs and Paving - Do not place concrete until subbase is completed and approved by the ENGINEER as required to provide uniform dampened condition at the time concrete is placed. Moisten

subbase as required to provide uniform dampened condition at the time concrete is placed.

B. Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete, which is being integrated, with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure, which will cause segregation.

2. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable or does not meet the required quality control limits or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location. Do not use concrete whose allowable mixing time has been exceeded.

C. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods, which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

3. The CONTRACTOR shall provide traffic control on the narrow access roads to the work sites.

4. The CONTRACTOR shall not wash concrete trucks/chutes/equipment off at the project site unless plastic tarps and hay bales are employed to

contain the concrete. The CONTRACTOR will be required to haul off-site all concrete contaminated soil.

D. Placing Concrete into Forms

1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

2. Do not interrupt successive placement; do not permit cold joints to occur.

3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted.

5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete at least six (6) inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

6. Do not place concrete in supporting elements until the concrete previously placed in columns and walls is no longer plastic.

E. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment so the concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in the remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other acceptable methods. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

4. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

F. Bonding

1. Roughen surfaces of set concrete at all joints except where bonding is obtained by use of concrete bonding agent, and clean surfaces of laitance, coatings, loose particles and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and not to leave laitance, loose particles of aggregate or damaged concrete at the surface.

2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

a. At joints between footings and walls or columns, and between walls or columns and beams or slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

b. At joints in exposed work; at vertical joints in walls; at joints in girders, beams, supported slabs and other structural members; and at joints designed to contain liquids; dampen, but do not saturate the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.

c. Use neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and not more than six (6) gallons of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16-inch. Deposit fresh concrete before cement grout has attained its initial set.

d. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instructions of the bonding material manufacturer.

3. Prepare for bonding of fresh concrete to fully cured hardened concrete or existing concrete by using an epoxy-resin-bonding agent as follows:

a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.

b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.

c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16-inch thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

G. Cold Weather Placing

1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.

2. When the air temperature has fallen to or is expected to fall below 40°F, provide adequate means to maintain the temperature in the area where concrete is being placed at either 70°F for three (3) days or 50°F for five (5) days after placing. Provide temporary housing or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Keep concrete moist. Avoid rapid dry-out of concrete due to over-heating and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50°F, and not more than 80°F, at point of placement.

4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen

materials. Ascertain that forms, reinforcing steel and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.

5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water soaked burlap if it becomes too hot so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.7 Finish of Formed Surfaces

A. Rough Form Finish

For formed concrete surfaces not exposed to view in the finish work or covered by other construction, unless otherwise shown or specified. This is the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Smooth Form Finish

Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view. Or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a

minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Curb Finishes

Curbs shall be screeded off accurately to true lines and planes or warped surfaces as indicated or directed. Finish smooth. Arises shall be true and straight or properly eased where curved and neatly rounded with approved tool. Smooth trowel finish with corners rounded to 3/4-inch radius.

D. Grout Cleaned Finish (Sacked)

Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment, and to all exposed to view interior and exterior building surfaces, typical.

Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces

At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.8 Monolithic Slab Finishes

A. Float Finish

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing or sand bed terrazzo, and as otherwise shown on drawings or in schedules.

2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven

floats, or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding 1/4-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill at low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

B. Trowel Finish

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, paint, or other thin-film finish coating system.

2. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Exposed Aggregate Finish

1. Screed to true plane, bullfloat surfaces, provide uniform double troweled finish. After troweling, let set until hard enough to wash without disturbing coarse aggregates. Simultaneously brush and spray with water to expose large aggregate and produce texture to match approved sample. Water cure or keep wet for 25 hours.

2. Scrub surface after 24 hours with a one (1) part muriatic acid to10 part water solution. Rinse thoroughly.

D. Broom Finish (Non-Slip)

1. Apply non-slip, broom finish to exterior concrete platforms, steps and ramps and elsewhere as shown on the drawings or in schedules.

2. Immediately after trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route or in the direction of water flow. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the ENGINEER before application.

E. Chemical-Hardener Finish

1. Apply chemical curing-hardening compound or chemical-hardener to all interior concrete floors which will not receive applied finish materials. Mask adjacent work and surfaces to avoid over spray. Apply liquid chemical-hardener after complete curing and drying of the concrete surface.

2. Dilute the liquid hardener with water and apply in accordance with the manufacturer's printed directions. Evenly apply each coat and allow for drying between coats in accordance with manufacturer's printed directions.

3. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

F. Non-slip Aggregate Finish

Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as shown on the drawings or in schedules.

After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using steel trowel, but do not force the non-slip aggregate particles below surface. After broadcasting and tamping, apply trowel finish as herein specified. After curing, lightly work the surface with a steel wire brush, or an abrasive stone, and water to expose the non-slip aggregate.

3.9 Schedule of Concrete Surface Finishes

Also see Section 09800 for protective coating requirements.

Surface Description		Type	Finish Requirement
A.	Interior Horizontal Slab	Slab	Trowel Finish to match existing interior slabs
B.	Exterior Horizontal Slab	Slab	Broom Finish (Non-Slip) to match existing exterior slab
C.	Exterior Vertical Surfaces Exposed to View	Formed	Smooth Form

3.10 Concrete Curing and Protection

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least seven (7) days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane curing or by combinations thereof, as herein specified. Provide the curing methods indicated as follows:

1. For concrete floor slabs provide moisture curing, moisture cover curing or liquid membrane/chemical curing-hardening curing. If liquid membrane curing is used, it must be compatible with concrete hardening compounds to be applied later.

2. For other concrete work, provide moisture curing or moisture cover curing. Do not use liquid membrane or chemical curing-hardening curing on any concrete work to receive any applied finishes.

3. For curing, use only water that is free of impurities, which could etch or discolor exposed, natural concrete surfaces.

4. Provide moisture curing by any of the following methods:

a. Keeping the surface of the concrete continuously wet by covering with water.

b. Continuous water-fog spray.

c. Covering the concrete surface with the specified absorptive cover thoroughly saturated with water and keeping the absorptive cover continuously wet. Place absorptive cover so as

to provide coverage of the concrete surfaces and edges with a 4-inch lap over adjacent absorptive covers.

5. Provide moisture-cover curing as follows - Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete placed in the widest practicable width with sides and ends lapped at least three (3) inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

6. Provide liquid membrane curing as follows:

   a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a coat continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas, which are subjected to heavy rainfall within three (3) hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

   b. Do not use membrane-curing compounds on surfaces, which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete. Such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the ENGINEER.

7. Curing formed Surfaces - Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

8. Curing Unformed Surfaces

   a. Initially cure unformed surfaces, such as slabs, floor topping and other flat surfaces by moist curing, whenever possible.

   b. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

   c. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise acceptable to the ENGINEER.

9. Provide liquid curing-hardening compound as follows:

   Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray or hair broom in accordance with manufacturer's directions.

C. Temperature of Concrete during Curing

1. When the atmospheric temperature is 40°F and below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period. When necessary, make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protections complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80°F, and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation wind breaks or shading, and for fog spraying, wet sprinkling or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protections complying with the requirements of ACI 305.

3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete, which exceed 5°F in any one-hour and 50°F in any 24-hour period.

D. Protection from Mechanical Injury - During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.11 Miscellaneous Concrete Items

A. Filling-In - Fill-in holes and openings in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Curbs - Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations - Provide machine and equipment bases and foundations as shown on the drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

3.12 Removal of Shores and Forms

A. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until the concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulative curing at not less than 50°F for 24 hours after placing concrete. Providing the concrete is sufficiently hard to not be damaged by form removal operations and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.

D. Form facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

E. Re-Use of Forms

Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, except as acceptable to the Architect.

No forming material will be allowed to be built permanently into exposed visible surfaces.

3.13 Concrete Surface Repairs

A. Patching Defective Areas

1. Repair and patch defective areas with cement mortar immediately after removal of forms but only when directed by the ENGINEER.

2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter and holes left by tie rods and bolts down to solid concrete but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the ENGINEER.

3. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

B. Repair of Formed Surfaces

1. Repair exposed-to-view formed concrete surfaces that contain defects, which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the ENGINEER. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolt; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

2. Repair concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01-inch wide, cracks or any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.

C. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so those repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the ENGINEER.

6. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating, or use concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same material to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair isolated random cracks and single holes not over 1 inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean off dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough

water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

8. For repair of existing unformed surfaces, mechanically remove all lose concrete as required to expose sound aggregate. Clean concrete surfaces to achieve a contaminate free, open textured surface. Square cut or under cut perimeter to minimum depth as specified by the repair mortar manufacturer. Remove all lose concrete around the exposed steel and hand tool or blast clean all portions of rebar with visible rust to near white metal finish. If half of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing to a 1/2-inch minimum depth. Splice new reinforcing steel to existing where corrosion has depleted the cross-section area by 25%. Apply a corrosion inhibitor/primer/bonding agent to all exposed rebar and other steel components and to concrete surfaces to be repaired per manufacturer's requirements, such as Sika Armatec 110 . Apply a polymer-modified, cement-based, repair mortar, trowel applied as specified by the manufacturer, such as Sika MonoTop 615.

9. Repair methods not specified above may be used subject to the acceptance of the ENGINEER.

3.14 Quality Control Testing during Construction

A. The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform all tests and to submit test reports to the ENGINEER and the CONTRACTOR. Per the OWNER or ENGINEER's requirements, the CONTRACTOR shall notify the special inspector/testing laboratory or the designated project representative to schedule the special inspections and materials testing required by the project documents.

B. Concrete shall be sampled and tested for quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete - ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump - ASTM 143; one (1) test for each concrete load at point of discharge; and one (1) for each set of compressive strength test specimens.

3. Air Content - ASTM C231, pressure method; one (1) for each set of compressive strength test specimens.

4. Compression Test Specimen - ASTM C31; one (1) set of four (4) standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

5. Concrete Temperature - Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens is made.

6. Compressive Strength Tests - ASTM C39; one (1) set for each 100 cubic yards or fraction thereof, of each concrete class placed in any one (1) day or for each 5,000 square feet of surface area placed; one (1) specimen tested at seven (7) days, two (2) specimens tested at 28 days, and one (1) specimen retained in reserve for later testing if required.

   a. When the frequency of testing will provide less than five (5) strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.

   b. When the total quantity of a given class of concrete is less than 50 cubic yards, the strength tests may be waived by the ENGINEER if, in his judgment, adequate evidence of satisfactory strength is provided.

   c. If required by the building official, perform strength tests of cylinders cured under field conditions. Field cured cylinders shall be taken and molded at the same time and from the same samples as the laboratory cured test cylinders. When the strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

C. Report test results in writing to the ENGINEER and the CONTRACTOR on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of CONTRACTOR, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day tests and 28-day tests.

D. Additional tests - The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the

ENGINEER. The testing service shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. CONTRACTOR shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL

1.1 Description

A. The CONTRACTOR shall furnish all materials for grout in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.

B. Work covered in this section includes:

1. Removal of loose and spalling grout and concrete.
2. Anchoring, patching, grouting, and sealing.

C. The following types of grout shall be covered in this section:

Non-shrink grout: This type of grout is to be used wherever grout is required in the Contract Documents, unless another type is specifically referenced.

1.2 Reference Specifications, Codes, and Standards

A. Specifications, codes, and standards shall be as specified in Section 03100, “Concrete Work,” and as referred to herein.

B. Commercial Standards

CRD-C 621Corps of Engineers Specification for Non-Shrink Grout

ASTM C 109Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)

ASTM C 531Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical - Resistant Mortars, Grouts, and Monolithic Surfacing

ASTM C 579Test Methods for Compressive Strength for Chemical - Resistant Mortars and Monolithic Surfacing

ASTM C 827Test Method for Early Volume Change of Cementitious Mixtures

1.3 Contractor Submittals

The CONTRACTOR shall submit certified test results verifying the compressive strength, shrinkage, and expansion requirements specified herein; and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout used in the work.

1.4 Quality Assurance

Field Tests

A. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the ENGINEER to insure continued compliance with these specifications. The specimens will be made by the ENGINEER or its representative.

B. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at seven (7) days, 28 days, and each additional time period as appropriate.

C. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.

D. The cost of all laboratory tests on grout shall be borne by the CONTRACTOR and the CONTRACTOR shall obtain the specimens for testing. The CONTRACTOR shall also be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The CONTRACTOR shall supply all materials necessary for fabricating the test specimens.

PART 2 PRODUCTS

2.1 Prepackaged Grouts

Non-Shrink Grouts

A. Non-shrink grout shall be a prepackaged, inorganic, non-gas- liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation of each class of

non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

B. Class A non-shrink grouts shall have minimum 28 day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C-827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRDC 621.

C. Class B non-shrink grouts shall have minimum 28 day compressive strength of 5000 psi and shall meet the requirements of CRD C621.

D. Application

1. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

2. Class B non-shrink grout shall be used or the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

2.2 Consistency

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where “dry pack” is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed four (4) inches.

2.3 Measurement of Ingredients

A. Measurements for cement grout shall be made accurately by volume using containers approved by the ENGINEER. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 EXECUTION

3.1 General

A. All surface preparation, curing, and protection of cement grout shall be as specified by the manufacturer. The finish of the grout surface shall match that of the adjacent concrete.

B. The manufacturer of Class A non-shrink grout shall provide on-site technical assistance upon request.

C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the ENGINEER.

3.2 Grouting Procedures

Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution of prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

END OF SECTION

SECTION 04100

MORTAR AND GROUT

PART 1 GENERAL

1.1 Scope

Work under this section shall include all labor, materials and equipment required to complete work required by contract documents.

1.2 Submittals

A. Submit grout design for review and approval by ENGINEER, indicating type and proportions of the ingredients according to the proportion requirements herein and ASTM C 476, or submit the mix designs and grout strength test performed in accordance with ASTM C 476.

B. Submit mortar design for review and approval by ENGINEER, indicating type and proportions of ingredients in compliance with the proportion specification herein and ASTM C 270, or submit the mix design and mortar tests performed in accordance with the property specification of ASTM C 270.

C. Submit color samples for OWNER selection of mortar color.

D. Submit material certificates certifying that each material is in compliance for all Mortar and Grout materials and admixtures.

E. Submit construction procedures for Cold Weather Construction and/or Hot Weather Construction for review and approval by ENGINEER in compliance with the requirements herein prior to use on the project.

1.3 Quality Assurance

A. Testing Service -- The OWNER or an agent of the OWNER will engage a testing laboratory acceptable to the ENGINEER to perform material evaluation tests and to perform required Special Inspections.

B. Materials and installed work may require testing and retesting, as directed by the ENGINEER, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. All testing required by the contract documents shall be done at the OWNER'S expense. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

C. An independent testing agency or laboratory shall make test specimens of grout and mortar on job site. One mortar test and one grout test shall be taken for each 2,000 square feet of wall area but at least one set of tests shall be taken. The use of testing and inspection does not relieve the CONTRACTOR of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

D. Masonry construction shall be inspected and evaluated in accordance with the requirements of the International Building Code (IBC) and the Oregon Structural Specialty Code (OSSC), and shall be governed by the classification of the building or structure or nature of occupancy to either Level 1 inspection or Level 2 inspection. The Contract Documents shall dictate the required level of inspection per above reference, or provide a project specific special inspection program. If the Contract Drawings do not specify the level of required inspection the CONTRACTOR shall provide Level 2 inspection or obtain written direction from the ENGINEER to the required level of inspection.

E. Where a Quality Assurance Plan is provided as part of the Contract Documents the CONTRACTOR shall provide a written statement of responsibility to the building official and to the OWNER prior to the commencement of work on the system(s) of component(s) so designated within the Quality Assurance Plan. The CONTRACTOR shall acknowledge: awareness of the special requirements contained in the quality assurance plan, control will be exercised to obtain conformance with the construction documents approved by the building official. Also included shall be procedures for exercising control within the CONTRACTOR'S organization, the method and frequency of reporting and the distribution of reports and identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

F. Environmental – The cold weather construction provisions of ACI 530.1/ASCE6/TMS 602, Article 1.8 C shall be implemented when the ambient temperature falls below 40 degrees F or the temperature of the masonry units is below 40 degrees F. The hot weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.D shall be implemented when the ambient temperature exceeds 100 degrees F or when the temperature exceeds 90 degrees F and the wind velocity is greater than 8 mph. No salt, anti-freeze chemicals or related materials permitted. Store masonry units and bagged materials off ground and protect from rain. Do not build on work having film of water or frost on surfaces. Protect work by covering in rainy weather; protect green masonry from freezing. Before stopping work for day, cover tops of walls at new work with non-staining waterproof covering extended 2 feet minimum down both sides of wall and secured.

PART 2 PRODUCTS

2.1 Mortar and Grout Materials

A. Cement shall be Type I Portland cement conforming to ASTM C150.

B. Fine and coarse aggregate shall meet ASTM C404 for grout. Sand shall be clean, sharp, well graded and free from salt, loam, clay and other foreign matter. Sand shall conform to ASTM C144 for mortar. Sand shall be graded as follows:

Sieve Size	Percent Passing
4	100
8	95 - 100
16	70 - 100
30	40 - 75
50	15 - 35
100	2 - 15
200	0

C. Lime shall be hydrated type conforming to ASTM C207, Type S.

D. Water shall be clean, fit for drinking (potable), and free from strong acids, alkalis, oils or organic material.

E. Waterproofing admixture shall be powder. Type: Grace Hydratite Plus, CemMaster Hydrolox 400, BASF Rheomix, BASF Rheopel or approved equal.

F. Accelerator or retardant may be added when required by weather conditions. Type: Anti-Hydro, Grace Dehydratine 80 or Dehydratine 80M, BASF Pozzolith, Sika Plastiment, Sonneborn Sonotard, Trimex, or approved equal.

G. Intrusion (water-reducing) admixture for grout. Type: BASF Pozzolith, IntrusionAid or approved equal.

H. Water-reducing admixture for mortar. Type: BASF Rheomix or approved equal.

I. Mortar Color. Pure natural finely milled inert water insoluble non-bleeding and free of deleterious fillers or extenders. Color shall be as shown on the plans. Color shall be selected by OWNER from manufacturer's standard range of colors.

2.2 Proportion of Mixes

A. Mortar shall conform to ASTM C270 and be of the type and color specified. Mortar shall be Type S and shall have a minimum 28-day compressive strength of 2,000 psi minimum. Mortar shall be mixed by volume in ratio of 1-part Portland cement (6 sacks per cubic yard minimum), 1/4 to 1/2 part lime, 2-1/4 to three (3) parts (to cement-lime combined volume) sand. Pointing mortar shall be one part cement, 1/4 lime, three (3) parts sand by volume. Add one (1) pound of water-reducing admix for mortar per bag of cement and one pound per cubic foot of lime. Add waterproofing in amounts recommended by manufacturer, 0.2 pounds of waterproofing per 100 pounds of cement minimum. Do not use admixtures containing more than 0.2 percent chloride ions. Limit the maximum percentage of mineral oxide or carbon black job site pigments by weight of cement as follows: For pigmented Portland cement-lime mortar; 10 percent maximum mineral oxide pigment or 2 percent maximum carbon black pigment.

B. Masonry grout shall conform to ASTM C476. It shall have a minimum 28 days compressive strength greater than or equal to f'm, but not less than 2,000 psi, seven (7) sacks of cement minimum per cubic yard, and include waterproofing admix and intrusion admix in amounts recommended by manufacturer, 0.2 lb. of waterproofing per 100 pounds of cement minimum.

C. Grout for pouring shall be of fluid consistency, seven (7) to eight (8) inches slump. Accurately mix by volume 1-part Portland cement: two (2) parts minimum to three (3) parts maximum of damp loose sand: two (2) parts maximum of 3/8-inch minus aggregate. For grout spaces less then three (3) inches in any dimension, omit 3/8-inch minus aggregate. Grout for pumping shall be without segregation of the constituent parts and shall be mixed to a consistency that has a slump between eight (8) to eleven (11) inches.

D. Empty bags for waterproofing and intrusion admixes shall be retained for verification by ENGINEER prior to their disposal. Use accelerator or retardant in strict accordance with manufacturer's printed instructions.

2.3 Masonry Cleaner

Sure Kleen #101 Lime Solvent, or approved equal.

PART 3 EXECUTION

3.1 Mixing

A. Grout shall be plant batched.

B. All tools and equipment used in mixing of mortar shall be clean and free of contaminants. Measure materials by volume or equivalent weight, not by shovel. Supply only as much water as necessary to obtain desired workability; required compressive strength must be met. Mix by placing 1/2 of the water and sand in the operating mixer. Then add the cement, lime and the remainder of the sand and water. After all ingredients are in the batch mixer they shall be mechanically mixed for not less than three (3) minutes. Hand mixing shall not be employed. Heat aggregates when air temperature is below 32 degrees F to maintain mortar at 70 to 120 degrees F until used.

C. Maintain workability of mortar by retempering. Retemper by adding only as much water as required to maintain high plasticity. Retempering shall only be done by adding water within a basin formed from mortar on a mortar board and working mortar into water. Discard all mortar which has begun to stiffen, or which is unused after 2-1/2 hours from the initial mixing.

3.2 Installation

A. See Section 04220 for masonry units.

B. All masonry shall be laid true straight level, plumb and neatly in accordance with the drawings; lay out in advance so that no concrete unit less than eight (8) inches in length occur except where necessary as in reveals, etc.

C. All units shall be saw cut accurately to fit all openings, and for electrical and plumbing work. No plumbing or electrical boxes or conduit shall be placed in any cell or course that contains reinforcing. All cutting shall be done with masonry saw and produce neat and true surface. All units shall be sound, dry, clean and free from cracks and chips.

D. No construction supports shall be attached to the wall except where specifically permitted by the ENGINEER.

E. Units shall be “air” dry at time of laying.

3.3 Reinforcement (See also Section 03100)

The following minimum requirements shall be met unless shown otherwise:

A. Provide #4 verticals at four (4) feet maximum on center. Locate two #4 at each jamb of door, window, louver, and other openings and end of walls; run full height of wall. Reinforcement adjacent to openings need not be provided for openings smaller than 16-inches in either the horizontal or vertical direction, unless the spacing of distributed reinforcing is interrupted by such openings. Position one #4 vertical at each wall corner and each wall intersection; run full height of wall. Dowel verticals to foundation with one #4

dowel four (4) feet long minimum per vertical; embed dowel two (2) feet in foundation unless otherwise shown on drawings.

B. Horizontal reinforcement, unless shown otherwise, shall be two #4 rebars in the bond beams which are located at four (4) feet maximum on center and at all floor and roof levels. Bend rebar at corners and intersections, or supply two (2) feet by two (2) feet rebar of same size and number as horizontal reinforcement. Horizontal reinforcement shall be anchored around vertical reinforcing bars with a standard hook at all wall ends, corners, and intersections that are not continuous around the corner or through the intersection. For openings, minimum lintel size and reinforcement shall be two (2) #4 rebar in bottom of 8-inch lintel for less than four (4) feet span, and two (2) #5 rebar in bottom of 16 inches lintel for four (4) feet to 10 feet span. Lintel reinforcement to extend two (2) feet beyond each side of jamb.

C. Before placing reinforcement remove mud, oil, mills scale, loose rust, ice and any other coatings from it. Position reinforcement accurately; center in cells unless noted otherwise. Secure against displacement, holding vertical reinforcement firmly in place by means of frames, rebar spacers, or other suitable devices, and place horizontal reinforcement as laying progresses. Vertical bars shall be held in position at the top and bottom and at intervals not exceeding 192 diameters of the reinforcement.

D. Minimum clear distance between longitudinal bars shall be nominal diameter of bar or 1-inch, whichever is larger. Minimum thickness of mortar or grout between masonry and reinforcement shall be 1/4-inch for fine grout and 1/2-inch for coarse grout. Unless noted otherwise, reinforcing bars and dowels shall be lapped 40 bar diameters or 2-foot six (6) inches minimum, where spliced end shall be separated by 1 bar diameter or wired together.

E. Splice reinforcement only at points shown on drawings or reviewed shop drawings; any other locations must be specifically reviewed by ENGINEER. Splices in adjacent bars shall be staggered; in horizontal reinforcement of walls separate at least 10 feet longitudinally for bars of same tier.

F. When a foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six vertical. Dowel shall be grouted into a core in vertical alignment, even though it may be in cell adjacent to cell holding vertical wall reinforcing.

G. Bond beam reinforcement shall be laid continuously on webs of bond beam units. Intersecting masonry walls shall be tied to one another by horizontal reinforcement, unless noted otherwise; where masonry walls intersect with concrete walls, connect with 1/2-inch diameter by 15-inch mechanical bolts in flush shells at bond beams.

H. To allow bonding masonry, clean laitance from top of concrete foundation before proceeding. The stating joint on foundations or slabs shall be laid with full mortar coverage except at the area where grout occurs, which shall be kept free of mortar so that grout is in contact with the foundation slabs.

I. Lay units in regular running bond except where soldier or other coursing is shown on drawings; maintain even module. Corners shall have same masonry bond by overlapping units. Joints shall be uniform throughout all work having same type of masonry units.

J. At running bond, thread vertical reinforcing through alternately overlapping cells. Lay units according to “face and shell” method; provide full mortar coverage on all face shells, and on faces and webs surrounding vertical and horizontal cells to be filled with grout.

K. Do not furrow bed joints. Shove tightly each new unit against existing unit so that mortar bonds well to both.

L. Rock closures into place. Do not pound corners and jambs to fit stretcher units after they are set in position. Remove all excess grout and mortar spilled on masonry units during construction.

M. Dry brush all masonry surfaces at end of each day’s work. Stop off horizontal run of masonry by racking back one half length of unit in each course at end of day’s work. Toothing is not permitted. Where fresh masonry joins partially set masonry, remove loose units and mortar clean and then lightly wet exposed surface of set masonry before starting new work.

N. Joints of walls to be covered or furred may be left flush, without tooling. Joints of all walls which are to be exposed shall be tooled when “thumb right” hard mortar is partially set but still sufficiently plastic to bond) with round jointer or bar to produce a dense, slightly concave surface, well bonded at edges. All tooling shall be done with a tool which compacts the excess mortar out of joint rather than dragging it out. Joints which are not tight at the time of tooling shall be raked out, pointed, then tooled. If it is necessary to move to a unit after it has been once set in place, the unit shall be removed from wall, cleaned and set in fresh mortar. Remove any mortar fins from joint junctions.

O. Unless shown otherwise on drawings, provide 8-inch lintel for concrete masonry openings four (4) feet wide or less and 16-inch lintel for openings greater than four (4) feet wide. Forms and shores for lintels shall be substantial. Brace or tie forms to maintain position and shape. Forms shall be tight with no leakage of mortar or grout. Do no remove forms and shores until masonry has hardened sufficiently to carry its own weight and other temporary loads that may be placed on it during construction, 10 days minimum.

3.4 Grouting

A. Grouting shall be by low lift method.

B. Cells containing reinforcement or embedded items shall be solidly filled with grout. Before grouting starts, reinforcing steel shall be secured in a place and inspected by both ENGINEER and Building Inspector from governmental unit having authority.

C. Vertical cells to be filled shall have vertical alignment to maintain continuous unobstructed cell area. To confine grout to horizontal masonry beams, the tops of unfilled cell cavities or cores in masonry units under beams shall be covered with metal lath, or special bond beam or lintel units shall be used, or another method may be employed if approved by ENGINEER, building paper shall not be permitted.

D. All bolts, anchors, etc., inserted in walls shall be fully and solidly grouted in place. Embedment shall not be less than 3/4 of the wall thickness, unless otherwise noted.

E. Masonry shall cure at least 24 hours before grouting. Keep clean of mortar and drippings those cavities and cores which are to be grouted. Mortar projections and droppings shall be washed out of spaces and off reinforcing with a jet stream of water.

F. Grout shall be poured in lifts not exceeding five (5) feet. All masonry shall be laid using the Low-Lift grouting method with maximum grout pour heights not to exceed five (5) feet unless otherwise allowed in writing by the ENGINEER. In addition, grout pour heights shall not exceed the maximum grout pour height limits of Table 7 of ACI 530.1/ASCE6/TMS 602, based upon the minimum grout space dimensions for grouting of cells of hollow units. Lay masonry until location of a bond beam or horizontal lintel beam is reached, but not to exceed the limits of Table 7 of ACI 530.1/ASCE6/TMS 602, and then grout full the vertical cells required to be grouted and fill the beam or lintel without pause.

G. To insure complete filling of grout space, consolidate grout at time of pouring by puddling and then reconsolidate by later puddling before the plasticity is lost. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

H. Solid grout hollow metal door and window frames; for all wall openings over two (2) feet wide, solid grout from lintel to floor or roof above in one continuous operation.

I. Place grout within 1 1/2 hour from introducing water in the mixture and prior to initial set.

3.5 Masonry Cleaning

A. All mortar and grout must be thoroughly set and cured before cleaning. Remove excess mortar or mortar stains or efflorescence; scraping devices shall be nonferrous. Protect all adjacent surfaces, including sash and other corrodible metal-work, from damage by cleaning solvent.

B. Saturate all exposed masonry with water immediately before cleaning, apply solution of cleaner as per manufacturer's instructions and rinse thoroughly with fresh, clean water immediately after cleaning. Do small sections at a time, working from top to bottom. Repeat as necessary.

C. Tuckpoint any loose, or defective mortar joints. At conclusion of masonry work, remove scaffolding and equipment used in work and remove debris, refuse and surplus masonry material.

END OF SECTION

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.1 Scope

Work included under this section shall include all materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to complete the work, including, but not limited to, these major items:

A. Concrete masonry units.

B. Vertical and horizontal reinforcing and dowels projecting into subsequently placed concrete.

C. Setting of flashing and other work to be embedded in masonry.

1.2 Submittals

A. Samples -- Before any concrete unit masonry materials are delivered to the job site, submit one sample of each proposed concrete masonry unit to the ENGINEER for approval.

B. Submit color samples for OWNER selection of concrete masonry unit colors.

C. Material Certificates -- Prior to delivery of concrete masonry materials, anchors, ties, fasteners, and metal accessories to the job site, deliver to the ENGINEER a letter from the manufacturer of the proposed masonry units, anchors, ties, fasteners, and metal accessories certifying that all such units to be delivered to the job site are in strict conformance with the provisions of this Section.

D. Submit construction procedures for Cold Weather Construction and/or Hot Weather Construction for review and approval by ENGINEER in compliance with the requirements herein prior to use on the project.

E. A letter of certification from the Supplier of the materials shall be submitted prior to delivery of the materials to the site to verify compressive strength (f′m) according to the IBC.

1.3 Quality Assurance

A. Qualifications of Workers

Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the

specified requirements and the methods needed for proper performance of the work of this Section.

Provide one skilled journeyman mason who shall be present at all times during execution of this portion of the work and who shall personally direct all work performed under this Section.

B. Standards, Specifications and Codes

Comply with the applicable provision of the following codes, specifications and standards to the extent indicated by reference thereto:

1. American Concrete Institute (ACI)
2. American Society of Testing and Materials (ASTM)
3. National Concrete Masonry Association (NCMA)
4. Structural Clay Products Institute (SCPI)
5. American Society of Civil Engineers (ASCE)
6. The Masonry Society (TMS)
7. The International Building Code (IBC)

Comply with building code requirements which are more stringent than the above and all O.S.H.A. requirements.

C. Masonry construction shall be inspected and evaluated in accordance with the requirements of the International Building Code (IBC), and shall be governed by the classification of the building or structure or nature of occupancy to either Level 1 inspection or Level 2 inspection. The Contract Documents shall dictate the required level of inspection per above reference, or provide a project specific special inspection program. If the Contract Drawings do not specify the level of required inspection the CONTRACTOR shall provide Level 2 inspection or obtain written direction from the ENGINEER to the required level of inspection.

D. Where a Quality Assurance Plan is provided as part of the Contract Documents the CONTRACTOR shall provide a written statement of responsibility to the building official and to the OWNER prior to the commencement of work on the system(s) of component(s) so designated within the Quality Assurance Plan. The CONTRACTOR shall acknowledge: awareness of the special requirements contained in the quality assurance plan, control will be exercised to obtain conformance with the construction documents approved by the building official. Also included shall be procedures for exercising control within the CONTRACTOR’S organization, the method and frequency of reporting and the distribution of reports and identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

E. An independent testing agency or laboratory shall verify the compressive strength (f'm) of the proposed construction prior to construction and at regular intervals during construction as indicated in the Contract Documents, but at lease one test for every 5,000 square feet during construction. The compressive strength (f'm) shall be determined for each wythe of multiwythe walls. Unless specifically directed within the Contract Documents, use the unit strength method specified by ACI 530.1/ASCE6/TMS 602 or the prism test method of ASTM C 1314. The use of testing and inspection does not relieve the CONTRACTOR of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

F. Testing Service -- The OWNER or and agent of the OWNER will engage a testing laboratory acceptable to the ENGINEER to perform material evaluation tests and to perform required Special Inspections.

G. Materials and installed work may require testing and retesting, as directed by the ENGINEER, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. All testing required by the contract documents shall be done at the OWNER'S expense. Testing expenses for the retesting of rejected materials and installed work will be charged back to the CONTRACTOR.

1.4 Product Handling

A. Store materials under cover in a dry place and in a manner to prevent damage or intrusion of foreign matter. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store masonry units under covers that will permit circulation of air and prevent excessive moisture absorption. Protect concrete masonry units from wetting.

B. Handle unit on pallets or flat bed barrows.

C. Replacements -- In the event of damage, immediately make all repairs and replacements necessary to the approval of the ENGINEER and at no additional cost to the OWNER.

D. Reinforcing, metal ties, and anchors shall be protected from contact with soil and water and before being placed shall be free of loose rust and other coatings that will reduce or destroy bond.

E. Environmental Conditions - CONTRACTOR shall implement the following special construction procedures based on the environmental conditions encountered during masonry construction. Failure of the CONTRACTOR to maintain the conditions specified below during the construction of masonry work will be just and sufficient cause for such work to be rejected.

1. Cold Weather - The cold weather construction provisions of ACI 530.1/ASCE6/TMS 602, Article 1.8 C shall be implemented when the ambient temperature falls below 40 degrees F or the temperature of the masonry units is below 40 degrees F. All masonry units and all work on which new masonry is constructed shall be free of frost, ice, snow, and surface moisture and their temperature shall not be lower than 40 degrees F. Protect green masonry from freezing. No salt, anti-freeze chemicals or related materials are permitted.

2. Hot Weather - The hot weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.D shall be implemented when the ambient temperature exceeds 100 degrees F or when the temperature exceeds 90 degrees F and the wind velocity is greater than 8 mph.

3. Wet Weather - Store masonry units and bagged materials off ground and protected from rain. Do not build on work having a film of water on any surfaces. Protect work by covering in rainy weather. Before stopping work for the day, cover the tops of walls at new work with non-staining, waterproof covering extended 2 feet minimum down both sides of wall and secured in place.

PART 2 PRODUCTS

2.1 Concrete Masonry Units

A. Unit shall be in modular sizes. Exposed-to-view units in any one building shall be of the same appearance. The texture of units shall match the approved samples for the types of construction and locations designated on the plans. Units shall not contain iron spots or other substances that will stain plaster or paint.

B. Hollow load-bearing units shall conform to ASTM C90 type 1, Grade N.

C. The composition shall be 50 percent lightweight (pumice) and 50 percent sand. The lightweight aggregate shall conform to ASTM C331 and the sand shall conform to ASTM C33.

D. Minimum compressive strength of all blocks shall be 2,000 psi based on the net area.

E. Maximum water absorption permitted for units at the time of delivery to the job site shall be 15 pounds per cubic foot (15 pcf) of concrete as an average of five units for normal weight aggregate per ASTM C140.

F. Maximum moisture content permitted for standard weight aggregate units at time of delivery shall be 30 percent of total absorption. The tests for moisture content shall be determined from an average of five units per ASTM C140.

G. Maximum linear shrinkage shall not exceed .035-inch/unit. Concrete masonry units shall include lintel, and bondbeam units, and special shapes and sizes required to complete the work indicated.

H. Certification required above shall show results of tests made not more than 12 months prior to delivery of concrete masonry units to the job site, shall show compliance with the specified values, and shall certify that the mix design, yield per batch, and curing procedures for the units delivered to the job site will be equal to those submitted for the test.

I. Unit Colors and Styles. Pure natural finely milled inert water insoluble non-bleeding and free of deleterious fillers or extenders. Colors and styles shall be as shown on the plans. Colors shall be selected by OWNER from manufacturer's selection.

2.2 Mortar and Grout

Provide mortar and grout as indicated on the drawings in conformance with the requirements of Section 04100 of these specifications.

2.3 Reinforcement Steel

Provide reinforcement steel as indicated on the drawings and in conformance with the requirements of Division 3 of these specifications.

2.4 Insulation

Not used.

2.5 Other Materials

All other materials, not specifically described but required of a complete and proper installation of the work of this Section, shall be as selected by the CONTRACTOR subject to the approval of the ENGINEER.

PART 3 EXECUTION

3.1 Inspection

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 Coordination

Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.3 Installation

A. Masonry shall be plumb, true to line, with level courses accurately spaced, and built to thickness and bond pattern indicated. Where no patter is indicated, masonry shall be laid in running bond pattern. Concrete masonry units shall be dry when laid. Each unit shall be adjusted to final position in the wall while mortar is still soft and plastic. Any unit disturbed after mortar has stiffened shall be removed and re-laid with fresh mortar. Chases shall be built in and not cut in. Chases shall be plumb and shall be minimum one unit length from jambs of openings. Chases and raked-out joints shall be kept from mortar or debris. Spaces around metal door frames and other built-in items shall be solidly filled with mortar as each course is laid. Anchors, wall plugs, accessories, flashings, and other items to be built in shall be installed as the masonry work progresses. All cutting and fitting of masonry, including that required to accommodate the work of other sections shall be done by masonry saws.

B. Where fresh masonry joins masonry that is partially set or totally set, clean the exposed surface of the set masonry and remove all loose mortar. If it is necessary to “stop off” a horizontal run of masonry, this shall be done by raking back one half brick or block length in each course. Toothing will not be permitted.

C. Before closing up any pipe, duct or similar inaccessible spaces or shafts with masonry, remove all rubbish and sweep out the area to be enclosed.

D. Provide level and solid bearing in masonry walls under all bearing structural floor and roof elements. Solid bearing shall be bond beams unless otherwise indicated.

E. All masonry walls shall extend to underside of floor beams or roof metal decking unless otherwise indicated.

F. If blowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt at no additional cost to the OWNER.

G. Mortar Beds and Joints

1. Hollow units shall be laid with full mortar coverage on horizontal and vertical face shells, except that webs shall be also be bedded in all

courses of the starting course on footings and solid foundation walls, and where adjacent to cells or cavities to be reinforced and/or filled with grout or concrete.

2. Horizontal and vertical face joints shall be 3/8-inch thick unless otherwise indicated. Vertical joints shall be shoved tight. Mortar joints in exposed or painted surfaces shall be tooled when thumbprint hard to a flush joint. Joints in unparged masonry below grade shall be pointed tight with a trowel. Mortar joints in surfaces to be plastered, stuccoed, or covered with other masonry shall be cut flush. Mortar protrusions extending into cells or cavities to be reinforced and filled shall be removed.

H. Placing Reinforcement

1. Splices in reinforcement shall be made only at such points and in such a manner that the structural strength of the member will not be reduced. Lapped splices shall provide sufficient lap to transfer the working stress of the reinforcement by bond and shear. Minimum lap shall be 40 bar diameters, where spliced end shall be separated by 1 bar diameter or wired together. Welded or mechanical connections shall develop the full yield strength of the reinforcement. Bond beams shall be continuous around corners.

2. Vertical reinforcement shall be rigidly secured at the top and bottom and at intervals necessary to hold the reinforcing in proper position.

   Reinforcement shall be placed at the wall centerline unless indicated otherwise.

I. Grouting

1. Units containing reinforcement shall be filled solid with grout. All cells that are indicated to be filled shall be filled with grout as specified in this Division and as shown on the drawings.

2. Grout shall be poured in lifts not exceeding 5-feet. The maximum grout pour height shall be not exceed the limits of Table 7 of ACI 530.1/ASCE6/TMS 602. Lay masonry until location of a bond beam or horizontal lintel beam is reached, but not to exceed the limits of Table 7 of ACI 530.1/ASCE6/TMS 602, and then grout full the vertical cells required to be grouted and fill the beam or lintel without pause.

3. To insure complete filling of grout space, consolidate grout at time of pouring by puddling and then reconsolidate by later puddling before the plasticity is lost. Consolidate pours exceeding 12 inches in height by

mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

4. Solid grout hollow metal door and window frames; for all wall openings over two (2) feet wide, solid grout from lintel to floor or roof above in one continuous operation.

5. Place grout within 1 1/2 hour from introducing water in the mixture and prior to initial set.

J. Low-Lift Grouting

1. The repetitive construction procedure of erecting a masonry wall to a height not greater than four (5) feet, grouting the wall as required and then repeating this cycle until the top of the wall is reached shall be classified as low-lift grouting. Grout shall be placed while mortar joints are still soft and plastic or the grout spaces shall be cleaned of mortar dropping and protruding mortar joints shall be removed.

2. Set steel lintels in beds of mortar. Fill spaces around jambs and head of metal door buck and frames solidly with mortar.

K. Pointing and Cleaning

1. At the completion of the work, all holes in joints of masonry surfaces to be exposed or pointed except weep holes shall be filled with mortar and suitably tooled, masonry walls shall be dry brushed at the end of each day's work and also final pointing, and shall be left clean and free from mortar spots and droppings. Any cracks in masonry shall be repaired. Defective joints shall be cut out and repointed.

2. Remove efflorescence, mortar spots and other areas that appear unclean with cleaning agent to a sample wall area as directed by the ENGINEER. The ENGINEER retains the right to change proposed cleaning methods and shall be notified before any additional cleaning agent is used. The cleaning methods agent shall be applied to a small section of the wall at a time and work shall proceed from the top to the bottom. Protect all metal sashes, lintel, louvers and other corrodible parts when masonry is cleaned.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 Description

A. The extent of metal fabrications work is shown on the drawings and includes items fabricated from iron, steel, stainless steel and aluminum shapes, plates, bars, sheets, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems in other sections of these specifications.

B. The types of miscellaneous metal items include but are not limited to the following:

1. Gratings
2. Handrails and railings
3. Miscellaneous framing, fabrication and supports
4. Rough hardware

1.2 Reference Specifications, Codes, and Standards

A. Codes and Standards -- Comply with the provisions of the following codes, standards and specifications, except as otherwise shown and specified:

1. AISC -- “Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings”, including “Commentary of the AISC Specifications”

2. AISC -- “Specifications for the Design of Cold-Formed Steel Structural Members”

3. AWS -- “Structural Welding Code”

4. Standard Specifications for Metal Bar Grating in the “Metal Bar Grating Manual”, National Association of Architectural Metal Manufacturers (NAAMM), 1981

B. Qualification for Welding Work -- Qualify welding processes and welding operators in accordance with AWS 1.1 “Standard Qualification Procedure”

C. Welding of Aluminum -- Conduct in accordance with Section 10 of the “Specifications for the Design and Construction of Structural Supports for

Highway Luminaries", AASHTO, 1971. Welding method shall be either gas tungsten arc or gas metal arc. Rods shall be 4043.

D. Field Measurements -- Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication.

E. Shop Assembly -- Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.3 Submittals during Construction

A. Manufacturer's Data -- Miscellaneous Metal, General - For information only, submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in miscellaneous metal work, including paint products.

B. Shop Drawings -- Miscellaneous Metal, General -- Submit copies of shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work which are not completely shown by the manufacturer's data sheets. Include plans, elevations and details of sections and connections and fabricators proposed shop coat paint or galvanizing specifications. Show anchorage and accessory items. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete construction.

C. Samples, Miscellaneous Metal, General -- Submit two (2) sets of representative samples of materials and finished products as may be requested by the ENGINEER. ENGINEER's review will be for color, texture, style and finish only.

1.4 Delivery, Handling and Storage

Delivery, handling and storage of metal fabrications shall be in accordance with manufacturer's requirements.

PART 2 PRODUCTS

2.1 General

For the fabrication of miscellaneous metal work items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting,

seam marks, roller marks, rolled trade names, roughness and defects which impair strength, durability and appearance. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating and application of surface finishes including zinc coatings.

2.2 Materials

A. Steel Plates, Shapes and Bars -- ASTM A 36

B. Steel Plates to be Bent or Cold Formed -- ASTM A 283, Grade C

C. Steel Tubing -- Hot formed, welding or seamless, ASTM A 500, Grade B

D. Steel Bars and Bar-Size Shapes -- ASTM A 36

E. Cold-Finished Steel Bars -- ASTM A 108, grade as selected by fabricator

F. Cold-Rolled Carbon Steel Sheets -- ASTM A 366

G. Galvanized Carbon Steel Sheets -- ASTM A 526, with ASTM A 525, G 90 zinc coating

H. Gray Iron Castings -- ASTM A 48, Class 30

I. Malleable Iron Castings -- ASTM A 47, grade as selected

J. Steel Pipe -- ASTM A 53, Type E or S; Grade A; galvanized standard weight (Schedule 40), unless otherwise indicated

K. Structural Aluminum Shapes and Plates -- ASTM B 308, Alloy 6061-T6, Anodic Coating Class I, AA-C22-A41, anodized after fabrication

L. Non-shrink Nonferrous Grout -- CE CRD C588

2.3 Anchors

All concrete anchors shall be epoxy anchors. Where shown, the following anchors shall be provided:

A. Threaded-type Concrete Inserts -- Galvanized ferrous casting, internally threaded to receive machine bolts; either malleable iron complying with ASTM A 47, cast steel complying with ASTM A 27; hot dip galvanized or, Type 304 stainless steel complying with ASTM A 320.

B. Wedge-type Concrete Inserts -- Galvanized box-type ferrous castings, designed to accept bolts having special wedge-shaped heads; either malleable iron complying with ASTM A 47 or cast steel complying with ASTM A 27;

hot-dip galvanized; provide carbon steel bolts having special wedge-shaped heads, nuts, washers and shims; all galvanized in compliance with ASTM A 153.

C. Slotted-type Concrete Inserts -- Galvanized 1/8-inch thick pressed steel plate complying with ASTM A 283; box-type welded construction with slot designed to receive square head bolt and with knockout cover; hot-dip galvanized, or stainless steel as noted.

D. Epoxy Anchors -- “Parabond” by Molly, HVA adhesive anchor system by Hilti or approved equal.

E. Proprietary products as named on the drawings, or approved equal.

2.4 Fasteners

Provide zinc-coated fasteners with galvanizing complying with ASTM A 153 or stainless steel as noted on drawings and elsewhere in the specifications. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items. Where stainless steel bolts are in contact with dissimilar metals, glass epoxy insulating sleeves and washers shall be used to electrically isolate the bolts. Fasteners to be as follows:

A. Standard Bolts and Nuts -- ASTM A 307, Grade A, regular hexagon head

B. Stainless Steel Bolts, Nuts and Washers -- 316 SS

C. High Strength Bolts -- ASTM A 325, regular hexagon head

D. Lag Bolts -- FS FF-B-561, hex head type

E. Machine Screws -- FS FF-S-92

F. Wood Screws -- FS FF-S-111, flat head carbon steel

G. Plain Washers -- FS FF-W-92, round, general assembly grade carbon steel

H. Lock Washers -- FS FF-W-84, helical spring type carbon steel

I. Toggle Bolts -- Tumble-wing type: FS FF-B-588, type class and style as required

J. Masonry Anchorage Devices -- Expansion shields, FS FF-S-325

2.5 Paint

A. Metal Primer Paint -- Primer paint selected must be compatible with the required finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Division 9 of these specifications. At locations in contact with process water, use only primer approved for potable water use.

B. Galvanizing Repair -- Comply with ASTM - A780, A1. Repair Using Zinc-Based Alloys (heat and stick method).

C. Protection of All Aluminum -- Aluminum materials in contact with concrete, other metals or other masonry materials shall have surfaces coated with one coat of Koppers 654 Epoxy Primer 1 to 2 mils dry film (D.F.), followed by 2 coats of Koppers Bitumastic No. 300-M 6 to 8 mils D.F., or one coat of Porters 7650 Epoxy Primer 1 to 2 mils D.F., followed by 2 coats of Porters Tarset C-200 6 to 8 mils D.F., or equal.

2.6 Fabrication, General

A. Workmanship -- Use materials of the size and thicknesses shown or if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use as approved by the ENGINEER. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of work.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

B. Weld corners and seams continuously and in accordance with the recommendations of AWS. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

C. Form exposed connections with hairline joints, which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown or, if not shown, use Phillips flathead (countersunk) screws or bolts.

1. Provide the anchorage of the type shown, coordinated with the supporting structure and the progress schedule. Fabricate and space anchoring devices to provide adequate support for the intended use of the work.

2. Cut, reinforce, drill and tap miscellaneous metal work indicated to receive finish hardware and similar items of work.

D. Galvanizing -- Provide a zinc coating for galvanizing for all steel using the hot-dip process after fabrication, unless otherwise specified.

ASTM A 153 for galvanizing of iron and steel hardware

ASTM A 123 for galvanizing of rolled, pressed and forged steel shapes, plates, bars and strip 1/8-inch thick and heavier

ASTM A 385 for providing high quality zinc coatings (Hotdip)

ASTM A 386 for galvanizing of assembled steel products

E. Shop Painting (when allowed)

1. Shop paint miscellaneous metal work in accordance with Section 09900 and these specifications, except those members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded and galvanized surfaces unless otherwise indicated.

2. Remove scale, rust and other deleterious materials before the shop coat of paint is applied. Clean off heavy rust and loose mill scale in accordance with SSPC SP-7 “Brush-off Blast Cleaning”. Remove oil, grease and similar contaminates in accordance with SSPC SP-1 “Solvent Cleaning”.

3. Apply one shop coat of metal primer paint to fabricated metal items, except apply two (2) coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

4. Immediately after surface preparation, brush or spray on metal primer paint, applied in accordance with the manufacturer’s instructions.

F. Loose Bearing and Leveling Plates -- Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

G. Miscellaneous Steel Trim -- Provide shapes and sizes for profiles shown. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings

and anchorages as required for coordination of assembly and installation with other work.

2.7 Gratings

A. General -- Use materials of the size and thickness shown or if not shown, of the size recommended by product manufacturer. Work to the dimension shown or accepted on final shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work.

B. Provide aluminum bar grating as shown on the drawings, complying with the NAAMM "Metal Bar Grating Manual", and as herein specified: IKG S194, "Galok" Aluminum Swaged Grating, or approved equal.

1. Bearing Bars -- Rectangular, place edgewise and joined by straight cross bars

a. Material: Aluminum Alloy 6063-T6
b. Dimensions: 2 inch x 3/16-inch

2. Cross Bars -- Perpendicular to bearing bars at 4-inch centers, secured to bearing bars by swaging.

Material -- Aluminum Alloy 6063-T6

3. Aluminum bar gratings shall be furnished with manufacturers standard mill finish.

C. Grating Installation

1. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack.

2. Provide removable grating sections with end-banding bars for each panel. Notch gratings and provide banding for penetrations as indicated. Layout units to allow grating removal without disturbing items penetrating grating.

a. Provide banding for openings in grating of same material and size as bearing bars unless otherwise indicated.

b. Fit exposed connections accurately together to form tight hairline joints.

c. Wherever bar gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar of same material and size as bearing bars to the cut ends of the bars.

d. Divide the panels into sections only to the extent required for installation wherever bar grating platforms, runways, etc., are to be placed around previously installed pipe, ducts, and structural members.

e. Install all gratings with bearing bars spanning the shortest dimension unless shown otherwise on the plans.

3. Provide welded positioning tabs in support angles at each grating section to prevent lateral movement of grating sections.

4. Notching of bearing bars at supports to maintain elevations will not be permitted.

2.8 Handrails and Railings

A. General -- Maximum spacing between members shall be as directed by local code and OSHA requirements unless otherwise noted on plans.

B. Provide 3 foot 6-inch high steel handrail, 2 inches outside diameter for top and vertical segments, 1-1/2 inches all others.

1. Top corners of handrail are to be bent to the smallest radius possible without causing grain separation or otherwise impairing the work.

2. Radius Sections -- Roll to radii shown on plans

3. Vertical segments of handrail are to be set plumb and mount as shown on plans or as otherwise specified.

4. Spacing between vertical segments will be according to drawings.

C. Welded Connections

1. Cope intersections of rails and posts, weld joints of tailings or use welding connectors, at fabricator’s option. Other methods of welding may be used when acceptable to the ENGINEER.

2. Weld corners and seams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush, to

match and blend with adjoining surfaces. Discoloration of finished surfaces and sharp edges will not be acceptable.

D. Primer coat and finishes shall be in accordance with Division 9, Finishes.

2.9 Miscellaneous Framing and Supports

A. Provide miscellaneous steel framing and supports required to complete the work.

B. Fabricate miscellaneous units to the sizes, shapes and profiles shown or, if not shown, of the required dimensions to receive adjacent grating, plates doors, or other work to be retained by the framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection. Cut, drill and tap units to receive hardware and similar items to be anchored to the work.

C. Equip units with integrally welded anchors for casting into concrete, bolting to structural steel or building into masonry. Furnish inserts if units must be installed after concrete is placed.

2.10 Rough Hardware

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting systems. Acceptable manufacturers are Simpson, or approved equal.

B. Manufacture or fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere furnish galvanized steel washers.

2.11 Miscellaneous Fabrications

A. Prepare miscellaneous fabrications of the sizes, shapes and profiles shown. Except as otherwise shown, fabricate from structural steel shapes, bars and plates of all welded construction using metered corners, welded brackets and splice plates and a minimum of joints for field connection.

B. Galvanize all miscellaneous fabrications unless otherwise noted.

2.12 Non-Shrink Grout

Where required for anchoring, patching, or sealing, grouting and sealing compounds shall conform to the requirements of Section 04100.

PART 3 EXECUTION

3.1 Preparation

Furnish setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the project site.

3.2 Installation

A. Fastening to In-Place Construction -- Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

B. Cutting, Fitting and Placement

1. Perform cutting, drilling and fitting required for the installation of the miscellaneous metal items. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in form work for items which are to be built into concrete, masonry of similar construction.

2. Fit exposed connections accurately together to form tight hairline joints. Weld connections, which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

C. Field Welding -- Comply with AWS Code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made and the methods used in correcting welding work.

D. Touch-up Painting, Prepainted Items -- Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of the original coating thickness.

E. Galvanizing Repair -- Repair any damaged areas by heat and stick method as may be required.

END OF SECTION

SECTION 06050

FASTENERS AND ADHESIVES

PART 1 GENERAL

1.1 Description

This Section specifies the requirements for fasteners and adhesives used in the construction of the raw water pump station extension.

PART 2 PRODUCTS

2.1 Rough Carpentry Hardware

Rough carpentry hardware used in building construction shall conform to the latest provisions of the Oregon Structural Specialty Code and to any local codes and ordinances.

2.2 Nails

Steel common nails for framing, appropriately sized for the materials being joined. Use hot dipped galvanized nails wherever exposed.

2.3 Bolts and Screws

Conforming to ASTM A307, appropriately sized for the materials being joined. Use galvanized bolts and screws where exposed.

2.4 Framing Anchors, Joist, Rafter and Beam Hangers

Use galvanized minimum 18-gauge steel of the size and type required for the materials connected. Simpson “Strong-Tie,” Teco “Lumber Lok,” Silver Metal Products, or approved equal.

2.5 Adhesives

Use gun grade adhesive suitable for bonding various metals and non-metallic materials such as wood, plastic and glass without primer. Submit manufacturer’s data for approval by ENGINEER.

PART 3 EXECUTION

3.1 General

Use only skilled workers and the highest standards of the craft. Lay out, cut, fit, and install all rough carpentry items. Anchor sufficiently to ensure rigidity and permanence as noted on the plans.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 Scope

This Section covers the work necessary to furnish materials, labor, equipment and services necessary to provide rough framing as shown on the Drawings and as specified herein.

1.2 Submittals

The CONTRACTOR shall submit a complete list of products, product information, type and grade for ENGINEER approval prior to beginning building construction.

1.3 Quality Assurance

All work specified herein shall conform to the latest provisions of the Uniform Building Code (UBC), the Plastic Lumber National Evaluation Service, NER-508, and the local Codes and Ordinances of the City of Oregon City, Clackamas County, and the State of Oregon.

1.4 Delivery, Handling and Storage

Immediately upon delivery to job site, place materials in an area protected from weather. Store materials a minimum of 6 inches (150 mm) above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation. Do not store seasoned materials in wet or damp portions of building. Protect sheet materials from breaking corners and damaging surfaces while unloading.

PART 2 PRODUCTS

2.1 Materials

A. Lumber grading rules and wood species shall be in conformance with U.S. Product Standard PS 20-70 and the National Forest Products Association. The wood members shall conform to the requirements above and provide design values equal to those published in the “Design Values for Wood Construction,” a supplement to the 1991 edition of the National Design Specification for Wood Construction, published by the National Forests Products Association.

B. Plywood grading rules shall be in conformance with latest edition of U.S. Product Standard PS 1, and the APA.

2.2 Grade Marks

Each piece of lumber shall be stamped or branded with the grade as determined by an approved grading association indicating conformance with U.S. Product Standard PS 20-70.

Each panel of plywood shall be identified with the appropriate grade trademark of the American Plywood Association.

Moisture content shall not exceed 19 percent, unless otherwise specified.

2.3 Lumber

Dimensions given are nominal. Surface four sides (S4S), unless specified otherwise.

Unless otherwise noted, lumber shall be as follows:

Use	Minimum Grade
General framing, studs, plates, blocking, furring, braces and nailers	Standard & Better or Stud Grade Douglas Fir, Hemlock, or Larch
Structural light framing, 2 inches to 4 inches thick, 2 inches to 6 inches wide	Douglas Fir Larch No. 2
Structural joists, rafters and planks, 2 inches to 4 inches thick, 5 inches and wider and headers	Douglas Fir Larch No. 2
Beams, stringers, posts, timber	Douglas Fir Larch No. 1
Sills and Plates	Standard Grade, Treated in accordance with UBC Standard 25-12

2.4 Building Paper

Asphalt-saturated felt conforming to ASTM D 226 or D 250, Type I, plain non-perforated.

2.5 Plastic Lumber

"TREX" wood polymer lumber as manufactured by TREX LLC. Plastic lumber shall conform with ASTM E84 (Flame Spread) and ASTM D1413 (Fungus Resistance).

PART 3 EXECUTION

3.1 General

Use only skilled workers and the highest standards of the craft. Plan work in advance and perform in proper sequence to facilitate prompt and continuous progress of the work.

Lay out, cut, fit, and install all rough carpentry items. Anchor sufficiently to ensure rigidity and permanence and as noted on Drawings. Provide for installation and support of other work.

3.2 Conditions of Surfaces

Verify that surfaces to receive rough carpentry materials are prepared to exact grades and dimensions.

3.3 Installation

A. Plates

Set level and flush with outside face of concrete or masonry unit walls or as shown on the Drawings. Anchor into concrete or masonry unit walls with specified anchors. Location and spacing of plate anchorages shall be as shown or if not shown in conformance with current local building codes.

END OF SECTION

SECTION 07200

THERMAL INSULATION

PART 1 GENERAL

1.1 Description

A. The extent of insulation work is shown on drawings and as specified by this Section.

B. Applications of insulation specified in this section include:

1. Foam-plastic board (Rigid) insulation.
2. Glass-fiber blanket (Batt) insulation.
3. Loose-fill insulation.

1.2 Submittals

The CONTRACTOR shall submit a complete list of products, product information, types and grades for approval by the OWNER prior to beginning building construction.

1.3 Product Handling

General Protection -- Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 PRODUCTS

2.1 Materials

A. Masonry Pourable Insulation: Pourable insulation shall be Perlite loose-fill masonry insulation per ASTM C549. Insulation shall be poured into the cavities of all concrete masonry blocks on all exterior walls, except those cavities that that are filled with grout for structural purposes. Insulation shall completely fill all cores, crevices, mortar areas and ear holes.

B. Insulation for steel face factory insulated roof panels – See section 07410.

PART 3 EXECUTION

3.1 Installation

A. Installer must examine substrates and conditions under which insulation work is to be performed, and must notify CONTRACTOR in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Set vapor barrier faced units with vapor barrier to warm side (during winter) of construction. Do not obstruct ventilation spaces, except for firestopping.

C. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation.

D. Masonry Pourable Insulation: Pour from bag into unfilled cells of masonry units. Height of pours shall not exceed 20 feet. Do not rod or tamp insulation.

E. Any pourable masonry insulation that drains from existing masonry units during demolition work shall be replaced prior to sealing the cut face of all existing masonry that is cut.

END OF SECTION

SECTION 07410

STEEL FACE FACTORY INSULATED ROOF PANELS

PART 1 - GENERAL

1.1 Section Includes

Steel faced factory insulated roof panels and accessories including fasteners, perimeter trim and penetration treatments

1.2 References

A. ASTM International

1. ASTM A792; Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

2. STM B117; Standard Practice for Operating Salt Spray (Fog) Apparatus

3. ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

4. ASTM D523; Standard Test Method for Specular Gloss

5. ASTM D522; Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings

6. ASTM D714; Standard Test Method for Evaluating Degree of Blistering of Paints

7. ASTM D968; Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

8. ASTM D1308; Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

9. ASTM D2244; Standard practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

10. ASTM D2247; Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity

11. ASTM D2794; Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

12. ASTM D3359; Standard Test Methods for Measuring Adhesion by Tape Test

13. ASTM D3363; Standard Test Method for Film Hardness by Pencil Test

14. ASTM D4145; Standard Test Method for Coating Flexibility of Prepainted Sheet

15. ASTM D4214; Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

16. ASTM E72; Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

17. ASTM E84; Standard Test Method for Surface Burning Characteristics of Building Materials

18. ASTM E283; Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

19. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

20. ASTM E1646; Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference

21. ASTM E1680; Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

22. ASTM G153; Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

23. ASTM G154; Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

B. Underwriters Laboratories

1. UL 580; Tests for Uplift Resistance of Roof Assemblies

C. Factory Mutual: FM 4471; Approval Standard for Class 1 Panel Roofs

1.3 Submittals

A. Refer to Section 01300 Submittal Procedures

B. Product Data: Submit manufacturer's current technical literature for each type of product.

C. Shop Drawings: Submit detailed drawings showing:

1. Profile
2. Gauge of both exterior and interior sheet
3. Location, layout and dimensions of panels on roof structure
4. Location and type of fasteners
5. Shape and method of attachment of all trim
6. Locations and type of sealants
7. Other details as required for a weathertight installation

D. Panel Analysis: Provide panel calculations to indicate compliance with max deflection of L/240 for the design loads. Include effects of thermal differential between the exterior and interior panel facings.

E. Samples: For each color indicated, provide 6-inch by 6-inch minimum sample size for OWNER approval.

F. Submit documentation that products have been certified in accordance with ISO 14025.

G. Quality Assurance Submittals

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.

2. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s), and attachment methods, details and required trim and accessories.

1.4 Quality Assurance

A. Manufacturer Qualifications:

1. Manufacturer shall have a minimum of five (5) years experience in the production of insulated metal standing seam roof panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.

2. Manufacturer to be registered with a Program Operator with a Certified, Environmental Product Declaration, in conformance with ISO 14025, for Insulated Metal Panels.

B. Installer Qualifications:

1. Installer shall be authorized by the panel manufacturer and the work shall be supervised by a person having a minimum of five (5) years experience installing insulated metal standing seam roof panels on similar type and size projects.

2. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

C. Wind and Uplift Rating

1. Design Uplift Load: [Insert load] psf

2. Units shall be rated and carry the following listings:

a. Factory Mutual 1-105 uplift rating for 5 foot spans with minimum 14 gauge purlins

b. Factory Mutual 4771 – Class 1 Approval

c. UL 580, Class 90 uplift ratings for 5 foot spans with a minimum 14 gauge purlins

d. UL 580, Class 90 uplift rating for panels attached to 20 gauge decking with fastening, 3 foot on center.

D. Fire Classifications: Factory Mutual Class 1A Approval when installed at a maximum roof slope of 5:12.

1.5 Delivery, Storage And Handling

A. Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

B. Store roofing panel materials on dry, level, firm, and clean surface using the three inch factory provide foam supports under the panels. Use of wood substitute is not acceptable. Stack no more than two bundles high. Elevate and ventilate to allow air to circulate and moisture to escape.

1.6 Warranties

A. Warranty: Manufacturer's standard warranty to repair or replace items that fail in materials or workmanship within two (2) years from date of Substantial Completion. Items covered by the warranty shall include structural performance.

B. Finish Warranty: Manufacturer's standard warranty to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess, and /or color fading. Warranty Period to be twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Manufacturer

A. Kingspan Insulated Panels; 726 Summerhill Drive, Deland, FL 32724; 386-626-6789; or 2000 Morgan Road, Modesto, CA 95358; 209-531-9091; or approved equal

B. Basis of Design: KingZip

2.2 Standing Seam Roof Panels

A. Panel Description:

1. Panel thickness: As required to meet the minimum R-Value specified on Drawing A-1.

2. Panel width: 42 inch wide

3. Panel length: As indicated on drawings

4. The side joint shall consist of a 2 inch vertical sidelap, mechanically seamed, with fasteners and thermally broken attachment clip completely concealed within the side joint.

5. Exterior Face of Panel:

a. Material: AZ50/Galvalume/Zincalume per ASTM A 792
b. Profile: Shallow "minor rib"
c. Texture: Stucco embossed
d. Gauge: 22 gauge
e. Yield: 33 ksi minimum
f. Exterior Finish: Valspar Fluropon "high build" paint finish up to 2.4mil. Submit color sample for color indicated on Drawings.

6. Interior Face of Panel:

a. Material: AZ50/Galvalume/Zincalume per ASTM A792
b. Profile: Shallow "minor rib"
c. Texture: Stucco embossed

d. Gauge: 22 gauge
e. Yield: 33 ksi minimum
f. Interior Finish: Valspar Dynapon modified polyester finish with a total minimum dry film thickness of 1.0 mil including primer. Submit color sample for color indicated on Drawings.

7. Insulating Core: Minimum 88 percent closed cell structure urethane modified isocyanurate core with the following minimum physical properties:

a. Density Nominal: 2.4 pcf
b. Shear Strength: 15 psi (to rise)
c. Tensile Strength: 29 psi
d. Compressive Strength: 14-22 psi
e. Surface burning characteristics when tested in accordance with ASTM E84: Flame Spread: less than 25; Smoke Developed: less than 450

B. Physical Characteristics:

1. Structural Test: Design shall be verified by representative structural test for wind loads in accordance with ASTM E72. The deflection criteria shall be L/240.

2. Thermal Properties: The roof panel insulation shall provide a minimum nominal R-value of 5.0 per inch thickness when tested in accordance with ASTM C518 at a mean temperature of 75 deg. F. Insulation thickness shall be sufficient to meet or exceed the requirements specified on Drawing A-1.

3. Fatigue Test: There shall be no evidence of metal/insulation interface delamination when the panel is tested by simulated wind loads of 20 psf (positive and negative loads), when applied for two million alternate cycles.

4. Bond Strength: No metal primer interface corrosion and/or delamination shall occur after 1000 hours at 140 deg. F and 100 percent relative humidity. No delamination shall occur after 2-1/2 hours in a 2 psi 212 deg. F autoclave.

5. Water Penetration: There shall be no uncontrolled water leakage at pressures of up to 20 psf when tested in accordance with ASTM E331 and ASTM E1646. Tested assembly must include endlap and sidelap conditions.

6. Air Infiltration: Air infiltration through the roof shall not exceed 0.003 cfm/sf at 6.24 psf air pressure differential when tested in accordance with ASTM E283 and ASTM E1680. Tested assembly must include endlap and sidelap conditions.

7. Hailstorm Rating: Factory Mutual 1 SH hailstorm rating.

C. Finish Characteristics:

1. Gloss: 15 ± 5 tested in accordance with ASTM D523

2. Pencil Hardness: HB – H tested in accordance with ASTM D3363

3. Flexibility, T-Bend: 1-2T bend tested in accordance with ASTM D4145

4. Flexibility, Mandrel: No cracking tested in accordance with ASTM D522

5. Adhesion: No adhesion loss tested in accordance with ASTM D3359

6. Reverse Impact: No cracking or adhesion loss tested in accordance with ASTM D2794

7. Abrasion Resistance: 65 ± 10 liters tested in accordance with ASTM D968

8. Graffiti Resistance: Minimal effect

9. Acid Pollutant Resistance: No effect tested in accordance with ASTM D1308

10. Salt Fog Resistance: Passes 1000 hours tested in accordance with ASTM B117

11. Cyclic Salt Fog and UV Exposure: Passes 2016 hours tested in accordance with ASTM B5894

12. Humidity Resistance: Passes 1500 hours when tested in accordance with ASTM D2247 and D714

13. Color Retention: Passes 5000 hours when tested in accordance with ASTM G153 and G154

14. Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A

15. Color Tolerances: Greater than 5ΔE units on panels when tested in accordance with ASTM D224.

2.3 Accessories

A. Fasteners:

1. Self drilling fasteners shall be cadmium plated steel, designed to resist maximum negative pullout loads and hold the face sheet mechanically to the structural support.

2. Panel attachment clip shall be two pieces and fully concealed within the panel side joint. Base clip shall be a minimum 14 gauge galvanized, and top clip shall be a minimum 20 gauge stainless steel with an integral thermal break.

3. Vibration resistant type fasteners with anti-backout threads. Self-drilling flathead screws with sealing washers and square drives, designed to resist back out by increasing thread friction as screw loosens.

B. Perimeter Trim and Penetration Treatments: All required trim and metal flashing shall have the same coating, color, and gauge as the exterior face of the insulated metal roof panel.

C. Butyl Tape: Per panel manufacturer's recommendations for panel to panel and panel to trim seal.

D. Butyl Sealants: Non-skinning type per panels manufacturer's recommendations.

PART 3 - EXECUTION

3.1 Examination

A. Examine alignment of the structure and supports prior to installing the insulated metal roof panels.

1. Structure Tolerance: In the plane of the roof 0 inches inward, plus 1/2 inch outward.

2. All deviations from structural tolerances shall be corrected by the responsible party prior to installation of the panels.

B. Examine individual panels upon removing from the bundle; both edges should be visually examined and any slight overfill of insulation should be carefully removed.

3.2 Panel Installation

A. Remove protective film before installation, or immediately thereafter to prevent sunlight damage.

B. Cut panels, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blades or a band saw prior to installation. Ventilate area where polyurethane dust is generated. Personnel should wear respiratory and eye protection devices.

C. Apply butyl sealant vapor seal around interior perimeter of roof assembly per panel manufacturer's instructions.

D. Apply butyl tape on panel sidelaps and clip assemblies per panel manufacturer's instructions.

E. Secure units to the roof sheathing with manufacturer's recommended fastener.

F. Place panel fasteners through predrilled top clip and base clip, concealed within the side joint of the panel.

1. Heads of concealed fasteners shall be insulated from the exterior environment to prevent condensation and "ice balling" from occurring on the fastener shaft.

G. Apply endlap sealing tape and butyl to panel surface to be lapped per manufacturer's instructions.

H. Endlap panel stitch fasteners to be vibration resistant type.

I. As each panel is installed, crimp hidden clip assembly prior to placement of next panel.

J. Repair or replace metal panels and trim that have been damaged.

3.3 Trim Installation

A. Place trim to determine the location of the closure strips, sealant and ridge closure trims.

B. Apply butyl tape above and below the foam closure strip and seat the closure strip firmly in the tape to ensure a continuous seal. If any voids exist add butyl caulking and reseat the closure.

C. Place a continuous layer of butyl tape on top of the metal ridge closure trims for the length of the building.

D. Fasten the exterior ridge trim to the metal ridge closure trims, per manufacturer's recommendations, on center with 1/4 inch by 7/8 inch low profile vibration resistant stitch fasteners.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 Summary

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed steep-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.

1.2 Action Submittals

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

1.3 Informational Submittals

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.4 Closeout Submittals

A. Maintenance data.

1.5 Quality Assurance

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.6 Warranty

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 Performance Requirements

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 Sheet Metals

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240, Type 304, dead soft, fully annealed; 2B (bright, cold rolled) finish.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; pre-painted by coil-coating process to comply with ASTM A 755.

1. Exposed Coil-Coated Finish:

a. Three-Coat Fluoropolymer: AAMA 2605 Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in

both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.

2.3 Miscellaneous Materials

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide, or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.4 Fabrication, General

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.

2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

2. Use lapped expansion joints only where indicated on Drawings.

C. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.5 Roof-Drainage Sheet Metal Fabrications

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

1. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen; Wire-ball downspout strainer.

a. Leaf screen shall be E-Z-Micro Mesh by E-Z Gutter or approved equal.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Hanger Style: Fig 1-35Baccording to SMACNA's "Architectural Sheet Metal Manual.".

2. Fabricate from the following materials:

a. Pre-finished Sheet Metal Steel: 20 gauge.

2.6 Steep-Slope Roof Sheet Metal Fabrications

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

B. Drip Edges: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

C. Eave, Rake,and Ridge Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

2.7 Wall Sheet Metal Fabrications

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

PART 3 EXECUTION

3.1 Installation, General

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.

5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel sheet.

2. Do not use torches for soldering.

3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.2 Roof-Drainage System Installation

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope gutters to downspouts.

1. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.

3.3 Roof Flashing Installation

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and

cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.4 Wall Flashing Installation

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.5 Cleaning And Protection

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions.

END OF SECTION

SECTION 07920

JOINT SEALANTS

PART 1 GENERAL

1.1 Summary

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Butyl-rubber based mastic.

1.2 Action Submittals

A. Product Data: For each joint-sealant product.

B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 Informational Submittals

A. Product test reports.
B. Preconstruction laboratory test reports.
C. Preconstruction field-adhesion-test reports.
D. Sample warranties.

1.4 Quality Assurance

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 Preconstruction Testing

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.

1.6 Warranty

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 Joint Sealants, General

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 Silicone Joint Sealants

A. Silicone, S, NS, 50, NT: Single-component, non-sag, plus 50 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.3 Urethane Joint Sealants

A. Urethane, S, NS, 25, NT: Single-component, non-sag, non-traffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Corporation-Construction Systems.

b. Bostik, Inc.
c. Pecora Corporation.
d. Sika Corporation.
e. Tremco Incorporated.

2.4 Joint-Sealant Backing

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bi-cellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Corporation-Construction Systems.
b. Construction Foam Products; a division of Nomaco, Inc.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.5 Miscellaneous Materials

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 Preparation

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove laitance and form-release agents from concrete.

2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 Installation of Joint Sealants

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.3 Joint-Sealant Schedule

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal non-traffic surfaces JS-1.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.

2. Joint Sealant: Silicone, non-staining, S, NS, 50, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces JS-2.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.

b. Vertical joints on exposed surfaces of unit masonry, .

2. Joint Sealant: Urethane, S, NS, 25, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces not subject to significant movement JS-3.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.

b. Perimeter joints between interior wall surfaces and frames of interior doors and louvers.

c. Other joints as indicated on Drawings.

2. Joint Sealant: Insert joint sealant.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Concealed mastics JS-4.

1. Joint Locations:

a. Louver sills.

2. Joint Sealant: Butyl-rubber based.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 08100

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 Description

Work includes providing metal doors and door frames of the described size, type and thickness specified herein and shown on plans.

1.2 Submittals

A. Shop drawings in accordance with Section 01300.

B Product Data: Provide general construction, component connections and details, electrical equipment.

Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

C Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.3 Quality Assurance

A. Materials: All material shall be free from defects impairing strength, durability, and appearance.

B. Doors and frames to be from a single manufacturer.

PART 2 PRODUCTS

2.1 Materials

A. Door opening shall be as shown on the plans.

B. Door shall be an insulated, weather-stripped service door provided with interlocking roll-formed slats.

C. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

D. Front slats shall be fabricated of 18 gauge galvanized steel. Back slats shall be fabricated of 24 gauge galvanized steel. Curtain bottom to be reinforced and windload protection provided. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation for an R Value of 7.7 and an STC rating of 21.

E. Finish: Slats and hood shall be galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint and PowderGuard Weathered Finish topcoat for a scratch resistant finish. Apply to entire door system including slats, guides, bottom bar and head plate. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.

F. Mounting of door shall be by face of wall mounting bracket with a continuous channel guide. The door hood shall be galvanized steel, 24 gage minimum.

G. Manual chain hoist, chain keeper lock and all other hardware and accessories per manufacturer standard design. Locate chain as shown on the plans.

H. Door shall include features that reduce air infiltration to comply with the 2012 IECC code requirement of less than 1 cfm/ft^2 of door area. The air infiltration reduction package shall be third-party tested and ICC-ES listed. A guide cover and cap shall block air transfer along the length and top of the guide. A lentil seal shall reduce air transference across the top of the door. A dual brush guide shall reduce air transference between slats at the guide. A bottom astragal shall reduce air transference across the base of the door.

I. Accepted Manufacturers and models – Overhead Door Company Stormtite™ Model 625 with air infiltration package, or approved equal.

PART 3 EXECUTION

3.1 Product Handling

A. Delivery and Storage -- Deliver and store doors and frames at the job site in dry area. Provide protection to insure against surface damage. Take special care at all times to prevent staining of door surface. Carry doors and frames when moving them; do not drag; do not slide one door or door component across another.

B. Replacements -- In the event of damage, immediately make all repairs and replacements necessary to the approval of the OWNER and at no additional cost to OWNER.

3.2 Installation

A. Install plumb, straight, true, rigidly secured in place and properly braced all in accordance with manufacturer's recommendations.

B. Solid grout frames at all exterior doors.

C. Fit and install specified hardware to operate freely and adjust doors before final acceptance.

3.3 Corrections and Cleanup

A. Immediately after erection, sand smooth all rusted, or damaged areas of prime coat and apply touch up compatible primer.

B. Finish Coatings - Provide finish coatings per Division 9.

END OF SECTION

SECTION 09800

PROTECTIVE COATINGS

PART 1 GENERAL

1.1 General

A. Work under this Section shall include the protective coating of all specified surfaces including all surface preparation, pretreatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, all in accordance with the requirements of the Contract Documents.

B. The Coating System Schedules summarize the surfaces to be coated, the required surface preparation and the coating systems to be applied. Coating notes on the drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

C. Related Work Specified in Other Sections -- Shop coatings and/or factory finishes on fabricated or manufactured equipment may be specified in other divisions. Some items with factory finishes, or corrosion resistant finishes may be scheduled or directed to be painted by the ENGINEER to unify a wall finish or color scheme, at the ENGINEER's discretion.

D. Exclusions -- Do not coat the following surfaces unless specified or directed elsewhere: Stainless steel, aluminum, copper, brass, bronze and other corrosion-resistant material (except for valve bodies and piping); Electrical switch-gear and motor control centers having factory finish; Fencing; Multiple coated factory finished baked enamel or porcelain products; Concealed areas such as ducts, piping, conduits and items specified elsewhere for special linings and coatings.

E. Damaged Factory Finish -- If directed by the ENGINEER, refinish the entire exposed surfaces of equipment chipped, scratched or otherwise damaged in shipment or installation.

F. All coating coming in contact with potable water shall be NSF approved.

1.2 Reference Specifications, Codes and Standards

A. Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. "Architectural Specification Manual" by the Painting and Decorating Contractors of America (PDCA), 333 Taylor Avenue North, Seattle, Washington 98109.

2. "Systems and Specifications" - Volume 2 of Steel Structures Painting Council (SSPC).

3. National Sanitation Foundation (NSF) Standard No. 61.

B. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 986, Katy, TX 77450.

C. Pipe Coating Commercial Standards

ANSI/AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
ANSI/AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4-inch and Larger - Shop Applied
ANSI/AWWA C209	Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Pipelines.
ANSI/AWWA C210	Liquid Epoxy Coating for Exterior and Interior of Steel Pipe.
ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
ANSI/AWWA C214	Tape Coating systems for the Exterior of Steel Water Pipelines.

D. Federal Specifications

DOD-P-23236A(SH)	Military Specification, Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast.

1.3 Contractor Submittals

A. Coating Materials List -- The CONTRACTOR shall provide a coating materials list which indicates the manufacturer and the coating number, keyed to the coating systems herein. The amount of copies to submit shall be as specified within Section 01100, Special Provisions.

B. Coating Manufacturer's and Applicator Information -- For each coating system to be used the CONTRACTOR shall submit, the following listed data.

1. Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

2. Manufacturer's instructions and recommendations on surface preparation and application.

3. Colors available for each product and each coat.

4. Compatibility of shop and field applied coatings (where applicable).

5. Material safety data sheet (MSDS) for each product used.

6. The manufacturer’s recommended products and procedures for field coating repairs and field preparation of field cut pipe ends.

7. The name of the proposed coating applicator shop along with certification that the applicator shop is qualified and equipped to apply the coatings systems as specified.

8. Certificate -- Submit manufacturer's certificate of compliance with the specifications and standards signed by a representative in the manufacturer's employ.

9. Samples -- Provide painted surface areas at the job for approval of main color selections, or submit sample on 12-inch sample of substrate using required finish system at ENGINEER’s discretion.

1.4 Quality Assurance

A. The CONTRACTOR shall give the ENGINEER a minimum of three (3) days advance notice of the start of any field surface preparation work of coating application work, and a minimum of seven (7) days advance notice of the start of any shop surface preparation work.

B. All such work shall be performed only in the presence of the ENGINEER, unless the ENGINEER has granted prior approval to perform such work in its absence.

C. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve the CONTRACTOR of its responsibility to perform the work in accordance with these Specifications.

D. Surface Preparation -- Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70.

E. Scaffolding shall be erected and moved to locations where requested by the ENGINEER to facilitate inspection. Additional illumination shall be provided by the CONTRACTOR to cover all areas to be inspected.

F. Paint Products -- No request for substitution shall be approved which decreases the film thickness designated or the number of coats to be applied, or which offers a change from the generic type of coating specified. Painting shall be done at such times as the CONTRACTOR and ENGINEER may agree upon in order that dust-free and neat work be obtained. All painting shall be in strict accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the ENGINEER.

G. Manufacturer's Representative -- Require coating manufacturer's representative to be at job site when the first day's coating application is in progress and periodically during progress of the work.

H. Labels -- Deliver to the job site in the original sealed containers with manufacturer's name, product name, type of product, manufacturer's specification or catalog number or federal specification number, and instructions for reducing where applicable.

I. Colors -- Colors will be selected from manufacturer's standard colors as reviewed by ENGINEER and approved by the OWNER. Colors for special coatings that are limited in their availability and color selection will be chosen on the basis of manufacturer's standard colors, provided that the manufacturer's product line represents a color range comparable to similar products of other manufacturers.

J. Flame Spread -- Provide paint materials which will result in a Class II finish for all coated surfaces in exit corridors, and a Class III finish for all other interior rooms or areas.

K. Film Thickness Testing -- On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gage such as Mikrotest model FM, Elcometer model 111/1EZ, or approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least eight (8) hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using wet film gage readings and destructive film thickness tests.

1.5 Delivery, Handling and Storage

A. Deliver in labeled containers as specified above and store in a locked room accessible for inspection. Comply with fire and health regulations.

B. Provide adequate heat and forced mechanical ventilation for health, safety and drying requirements. Use explosion proof equipment. Provide face masks.

C. Protect adjacent surfaces with suitable masking and drop cloths as required. Remove cloths or waste from the project daily.

D. Apply to surfaces under recommended environmental conditions and within the limitations established by the material manufacturer. Do not apply coating in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. Coating application may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

1.6 Protection

A. Follow all safety recommendations of manufacturer regarding ventilation and danger from explosion or breathing paint fumes or skin exposure, and all applicable O.S.H.A. and other regulations.

B. Protect surface adjacent to work being coated from overspray, drips or other damage.

PART 2 PRODUCTS

2.1 General

A. Definitions -- The terms "paint," "coatings" or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, tape and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. General -- Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

C. The CONTRACTOR shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.

D. Compatibility -- In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the ENGINEER, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

E. Colors -- All colors and shades of colors of all coatings shall be as selected or specified by the ENGINEER. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the ENGINEER. Color pigments shall be lead free.

F. Protective Coating Materials -- Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the CONTRACTOR shall provide the ENGINEER with the names of not less than 10 successful applications of the proposed manufacturer's products demonstrating compliance with this specification requirement.

G. Substitute or "Or-Equal" Submittals -- Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or equal" material that said material meets the specified requirements and is equivalent or better than the listed materials.

H. The cost of all testing and analyzing of the proposed substitute materials that may be required by the ENGINEER shall be paid by the CONTRACTOR. If the proposed substitution requires changes in the contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution.

2.2 Industrial Coating Systems

A. General

Provide and apply the industrial coatings systems which follow as listed in the coating schedule, as required by these specifications and as directed by the ENGINEER. Coat all existing and new exposed interior or exterior surfaces and submerged and intermittently submerged surfaces as indicated, except as specifically excluded in Part 1 of this section or on the drawings or finish schedules. Coating System Numbers listed below shall be used as the Coating System code letter, and shall be used on any coating submittals or correspondence.

B. Industrial coating systems shall be as follows

1. Coating System 100

   a. Location -- Exposed, unprimed, non-galvanized, nonsubmerged metal surfaces, both interior and exterior including piping and structural steel.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply prime coat and topcoat, 4.0-6.0 mils each coat of Tnemec Series 66-2 Hi-Build Epoxoline, or approved equal. Color as selected by OWNER.

2. Coating System 101

   a. Location -- Exposed metal surfaces, shop primed, both interior and exterior including piping, railings, ladders, steel doors, and any other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply shop prime coat 3.0 mils DFT Tnemec Series 90-97 Tnemec-Zinc, one coat 4.0 - 6.0 mils DFT Tnemec Series 66 Hi-Build Epoxoline, and 3.0 - 4.0 mils DFT of Tnemec Series 175 Endura Shield, or approved equal. Color as selected by OWNER.

3. Coating System 102

   a. Location -- Unprimed or non-galvanized, continuously or intermittently submerged metal items, both interior and exterior including piping, structural steel and all other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prime, intermediate and topcoat, 4.0-6.0 mils each coat of Tnemec Series 20 Pota-Pox, or approved equal. Color as selected by OWNER.

4. Coating System 103

   a. Location -- Vertical concrete walls, exterior, below finish grade, not exposed to view.

   b. Surface Preparation -- As specified herein.

c. Paint System -- Apply two coats 2.0-3.0 mils each, Kop-Coat Bitumastic Super Service Black, or approved equal.

5. Coating System 104

a. Location - Nonsubmerged, exposed to view, PVC piping.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply one coat, 4.0-6.0 mils Tnemec Series 66-2 Hi-Build Epoxoline, or approved equal. Color as selected by OWNER.

6. Coating System 105

a. Location – Nonsubmerged, exposed to view, HDPE and polyurethane coated surfaces.

b. Surface Preparation – As specified herein.

c. Coating System – Apply two coats, 3.0 - 4.0 mils DFT of Tnemec Series 175 Endura Shield, or approved equal. Color as selected by OWNER.

2.3 Special Pipe and Severe Service Coating Systems

A. General

The following coatings are for buried pipe and surfaces used in severe service conditions. The manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products will be considered as indicated within the paragraph entitled " ‘Or-Equal’ Clause” in Section 01100, Special Provisions.

B. Special pipe and severe service coating systems shall be as follows:

1. Coating System 200 -- Cement Mortar Coating

a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

b. Surface Preparation - As specified herein.

c. Coating System -- A 1-1/2-inch minimum thickness mortar coating reinforced with 3/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than one part Type V cement to three (3) parts sand. The cement

mortar shall be cured by a curing compound meeting the requirements of "Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C 309-81, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped by at least six (6) inches. At the ENGINEER's discretion, the hot applied coal tar epoxy coating may be used as the curing membrane for the mortar coating.

2. Coating System 201 -- Hot Applied Coal Tar Epoxy Coating

   a. Location -- Exterior surface of concrete pipe and cement-mortar coated pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- The hot applied coal tar epoxy shall be a solvent free 100 percent solids coal tar epoxy chemically compatible with hydrating cement and suitable for application on moist surfaces of freshly placed cement mortar or concrete and properly prepared cured surfaces. The coal tar epoxy coating material shall be Amercoat 1972B or approved equal. The finish coal tar epoxy coating shall have a minimum DFT of 26 mils.

3. Coating System 202 -- Coal-Tar Epoxy Coating System

   a. Location -- Exterior surface of buried steel pipe, fittings and other ferrous surfaces.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- High build, 2-component amine or polyamide cured coal-tar epoxy shall have a solids content of at least 68 percent by volume, suitable as a long term coating of buried surfaces, and conforming to AWWA C210. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both surface preparation and coating are to be performed in the field. The coal-tar epoxy coating system shall include:

      i. Prime coat (DFT = 1.5 mils), Amercoat 83HS, Tnemec P66, or equal.

      ii. Finish coats (2 or more, DFT = 18 mils), Amercoat 78 HB, Tnemec 46 H-413, or equal.

      iii. Total system DFT = 19.5 mils.

4. Coating System 203 -- Fusion Bonded Epoxy

   a. Location -- Ferrous surfaces of sleeve couplings, steel pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- The coating material shall be a 100 percent powder epoxy applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines". The coating shall be applied using the fluidized bed process.

      i. Liquid Epoxy -- For field repairs, the use of a liquid epoxy will be permitted, applied in not less than 3 coats to provide a DFT 16 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer.

      ii. Coating (DFT = 16 mils), Scotchkote 203, or equal.

      iii. Total system DFT = 16 mils.

5. Coating System 204 -- Hot, Coal-Tar Enamel

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation - As specified herein

   c. Coating System -- Coal-Tar Enamel materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a primer layer, coal-tar enamel layer, coal-tar saturated nonasbestos felt outerwrap and a finish coat. Total system DFT = 188 mils.

6. Coating System 205 -- Hot Applied Tape

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a cold-applied liquid primer and heated coal-tar base tape. Total system DFT = 50 mils.

7. Coating System 206 -- Cold Applied Tape

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. Prefabricated tape shall be Type II. The system shall consists of a primer layer, inner layer tape of 35 mils, and an outer layer tape of 35 mils. Total system DFT = 70 mils.

8. Coating System 207 -- PVC Tape

   a. Location -- Small galvanized steel pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prior to wrapping pipe with PVC tape, the pipe and fittings shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half lapped for a total thickness of 40 mils.

9. Coating System 208 -- Mastic

   a. Location -- Pipe and fitting joints, and general buried surface coating repair and touch up.

   b. Surface Preparation - As specified herein.

   c. Coating System -- Mastic shall be a one-part solvent drying heavy bodied thixotropic synthetic elastomeric coating with chemically inert resins and fillers and an average viscosity of 650,000 CPS at 77 degrees Fahrenheit, thereby requiring generous applications by hand or trowel. Total coat thickness shall be 30 mils, minimum. Mastic shall be Protecto Wrap 160 H or approved equal and be fully compatible with pipeline coating systems.

10. Coating System 209 -- Polyethylene Encasement

   a. Location -- Ductile iron, steel and concrete cylinder pipe and fittings.

   b. Surface Preparation -- None required.

c. Coating System -- Except as otherwise specified, application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

2.4 Architectural Coating Systems

A. General

"Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or topcoat.

Fungus Control: Submit evidence for all paints attesting the passing of Federal Test Method Standard No. 141, Method 6271.1 showing no fungus growth or other approved test results.

Apply to surfaces under recommended environmental conditions and within the limitations established by the material manufacturer. Acrylics require 60 degrees Fahrenheit (°F) and above temperature and below 50 percent relative humidity. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50°F and 90°F unless otherwise permitted by the paint manufacturer's printed instructions.

B. Architectural coating systems shall be as follows:

1. Coating System 300

a. Location -- Exterior above grade concrete, brick, block masonry and stucco surfaces not otherwise specified, exposed to view.

b. Surface Preparation -- Surfaces shall be cleaned with a manufacturers approved chemical cleaner and power washed. Surfaces shall be completely dry, free from efflorescence, oils, paint and other contaminants before the coating system is applied. Coating system shall be applied according to the manufacturers published recommendations. A manufacturer’s representative shall be present during application of the coating system, if required by the manufacturer’s warranty.

c. Coating System -- Apply two flood coats of an RTV silicone rubber water repellent and graffiti protectant, Chemprobe Series 626 Dur A Pell GS, or equal. All coatings to be clear. Apply per manufacturer’s instructions.

2. Coating System 301

   a. Location -- Vertical concrete exterior walls and flat concrete exterior roofs and slabs exposed to view.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply two coats 6.0-9.0 mils (100 ft^2/gal) each coat, Tnemec Series 156 Envirocrete, or approved equal. Color as selected by OWNER.

3. Coating System 302

   a. Location -- Interior concrete masonry unit walls and interior and exterior wood walls, ceilings and other wood surfaces not otherwise specified, exposed to view.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prime as specified by coating manufacturer. Apply two coats 6.0 - 9.0 mils (100 ft^2/gal) each coat, Tnemec Series 156 Envirocrete, or approved equal. Color as selected by OWNER.

4. Coating System 303

   a. Location -- Wood surfaces not otherwise specified, exposed to view.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply an alkyd primer as recommended by the manufacturer, two (2) mils. Apply finish coats (two (2) or more coats six (6) mils total) of single component, water based acrylic latex coating, Tnemec Series 6, Carboline Carbocrylic 3350 or equal. Total DFT = eight (8) mils. Color as selected by OWNER.

5. Coating System 304

   a. Location -- Interior drywall surfaces not otherwise specified, exposed to view.

   b. Surface Preparation - As specified herein.

   c. Coating System -- Apply two (2) coats 2.0 - 3.0 mils each coat of single component, water based acrylic latex coating, Tnemec Series 6, Carboline 3350 or equal. Color as selected by OWNER.

6. Coating System 305

   a. Location – Horizontal concrete surfaces, vertical exterior brick or masonry surfaces, exposed to view.

   b. Surface Preparation -- Surfaces shall be cleaned with a manufacturers approved chemical cleaner and power washed. Surfaces shall be completely dry, free from efflorescence, oils, paint and other contaminants before the coating system is applied. Coating system shall be applied according to the manufacturers published recommendations. A manufacturer's representative shall be present during application of the coating system, if required by the manufacturer's warranty.

   c. Coating System -- Apply two coats of masonry water retardant material. The system shall be clear, non-staining, silane-modified-siloxane, Chemprobe Dur A Pel 20, Tex-Cote Rainstopper 1500, or equal. The selected coating system shall provide a minimum of a 5-year manufacturer's warranty.

7. Coating System 306

   a. Location -- Vertical concrete walls, exterior, below finish grade, not exposed to view.

   b. Surface Preparation -- Per manufacturer's requirements, surface shall be clean and free of all oil, grease, dirt, laitance, and loose or foreign materials. Surface shall be dampened with water and kept damp until application of the coating.

   c. Paint System -- Apply two coats of BASF Hydrocide 700B, or approved equal, in accordance with manufacturer's recommendations. Allow first coat to dry tacky before applying second coat. Ensure a continuous, pinhole-free coating from the top and outside edge of the footing to the finished grade.

8. Coating System 307

   a. Location -- Exterior siding, trim and related products, all comprised of fiber cement material with a factory installed primer.

   b. Surface Preparation – If cleaning is required, surface shall be cleaned with a in a manner approved by both the coating system manufacturer and the siding manufacturer. Under no circumstances shall fiber cement siding products be cleaned with high pressure water blasting, sand blasting, or acid washing as these techniques may damage the surface of the fiber cement.

Low pressure water spray and a medium-stiff, nonmetallic bristle brush may be used for cleaning fiber cement products. Coating system shall be applied according to the coating system manufacturer's published recommendations. A manufacturer's representative shall be present during application of the coating system, if required by the manufacturer's warranty. Coating system must be applied within 180 days of installation of the factory primed siding products, or less if the siding product manufacturer's warranty requires painting in less than 180 days.

c. Coating System -- Apply primer coat of high performance acrylic primer/sealer specifically engineered for high-performance protection of exterior, above-grade, cementitous surfaces and fiber cement siding. Apply topcoat of 100% acrylic latex, cross-linked. The system shall Sherwin Williams Loxon Concrete & Masonry Primer/Sealer and Sherwin Williams Emerald Exterior Acrylic, or approved equal. The selected coating system shall provide a minimum of a five-year manufacturer's warranty.

PART 3 EXECUTION

3.1 Storage, Mixing and Thinning of Materials

A. Manufacturer's Recommendations -- Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage and Mixing -- Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.2 Surface Preparation Standards

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification.

1. Solvent Cleaning (SSPC-SP1) -- Removal of oil, grease, soil, salts and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion or steam.

2. Hand Tool Cleaning (SSPC-SP2) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing and grinding.

4. White Metal Blast Cleaning (SSPC-SP5) -- Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC-SP7) -- Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust and loose paint.

7. Near-White Blast Cleaning (SSPC-SP10) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

3.3 Corrections and Cleanup

At completion any damaged, de-laminated or defaced coated surfaces shall be touched up, restored and left in first class condition. Any coated or finished surfaces damaged in fitting or erection shall be restored. If necessary, an entire wall shall be refinished rather than spot finished. Upon completion and prior to final acceptance, all equipment and unused materials accumulated in the coating process shall be removed from the site and any spillage, spatter spots or other misplaced coating material shall be removed in a manner which will not damage surfaces. Perform required patching, repair and cleaning to the satisfaction of the ENGINEER. Cooperate and coordinate work with the work of other trades in the removal and replacement of hardware, fixtures, covers, switch plates, etc., as required for coating.

3.4 Surface Preparation

A. General

Prepare all surfaces scheduled to receive new coating systems, as required to provide for adequate bonding of the specified coating system to the substrate material. Request review of prepared surfaces by the ENGINEER prior to proceeding. For existing coated surfaces, hand wash with cleaner or product recommended by coating manufacturer to properly prepare existing surface and provide for bonding of coating specified to follow. Remove any loose,

peeling or flaking coating, or mildewed areas. Surface preparation minimums shall be as follows:

1. Exposed metal items, nonsubmerged, unprimed, non-galvanized both interior and exterior, including: piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP6, "Commercial Blast Cleaning".

2. Exposed metal items, shop primed, both interior and exterior including: piping, steel doors, steel ladders to be painted, and railings, and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning"; SSPC-SP2, "Hand Tool Cleaning"; and SSPC-SP3, "Power Tool Cleaning" as may be required to remove grease, loose or peeling or chipped paint.

3. Metal items, unprimed or non-galvanized, continuously or intermittently submerged, both interior and exterior including: piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in conformance with SSPC-SP10, "Near-White Blast Cleaning".

4. Stainless Steel - Nonsubmerged and submerged, exposed piping and fittings, both interior and exterior shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning".

5. Polyvinyl Chloride (PVC) - Nonsubmerged, both interior and exterior, process piping and plumbing, shall be lightly sanded prior to application of the specified coating system to follow.

6. Nonsubmerged Concrete - Clean all concrete surfaces of dust, form oil, curing compounds or other incompatible matter. Etch and prime if required by manufacturer for specified coating products to follow. Allow minimum 28-day cure of concrete prior to application of coating systems.

7. Concrete Masonry Units -- Repair all breaks, cracks and holes with concrete grout. The surface must be free of dirt, dust, loose sand and other foreign matter. Brush clean. Allow minimum 28-day cure of concrete joint mortar and repair grout prior to application of coatings system.

8. Wood -- Wood surfaces shall be thoroughly cleaned and free of all foreign matter with cracks, nail holes and other defects properly filled, smoothed and sandpapered to fine finish. Wipe clean of dust.

9. Preparation of All Existing Coated Surfaces -- Removed rough and defective coating film from material surfaces to be painted. Touch up

with approved primer. Clean all greasy or oily surfaces, to be painted, with benzine or mineral spirits or Rodda's Gresof before coating, or as recommended by manufacturer. For walls, patch existing nicks and gouges, sand to match wall finish.

3.5 Prime Coating

A. Exposed Steel -- Prime coat all exposed steel in accordance with SSPC PS 13.01 for epoxy-polyamide coating systems. Prime coats shall be applied following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above.

B. Galvanized Metal -- After surface preparation specified above, prime galvanized metal items receiving paints as specified with Tnemec Series 66 Hi-Build Epoxaline or equal, verifying with manufacturer before application the compatibility with coatings specified to follow.

C. Shop Primed Metal -- Where indicated on the plans or coating schedule and following the surface preparation procedures specified in paragraph 3.4.A.2 above, the CONTRACTOR shall apply intermediate and topcoats of the specified paint system to shop primed metal. The CONTRACTOR shall verify with the manufacturer(s) representative of the item(s) to be painted, before application, the compatibility of shop primers with the specified intermediate and topcoat coating systems.

D. Non-Shop Primed Metal and Piping -- Prime coat all exposed metal and piping, except stainless steel, received at job site following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above. Prime paint in accordance with SSPC PS No. 13.01 for epoxy-polyamide primers. Epoxy-polyamide primers shall conform to the standards set forth in SSPC Paint Specification No. 22.

E. Cast-In-Place Reinforced Concrete -- After surface preparation specified above, prime coat concrete as specified in the coating schedule found elsewhere in the specifications.

F. Concrete Masonry Units -- After surface preparation specified above, prime coat as specified in the coating schedule found elsewhere in the specifications.

G. Wood Surfaces -- Following surface preparation specified above, prime coat exterior exposed wood surfaces with appropriate coating system as specified in the painting schedule.

3.6 Field Prime

Wherever shop priming has been damaged in transit or during construction, the damaged area shall be cleaned and touched up with field primer specified herein or

returned to the shop for resurfacing and repriming, at the ENGINEER's discretion. Metal items delivered to the job site unprimed shall be cleaned and primed as specified herein.

3.7 Application

A. Thickness -- Apply coatings in strict conformance with the manufacturer's application instructions. Apply each coat at the rate specified by the manufacturer to achieve the dry mil thickness specified. If material must be diluted for application by spray gun, build up more coating to achieve the same thickness as undiluted material. Correct apparent deficiency of film thickness by the application of an additional coat.

B. Porous Surfaces -- Apply paint to porous surfaces as required by increasing the number of coats or decreasing the coverage as may be necessary to achieve a durable protective and decorative finish.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe coating for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

G. Ventilation -- Adequately ventilate enclosed rooms and spaces during painting and drying periods.

H. Drying Time -- Do not apply next coat of coat until each coat is dry. Test non-metallic surfaces with moisture meter. The manufacturer's recommended drying time shall mean an interval under normal condition to be increased to allow for adverse weather or drying conditions. Coating manufacturer's representative shall verify by cure testing, complete cure of coatings systems used for immersion service.

3.8 Coating Schedule

Provide protective coatings in accordance with following Coating Schedule:

Coating Schedule

Item	Location	Material	Coating System
Piping[1]	Exposed in building extension and within the settling chamber above the water surface (exterior surface of pipe)	Ductile Iron	Coating System 100
Valves & Couplings[2]	All	--	See Note 2
Exterior of Walls, below grade	Building extension	Concrete	Coating System 306
Concrete Floors and Slabs	Interior Floor, Exterior Slab (sediment containment area)	Concrete	Coating System 305
Miscellaneous Metals, including manufactured steel trusses and frames	Exposed Surfaces, Exterior and Interior	Steel, Galvanized Steel, Aluminum	Coating System 101
Interior of CMU Walls	Building Interior, Exposed Surfaces	Concrete Masonry	Coating System 302
Exterior of CMU Walls	Building Exterior, Exposed Surfaces	Concrete Masonry	Coating System 300
Doors	Exposed Interior & Exterior Surfaces	Steel	Refer to roll up door specification
Metal Roofing	Exposed exterior surface and unexposed interior surface	Steel	Refer to metal roofing specification

Notes:
[1] Pipe linings shall be as specified elsewhere in these specifications.
[2] Finish coating of exposed valves and couplings to be shop-applied fusion-bonded epoxy.

END OF SECTION

SECTION 10400

IDENTIFYING DEVICES

PART 1 GENERAL

1.1 Scope

This section covers the work necessary to furnish and install, complete, the identifying devices for the project. These devices shall include pipe color coding and labeling, process equipment nameplates, door and warning signs.

1.2 Submittals during Construction

A. Manufacturer's Data - For information only, submit four (4) copies of manufacturer's specifications and installation instructions for each type of sign required.

B. Samples - Submit three (3) full size samples of each color and finish of pipe labeling, process equipment nameplates and warning signs with sample letters. ENGINEER's review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR. Submit samples of any other special identifying or signing provided for elsewhere in this specification.

1.3 Standards, Specifications and Codes

All safety related signs, markers, labeling and symbols shall conform to the applicable provisions or codes of the Occupational Safety and Health Administration (OSHA) unless specifically modified hereinafter. All signage that provides emergency information or general circulation directions or identifies rooms for the physically handicapped shall comply with the requirements of the latest edition of American National Standards Institute (ANSI A117.1).

PART 2 PRODUCTS

2.1 Pipe Labeling and Colors

Unless noted otherwise on the plans or specified differently hereinafter, pipe labeling colors shall conform to the following labeling colors schedule:

Service	Label Text	Text Color	Label Background	Pipe Color
Raw Water	Raw Water	White	Green	Blue
Drains	Drain	Black	Yellow	Brown
Vents	Vent	Black	Yellow	Blue
Misc. Piping	As directed by the ENGINEER			

NOTE: Colors to match existing

Pipe identification labels and flow direction arrows shall consist of lettering and symbols. Colors for pipes, lettering and flow arrows shall be as shown in the labeling color schedule above. Coating systems and surface preparation requirements used in color coding piping and lettering and flow arrows shall be as specified in Section 09800 Protective Coatings.

2.2 Process Equipment Nameplates

Nameplates shall be used to identify all process equipment including but not limited to pumps, chlorinators, control panels and any other equipment requiring identification as directed by the Engineer. Process equipment nameplates shall be fabricated from 1/16-inch thick satin-surfaced Setonply with all edges beveled neatly. Nameplates shall be furnished with drilled holes for mounting to the appropriate equipment or nearest adjacent surface. As an alternative, acceptable adhesive attachment methods may be used if approved by the Engineer. Nameplate background color, lettering color and wording shall be as directed by the Engineer and approved by the Owner. Minimum size for nameplates shall be 4" x 1-1/2". Nameplates shall be style 2060-40 as manufactured by Seton Nameplate Company, New Haven, CT, or approved equal.

PART 3 EXECUTION

3.1 Pipe Labels and Flow Direction Arrows

Pipe labels and flow direction arrows shall be located at all connections to equipment, valves, branching fittings, at wall boundaries and at intervals along the piping not greater than 5 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe. Exposed piping not normally in view, such as behind ceilings and in closets and cabinets, shall also be labeled.

Labels shall not be applied to the pipe until all pipe painting is complete or as approved by the ENGINEER. Labels and flow direction arrows shall be applied by stencil over pipe base color. Base coat shall be cured, clean and dry, prior to application of lettering. Location of labels and arrows shall be as described above. Lettering sizes for pipe labels shall be in accordance with ANSI A13.1, Table 3, and based upon the outside diameter of the pipe to which they are applied. Colors of

letters and arrows shall be as described in the labeling color schedule specified herein. Stripes on solution pipe shall be applied at intervals along the piping not greater than 5 feet on center with at least one stripe applied to each exposed horizontal and vertical run of pipe.

3.2 Process Equipment Nameplates

Process equipment nameplates shall be located as directed by the ENGINEER. Mounting of process equipment nameplates shall be in accordance with the manufacturer's instructions, and as directed by the ENGINEER.

3.3 Painted Signs

Prepare and mask base material as required to provide clean surface for application of letters by stencil. Unless otherwise noted, color of letters shall be black. Paint type shall be semi-gloss alkyd enamel.

END OF SECTION

SECTION 11000

EQUIPMENT, GENERAL

PART 1 GENERAL

1.1 Description

A. The CONTRACTOR shall provide all tools, supplies, materials, equipment and all labor necessary for the furnishing, construction, installation, testing and operation of equipment and appurtenant work, complete and operable, all in accordance with the requirements of the Contract Documents.

B. The provisions of this Section shall apply to all equipment specified and where referred to, except where otherwise specified or shown.

1.2 Reference Specifications, Codes and Standards

A. All equipment, products and their installation shall be in accordance with the following standards, as applicable and as specified in each section of these specifications:

1. American Society for Testing and Materials (ASTM)
2. American Public Health Association (APHA)
3. American National Standards Institute (ANSI)
4. American Society of Mechanical Engineers (ASME)
5. American Water Works Association (AWWA)
6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
7. American Welding Society (AWS)
8. National Fire Protection Association (NFPA)
9. Federal Specifications (FS)
10. National Electrical Manufacturers Association (NEMA)
11. Manufacturer’s published recommendations and specifications

12. Oregon Occupational Safety and Health Division (OR-OSHA)

B. The following standards have been referred to in this section of the specifications.

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and Other Special Alloys
ANSI B46.1	Surface Texture
ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch)
ANSI/ASME B31.1	Power Piping
ANSI/AWWA D100	Welded Steel Tanks for Water Storage
AWWA C206	Field Welding of Steel Water Pipe
ASTM A48	Specification for Gray Iron Castings
ASTM A108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality

1.3 Submittals

A. The CONTRACTOR shall furnish complete shop drawings for all equipment specified in the various sections, together with all piping, valves and controls for review by the ENGINEER in accordance with Section 01300 – Submittals.

B. The CONTRACTOR shall supply one complete set of special tools where necessary for the assembly, adjustment and dismantling of the equipment. Tools shall be suitable for professional work and manufactured by a recognized supplier of professional tools such as Snap On, Crescent, Stanley, or equal.

C. The CONTRACTOR shall obtain and submit from the manufacturer a list of suggested spare parts for each piece of equipment. CONTRACTOR shall also furnish the name, address and telephone number of the nearest distributor for each piece of equipment. Spare parts shall be supplied by the

CONTRACTOR when indicated in the appropriate equipment specification sections.

D. Where required by the individual equipment sections, the CONTRACTOR shall submit to the ENGINEER a torsional and lateral vibration analysis of the equipment, in accordance with Section 01100 – Special Provisions. Equipment shall be designed and constructed such that the natural frequency of the drive train is avoided by a minimum of 25 percent throughout the entire operating range. The analysis shall be performed by a specialist experienced in this type of work and approved by the ENGINEER. The specialist or their assigned representative who shall similarly be experienced in this type of work and who shall be approved by the ENGINEER shall visit the project site during startup and testing of the equipment to analyze and measure the amount of equipment vibration, certify that the operating frequency avoids the natural frequency by 25 percent, and make a written recommendation for keeping the vibration at a safe limit.

1.4 Quality Assurance

A. The CONTRACTOR shall demonstrate that all equipment meets the specified performance requirements. CONTRACTOR shall provide the services of an experienced, competent and authorized service representative of the manufacturer of each item of major equipment, who shall visit the project site to perform the following tasks.

1. Assist the CONTRACTOR in the installation of the equipment.

2. Inspect, check, adjust if necessary and approve the equipment installation.

3. Start-up and field-test the equipment for proper operation, efficiency and capacity.

4. Perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the ENGINEER.

5. Instruct the OWNER's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.

B. The costs of all inspection, startup, testing, adjustment and instruction work performed by said factory-trained representatives shall be borne by the CONTRACTOR. When available, the OWNER's operating personnel will provide assistance in the field testing.

C. Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts.

D. The type of finish shall be the most suitable for the application and shall be in accordance with ANSI B46.1.

E. Unless otherwise noted, all equipment furnished shall have a record from the same manufacturer of at least 3 years successful, trouble-free operation in similar applications

PART 2 PRODUCTS

2.1 General Requirements

A. At each high noise level location, where equipment produces noise exceeding 85 dBA at 3 feet or exceeding OR-OSHA noise level requirements for operator safety, the CONTRACTOR shall supply two pairs of high attenuation hearing protectors. The ear protectors shall meet the requirements of ANSI S12.6 and shall produce a noise level reduction of 25 dBA at a frequency of 500 Hz. The hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband. The protectors shall be stored in a weatherproof, labeled, steel cabinet, furnished by the CONTRACTOR and mounted in an approved location near the noise producing equipment.

B. Unless otherwise specified or shown, all welding shall be by the metal arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. All sharp corners of material to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

C. All equipment shall be painted or coated in accordance with Section 09800 – Protective Coatings, unless otherwise indicated. Non-ferrous metal and

corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly and shipping.

D. All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling and storage. All equipment shall be protected from exposure to corrosion and shall be kept thoroughly dry at all times.

E. Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.

F. All equipment subject to vibration shall be provided with restrained spring type vibration isolators or pads per manufacturer's written recommendations.

G. Shop fabrication shall be performed in accordance with the Specifications and the ENGINEER-approved shop drawings.

2.2 Equipment Supports and Foundations

A. All equipment supports, anchors and restraint shall be adequately designed for static, dynamic, wind and seismic loads. The design horizontal seismic force shall be the greater of that noted in the general structural notes or as required by the governing building code (10 percent of gravity minimum).

B. Equipment foundations shall be as per manufacturer's written recommendations. All equipment shall be mounted as shown on the manufacturer's standard details, unless otherwise shown or specified.

C. Shop drawings submitted to the ENGINEER for review in accordance with the requirements of Section 01100 – Special Provisions shall include calculations showing equipment anchorage forces and the capacities of the anchorage elements to be provided by the CONTRACTOR.

2.3 Pipe Hangers, Supports and Guides

All pipe connections to equipment shall be supported, anchored and guided to avoid stresses and loads on equipment flanges and equipment.

2.4 Flanges and Pipe Threads

All flanges on equipment and appurtenances provided under this section shall conform to ANSI B16.1, Class 125 or B16.5, Class 150, unless otherwise shown. All

pipe threads shall be in accordance with ANSI/ASME B1.20.1 and with requirements of Section 15000 – Piping, General.

2.5 Couplings

A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float and to cushion shock loads. Where required for vertical shafts, three-piece spacer couplings or universal type couplings for extended shafts shall be installed.

B. The CONTRACTOR shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.

C. Taper-lock bushings may be used to provide for easy installation and removal on shafts of various diameters.

D. Where universal type couplings are shown, they shall be equipped with grease fittings.

2.6 Bearings

A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association (AFBMA).

B. All field-lubricated type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

C. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.

D. Except where otherwise specified or shown, all bearings shall have a minimum B-10 life expectancy of 5 years or 20,000 hours, whichever occurs first.

E. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as specified or shown, or as recommended in the published standards of the manufacturer. Split type housings may be used to facilitate installation, inspection and disassembly.

F. Sleeve type bearings shall have a Babbitt or bronze liner.

2.7 V-Belt Drives

A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA and RMA standards.

B. Unless otherwise specified, sheaves shall be machined from the finest quality gray cast iron.

C. All sheaves shall be statically balanced. In applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm may be required to be of special materials and construction.

D. To facilitate installation and disassembly, sheaves shall be furnished complete with taper-lock or QD bushings as required.

E. Finish bored sheaves shall be furnished complete with keyseat and set screws.

F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.8 Drive Guards

All power transmission, prime movers, machines, shaft extensions and moving machine parts shall be guarded to conform with the OR-OSHA Safety and Health Standards (29CFR1910) requirements. The guards shall be constructed of minimum 10-gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.9 Flexible Connectors

Flexible connectors shall be installed in all piping connections to engines, blowers, compressors and other vibrating equipment.

2.10 Gaskets and Packings

A. Gaskets shall be in accordance with the requirements of Section 15000 – Piping, General.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron type “V” packing shall be Garlock No. 432, John Crane “Everseal” or equal.

C. Packing around rotating shafts (other than valve stems) shall be “O” rings, stuffing boxes or mechanical seals, as recommended by the manufacturer and approved by the ENGINEER.

2.11 Nameplates

Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location. Nameplates shall contain the manufacturer’s name, model, serial number, size, characteristics and appropriate data describing the machine performance ratings.

PART 3 EXECUTION

3.1 Couplings

The CONTRACTOR shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application. Installation shall be per equipment manufacturer’s printed recommendations.

3.2 Packaged Equipment

A. When any system is furnished as pre-packaged equipment, the CONTRACTOR shall coordinate all necessary space and structural requirements, clearances, utility connections, signals and outputs with his subcontractors.

B. If the packaged system has any additional features other than specified, the CONTRACTOR shall coordinate such features with the ENGINEER and furnish all material and labor necessary for a complete installation, as required by the manufacturer, at no additional cost to the OWNER.

END OF SECTION

SECTION 11800

SHAFTLESS GRITT CLASSIFIER

PART 1 GENERAL

1.1 Furnish, install, test and place into operation one (1) shaftless grit classifier as shown on the Drawings. Classifier shall consist of a grit cyclone, a settling hopper and trough, a drive assembly, a shaftless spiral, electrical controls and all other appurtenances as specified herein, as shown on the Drawings and as required for proper installation and operation.

1.2 Design Criteria:

A. Number of Grit Cyclones: One (1)

B. Maximum Pumped Flow to Each Cyclone: 250 gpm

C. Required Cyclone Inlet Pressure: 5-8 psi

D. Cyclone Inlet Connection: 4 inch flanged

E. Cyclone Overflow Outlet Connection: 6 inch flanged

F. Cyclone Underflow Rate: 20-30 gpm

G. Solids Capacity: 25 cfh

H. Screw Diameter: 11 inch

I. Screw Pitch: 2:3

J. Screw Length: 12 feet

K. Classifier Screw Angle of Inclination: 25 degrees

L. Classifier Overflow Outlet Connection: 6 inch flanged

M. Classifier Tank Drain Connection: 2 inch NPT

1.3 Warranty: Provide a written manufacturer's warranty for a minimum period of one (1) year from start-up. Warranty shall cover all defects or failures of materials or workmanship which occur as the result of normal operation and service.

1.4 Submittals and Shop Drawings: Provide submittals in accordance with Division 1 – General Requirements of the Standard Construction Specifications. Submittals shall include at least the following:

A. Certified general arrangement drawings showing all important details including materials of construction, dimensions, loads on supporting structures, and anchor bolt locations.

B. Descriptive literature, bulletins and/or catalogs of the equipment.

C. Complete data on motors and gear reducers.

D. Wiring diagrams and electrical schematics for all electrical and control equipment to be furnished.

E. Quality system ISO 9001 certification. The quality procedures shall provide for a means of qualifying all sub-vendors and shall specify that the fabrication facility is a critical vendor and shall require inspection. The quality system shall be audited by a third party independent inspector. Certification shall remain in effect throughout the project startup.

PART 2 PRODUCTS

2.1 General Design:

A. Functional Description: The grit slurry shall be pumped through a grit cyclone mounted on top of the screw classifier over the settling pool. Grit shall exit the cyclone underflow and settle in the classifier hopper. The grit shall be conveyed out of the hopper by a shaftless spiral, dewatered and discharged by gravity into a dumpster.

B. Materials of Construction: All wetted parts shall be constructed from high strength plastic or stainless steel except for the shaftless spiral. The shaftless spiral shall be constructed from a high strength alloy steel and supplied with a protective primer coating. Bearings, electrical devices, motor and gear reducer shall be of the manufacturer's standard materials.

C. Shop Surface Preparation/Coating: All welds shall be cleaned and passivated to remove weld spatter, slag and discoloration. Bearings, electrical devices, motor and gear reducer shall be provided with the manufacturer's standard coating system.

2.2 Grit Cyclone: One (1) grit separation hydrocyclone shall be provided to remove excess liquid and organics from the pumped flow to improve the efficiency of the grit classifier. The hydrocyclone unit shall be watertight and shall remove grit

through hydraulic forces requiring no moving parts. Each unit shall be a Krebs model D10LB Cyclone and provided with the following features:

A. Cyclone housing constructed from steel with aluminum apex housing, pure gum rubber inlet head liner and Nihard vortex finder.

B. Fixed pure gum rubber apex liner and quick release toggle clamps on apex. The underflow apex shall be interchangeable with different size openings to adjust the flow split as required.

C. Tangential inlet connection to induce a vortex for separation of grit from the liquid.

D. Neoprene elbow for gravity discharge from the underflow to the classifier hopper.

E. Support stand from type 304 stainless steel.

F. An inlet pressure gauge field installed on the inlet to the hydrocyclone. The pressure gauge shall have a dial indicator with a range from 0-15 psig and shall be protected by a silicon or glycerin filled diaphragm assembly.

G. Capable of discharging at least 95% of the 150 mesh grit having a specific gravity of 2.65 or greater from the underflow of the grit collection equipment.

2.3 Classifier Hopper and Trough: The concentrated grit slurry from the cyclone underflow will enter the screw classifier. Classifier hopper shall provide adequate volume to ensure that the inflow grit and water mixture has sufficient retention time to fully separate the heavy grit from the water and residual light organic solids.

A. The grit hopper and trough shall be constructed from 0.12 inch thick type 304 stainless steel. The unit shall be supported by an integral base at the bottom of the hopper and support stand bolted to the trough portion.

B. The hopper will contain a weir to drain off the water. Weir shall be adjustable to allow precise control of the floatation and removal of light organic solids and to minimize the carry over of fine grit. There shall be no parallel plate separators inside the hopper that can accumulate solids and inhibit performance. An underflow baffle shall separate the grit settling area from the overflow weir.

C. A drain connection will be located at the base of the hopper and trough, to allow the equipment to be emptied of water. The drain connection shall be provided with a brass or PVC body ball valve.

D. Wear bars constructed from .0.31-inch thick type 304 stainless steel shall be mechanically fastened in the trough to support the spiral assembly. Screws

fastening the bars shall use seal washers and shall have their heads external to the unit to allow for periodic tightening or adjustment of the bars. Wear bars shall be replaceable without requiring welding or replacement of the conveyor tube.

E. Sectional covers constructed from type 304 stainless steel shall be bolted to the top of the classifier hopper and inclined trough.

F. A spray bar shall be installed inside the inclined trough to help rinse organics from the collected grit. The spray bar shall be constructed from type 304 stainless steel pipe with a 1/2 inch NPT connection and type 304 stainless steel body manual ball valve. Spray bar shall be design for 4 gpm at 30-40 psi.

2.4 Drive Assembly: The drive assembly shall transmit power generated by the motor to the spiral screw of the classifier to convey settled grit up the inclined trough to the discharge of the unit.

A. The reducer shall be a helical gear type as manufactured by SEW-Eurodrive. The unit will be provided with a cast iron frame and shall be designed in accordance with AGMA recommendations for Class II service based on the horsepower required to operate the screen.

B. The motor shall be TEFC, 1/2 HP, 1800 RPM, 460 Volt, 3 phase, 60 Hz. The motor shall be NEMA design code B and be direct coupled to the reducer.

C. The motor/reducer assembly shall be directly connected to the main drive shaft via the reducer's hollow shaft. Designs that incorporate additional chain and sprocket assemblies that might bind or break shall not be accepted.

D. The main drive shaft of the classifier shall extend from the reducer into the end of the inclined trough. The drive shaft shall be constructed from high strength alloy steel and supplied with a protective epoxy primer. The free end of the drive shaft shall end in a mounting flange for connection of the spiral screw.

2.5 Shaftless Spiral Screw Assembly: The shaftless spiral screw shall convey the settled material up the inclined trough to the discharge of the unit.

A. The spiral screw shall be shaftless throughout the length of the trough. The screw shall be fabricated from a high strength alloy steel section formed continuously into a spiral. The flight shall have a minimum thickness of 0.79-inch. OD shall be as indicated under Screw Diameter in the design criteria. The spiral shall be supplied with a protective epoxy primer.

B. The drive end of the spiral at the discharge location shall be welded to a coupling plate to mate with the drive shaft connected to the motor/reducer assembly. Design shall ensure that the screw can be replaced as an individual

item without the need to disconnect the drive system from the unit, or remove the shaft from the gearbox.

2.6 Electrical: The control panel shall be as specified in Division 16 of the Technical Specifications and as shown on the Drawings.

A. Local Emergency Stop Pushbutton: A local emergency stop pushbutton will be provided on the local control panel, as shown in the Drawings.

2.7 Sequence of Operation:

A. Classifier Hand Operation: When the classifier selector switch is in the Hand position, the classifier spiral will run continuously. Turning the selector switch to Off will stop the unit.

B. Classifier Automatic Operation: When the classifier selector switch is in the Auto position, the classifier will be activated by the operation of the grit pump currently pumping to the classifier. While the pump is operating, the classifier shall cycle on and off by the settings of a repeat cycle timer. Once the pump completes operation, the classifier shall run for an adjustable off delay time.

C. Spray Wash Operation: The spray wash is manual and will operate continuously when the manual valve is open.

D. Fault Conditions:

1. Excessive motor current will trip the starter overload relays, immediately stop the drive motor, and illuminate the alarm indicating light. This fault must be reset by depressing the motor starter overload reset internal to the control panel.

2. Momentary motor over current will trip the current monitor, immediately stop the drive motor, and illuminate the alarm indicating light. Pushing the reset pushbutton will reset this fault.

2.8 Anchorage and Fasteners:

A. Anchor Bolts: All anchor bolts shall be a minimum of 1/2 inch diameter and made of type 304 stainless steel.

B. Fasteners: All fasteners shall be type 304 stainless steel.

2.9 Manufacturer and Model

A. WesTech Gritt Mitt™ Shaftless Classifier Model GSF31, to match existing.

PART 3 EXECUTION

3.1 General: The equipment shall be installed properly to provide a complete working system. Installation shall follow the supplier's recommendations and written installation instructions.

3.2 Manuals: Furnish four (4) copies of operation and maintenance manuals. The manual shall include the supplier's erection and assembly recommendations, a complete parts list, and a list of recommended spare parts.

3.3 Shop Assembly: The equipment specified herein shall be completely factory assembled and inspected prior to shipment.

3.4 Field Service: Provide the services of a manufacturers certified representative during start-up. The equipment supplier shall provide the service of a qualified representative to inspect the equipment installation, assist in start-up, and instruct plant personnel in the proper operation and maintenance of the equipment.

END OF SECTION

SECTION 15000

PIPING, GENERAL

PART 1 GENERAL

1.1 Description

Work under this Section applies to the furnishing and installation of piping inside a building, structure, enclosure piping and miscellaneous yard piping. All work shall conform to the standard construction specifications except as modified herein. In the case of discrepancy, the more stringent provision shall apply.

1.2 Requirements

A. The CONTRACTOR shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the CONTRACTOR's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

1.3 Reference Specifications, Codes and Standards -- Comply with the provisions of the following Codes, Specifications and Standards, Except as otherwise shown or specified.

Commercial Standards

ANSI/ASME B1.20.1 Pipe Threads, General Purpose (inch)

ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys

ANSI/AWWA C207 Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.

ANSI/AWWA C606 Grooved and Shouldered Joints

ANSI/AWS D1.1 Structural Welding Code

ASTM A 307 Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile

ASTM A 325 Specification for High-Strength Bolts for Structural Steel Joints

ASTM D 792 Test Methods for Specific Gravity and Density of Plastics by Displacement

ASTM D 2000 Classification System for Rubber Products in Automotive Applications

1.4 Submittals

A. The CONTRACTOR shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems, in accordance with the contract documents and as specified in the individual piping sections. The shop drawings shall include all necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, couplings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

B. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

C. The CONTRACTOR shall submit as part of the shop drawings a statement from the pipe fabricator certifying that all pipes will be fabricated subject to a recognized Quality Control Program. An outline of the program shall be submitted to the ENGINEER for review prior to the fabrication of any pipe.

1.5 Quality Assurance

A. Inspection -- All pipe shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the ENGINEER shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

B. Tests -- Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards. Welds shall be tested as specified. The CONTRACTOR shall perform all tests at no additional cost to the OWNER.

C. Welding Requirements -- All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. Welder Qualifications -- skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used shall do all welding. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local approved testing agency prior to commencing work on the pipeline. Machines and electrodes similar to those used in the WORK shall be used in qualification tests. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

1.6 Material Delivery, Storage and Protection

All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

PART 2 PRODUCTS

2.1 General

Unless specified otherwise or indicated differently on the plans, all piping systems and process piping materials shall be as listed in the table below or as shown on the drawings:

Service Conditions

Service	Material
Drainage/Sanitary Sewer	See Division 2.
Exposed ≥ 4”	Class 52 Ductile Iron or Heavy Wall Welded Steel
Buried ≥ 4”	Class 52 Ductile Iron
Submerged/Buried < 4”	Stainless Steel - Type 316 Schedule 40 Threaded - ASTM A 312 Fittings Welded or Threaded
Exposed < 4”	Brass - ASTM B 43, Fittings - Bronze - ASTM B 62 Threaded - ANSI/ASME B 16.15
Buried < 4”	Copper Tubing - ASTM B88 Type K Soft - Fittings - Wrought Copper - ANSI B16.22, Joints-Soldered
Miscellaneous Pipelines	As shown on drawings

2.2 Performance Requirements

A. Ductile Iron Pipe and Fittings -- All ductile iron pipe shall conform to the current provisions of the American Water Works Association (AWWA)/American National Standards Institute (ANSI) C151/A21.51. Unless otherwise designated, ductile iron pipe shall be standard thickness Class Number 52 with cement mortar lining.

1. Pipe and fittings shall be flanged, mechanical joints or push-on as required, as shown on the drawings or as specified. Unless otherwise shown on the drawings or specified herein, mechanical joint pipe shall be used for underground installations. Joints of the push-on type may be used instead of mechanical joints after the ENGINEER has approved design. Thrust restraint shall be by thrust blocks or by pipe joint restraint as shown on the drawings. Restrained joints shall be the lock-type mechanical joint or approved equal at bends and for sufficient distance on each side of the bend to prevent pulling at the joint during testing. No set screw type retainer glands or joint harness systems will be allowed.

2. The following is the approved list of restrained joint systems:

   a. “TR Flex”, United States Pipe and Foundry Company
   b. “Mega-lug”, EBAA Iron, Inc

   c. “Thrust Lock”, Pacific States Cast Iron Pipe Company

   d. “Flex-Ring”, American Cast Iron Pipe Company

   e. “Uni-Flange Series 1400”, Ford Meter Box Co., Inc.

   f. “Romagrip”, Romac Industries, Inc.

   g. “Tufgrip”, Tyler Pipe Company and Union Foundry Co.

3. Flanged pipe shall be flanged in accordance with AWWA/ANSI C115/A21.15 with Class 125 drilling.
4. Gaskets for flanged joints shall be as follows:

   a. Pipe sizes up to 24-inch: Gaskets shall be full face gaskets, Garlock 98206 EPDM for pressures up to 150 psi, Garlock Stress Saver XP for pressures between 151 and 250 psi, or equal.

b. Pipe sizes 24-inch and greater: Gaskets shall be ring gaskets (unless specified otherwise) Garlock 98206 EPDM for pressures up to 150 psi, Garlock Stress Saver XP for pressures between 151 and 250 psi, or equal.

5. All ductile iron pipe and fittings shall be cement-lined and seal-coated according to ANSI/AWWA C104/A21.4. The seal coat for buried pipe shall be coal tar. For exposed pipe, the exterior coating shall be in accordance with Sewction 09800 – Prtetctive Coatings

6. Fittings for ductile iron pipe shall conform to AWWA/ANSI C110/A21.10 or AWWA/ANSI C153/A21.53. Fittings for push-on pipe shall be mechanical joint.

B. Copper Pipe and Fittings -- Copper pipe unless specified elsewhere shall be Type “L”, hard drawn, conforming to ASTM B88. Copper pipe under floor slabs, underground or cast in concrete shall be Type “K”.

Connection of copper tubing to steel or other metallic piping shall be made using insulating couplings or fittings such as to provide complete electrical isolation. Care shall be taken that copper tubing or fittings are not permitted to come in contact with concrete, steel or other metallic piping, reinforcing steel, or other steel at any location. Electrical checks shall be made between copper tubing and metallic elements to assure that isolation is maintained. Wherever electrical contact is demonstrated by such tests, the CONTRACTOR shall locate the point or points of contact and correct this condition.

C. Polyvinyl Chloride (PVC) Water Pipe and Fittings -- PVC pipe 4 inches and smaller shall be schedule 80, Type 1 Grade I normal impact PVC pipe conforming to ASTM D1785 and D2467 and shall be solvent welded.

D. Flexible Tubing -- Flexible plastic pipe shall be standard weight polyethylene thermoplastic tubing conforming to ASTM D-1248 Type 1, Class A, Category 4, Grade E5.

E. Galvanized Steel Pipe and Fittings -- Galvanized steel pipe shall be seamless, or electric resistance welded, ASTM A120, Schedule 40. Joints for galvanized steel pipe shall be threaded. Fittings shall be threaded, 150 lb. malleable iron, galvanized, ASTM A197 or ASTM A47, dimensions conforming to ANSI B16.3; Unions, 300 lb. malleable iron, galvanized with dimensions conforming to ANSI B16.3, brass to iron seat. Thread lubricant shall be Teflon tape or joint compound that is insoluble in water.

All buried galvanized pipes shall be spirally wrapped with polyvinyl chloride or polyethylene pressure sensitive tape, applied with a suitable primer. The

wrap shall have a nominal thickness of 20 mils, consisting of either one layer of 20-mil tape or two separate layers of 10-mil tape.

Before the primer and wrap is applied, the piping shall be thoroughly cleaned so that all surfaces shall be dry and free of dirt, dust, rust, oil scale, oil, grease, or other foreign matter. Any solvents used shall be totally volatile so as to leave no trace of oil. Weld spatters, burrs, or sharp points and edges shall be removed by chiseling, ball peening or filling. After thorough cleaning, the piping shall be coated with a primer applied in accordance with the tape manufacturer's recommendations. Spiral wrappings shall be applied with an overlap of at least 1-inch.

2.3 Couplings and Specials

A. Flexible Couplings

1. Flexible Couplings and Flanged Coupling Adapters -- Flexible couplings or flanged coupling adapters where shown on the drawings or where required shall be of the gasketed sleeve type with diameter to properly fit the pipe.

2. Flexible couplings for steel pipe and ductile iron pipe shall be provided where shown and shall be steel middle ring with steel followers. For exposed service, the coupling shall be lined with material equal to pipe lining material. Coupling shall be coated with primer compatible with the pipe painting system. For buried or inaccessible service, the coupling and bolts shall be epoxy coated and lined. Couplings shall be Dresser Style 38, Ford FICA series, Romac or Smith-Blair.

3. Flexible couplings for PVC pipe shall be Romac Model 501 or approved equal.

4. Flanged coupling adapters for steel piping shall be Dresser Style 128 or approved equal.

5. Couplings shall be assembled on the job in a manner to insure permanently tight joints under all reasonable conditions of expansion and contraction. Gasket and O-ring material to be as recommended by manufacturer for intended service.

6. All flexible couplings and flange coupling adapters as shown on the drawings shall be suitably harnessed or blocked. The flexible coupling harnesses shall be installed to allow the flexible coupling to be pushed clear of the joint and as detailed in the AWWA Manual M11, 2nd Ed. and approved by the ENGINEER. Flexible couplings shall have

center pipe stop where noted on drawings. Flanged coupling adapters shall be harnessed as shown on drawings and details. Flexible couplings and flange coupling adapters shall be provided with stainless steel bolts where submerged.

7. All tie bolt diameters shall be designed using ASTM A7 or A373 steel. Design pressure shall be 150 psi.

B. Tapping Sleeves -- Tapping sleeves shall be stainless steel conforming to 18-8 Type 304 stainless steel with a CF 8 cast stainless steel flanged end with ANSI 150 pound drilling. Bolts and hardware to be Type 304 stainless steel and the branch outlet shall be heavy stainless steel pipe. The gasket shall be full circumferential gasket. Tapping sleeve shall be JCM 432 or approved equal. Valve for tapping sleeve shall be cast iron body with fusion bonded epoxy coating. Tapping valve shall be AFC Series 500 NRS resilient wedge valve or approved equal. Provide insulated flange joint between tapping sleeve and valve.

C. Restrained Flange Adapters for Ductile Iron Pipe

Restrained flange adapters for ductile iron pipe shall conform to the following specifications:

1. Restrained flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C115/A21.15. Restraint for the flange adapter shall consist of a plurality of individually actuated gripping wedges to maximize restraint capability. Torque limiting restraining bolts with breakaway heads shall be used to insure proper initial set of the gripping wedges.

2. The flange adapters shall be capable of deflection during assembly of up to 3.5° for 4-inch and 6-inch diameter pipe. Adapters shall permit lengths of pipe to be field cut to allow a range of pipe insertion between the end of the pipe and the mating flange without affecting the integrity of the seal. The minimum difference between the maximum and minimum pipe insertion requirements for the adapter shall be 3.0 inches for 4-inch diameter pipe and 3.5 inches for 6-inch diameter pipe.

3. Restrained flange adapters for ductile iron pipe shall be Romac RFCA flange adapters, EBBA Iron 2100 Megflange or approved equal as shown on the drawings.

D. Where required copper pipe to copper pipe connections shall be made with compression couplings. Couplings shall be Mueller Model 110 or approved equal.

E. Cast-In Wall Pipe -- Cast-in wall pipe shall be cast ductile iron, or steel with pipe diameter and end types as shown on the plans.

F. Cast-In Wall Sleeve -- Cast-in wall sleeves shall be fabricated from Schedule 40 galvanized steel pipe. The inside surface of all wall sleeves shall be coated with coal-tar. The annular space between the penetrating pipe and the wall sleeve shall be filled with an approved permanently flexible sealant. Diameter of wall sleeve shall be as shown on the plans.

G. Cast-In Floor Pipe -- Cast-in floor pipe shall cast ductile iron or steel pipe as required by the plans and the intended service. Pipe diameter shall be as shown on the plans.

H. Cast-in Floor Sleeves -- Cast-in floor sleeves shall be fabricated from Schedule 40 galvanized steel pipe. Sleeve diameter shall be as shown on the plans. The annular space between the penetrating pipe and the sleeve shall be filled with an approved permanently flexible sealant.

I. Cast-In Wall Sleeve -- Interior Wall Penetrations: Cast-in wall sleeves for interior wall penetrations shall be fabricated from 16-gauge galvanized steel. Sleeve diameter shall be as shown on the plans. The annular space between the penetrating pipe and the sleeve shall be filled with an approved permanently flexible sealant.

J. Seep Rings -- Seep rings shall be fabricated from 3/8-inch thick steel plate conforming to ASTM A36 unless otherwise noted. The inside diameter of the seep ring shall be equal to the outside diameter of the pipe or sleeve to which it is attached plus 1/4-inch. The outside diameter of the seep ring shall be as shown on the plans. The seep ring shall be attached to the pipe or sleeve by means of a continuous seal weld located on both sides of the ring.

K. Rubber expansion joints: Rubber expansion joints shall be used where shown on the Plans for connecting rigid pipe to vibrating equipment. Rubber expansion joints shall use EPDM for the arch, ductile iron for the retaining ring and shall have integral sleeve support on the retaining ring. Joints shall be Flextra 150 Wide Arch expansion joints as manufactured by Flexicraft, or approved equal and shall include control rods for restraint where indicated on the Plans.

L. Dismantling Joints

Dismantling joints shall be a self-contained flanged restrained joint fitting, including both flanged components and sufficient harness bars to withstand the imposed thrust. The Dismantling Joint will allow for a minimum of 2 inches of longitudinal adjustment. The pressure rating will be determined by the flange configuration, and all commonly used flanges shall be available. As standard, flanges in accordance with AWWA C207 Class D shall be used. Where working pressures or test pressures are 150 psi to 275 psi, flanges shall be in accordance with the specification for AWWA C207 Class E flanges.

The Dismantling Joint shall be furnished as a complete assembly consisting of spigot piece, flange adaptor, tie bars and gasket. The Dismantling Joint shall be designed so that no part of the restraint system extends outside the flange diameter. The internal bore shall match that of the pipe system.

The spigot piece shall be of steel to ASTM A283 Grade C. The Flange Adaptor shall be either steel to ASTM A283 Grade C or Ductile Iron to ASTM A536 Grade 65-45-12. Tie bars shall be ASTM A193 Grade B7 threaded rod with rolled threads. MB7 may be used as an alternative. Gasket shall be EPDM Grade E. The Dismantling Joint shall be supplied with an in-house applied fusion bonded Epoxy or Rilsan Nylon coating applied by fluidized bed method. The coating shall comply with the requirements of NSF 61 and AWWA C550 as applicable. As an alternative a shop-coat primer suitable for field applied coatings can be supplied.

The Dismantling Joint shall comply with AWWA C.219 where applicable, and the manufacturer shall operate an accredited quality management system to ISO 9001. The design pressure rating shall be equal to or greater than the mating flanges. The gasket seal and compression stud and nut arrangement shall be independent of the tie rod restraint system. Tie Rod diameter shall be compatible with the corresponding bolt diameter of the mating flange. The Tie Rod restraint system shall be capable of withstanding the full pressure thrust that the pipe system can develop at no more than 50% of the yield strength of tie rod material. The Dismantling Joint shall be as manufactured by Romac Industries, Viking Johnson, or approved equal.

Spigot Piece shall be Steel that conforms to ASTM A283 Grade C

Flange Adapter (up to 12”) shall be Ductile Iron ASTM A536 Grade 65-45-12

Flange Adaptor (above 12”) shall be Steel ASTM A283 Grade C

Tie Bars shall be High Tensile Steel ASTM A193 Grade B7

Gaskets shall be EPDM compound conforming to ASTM D2000. Suitable for water.

Flange adaptor and flange spigot shall be fusion bonded epoxy coated. Tie bars, nuts and washers shall be zinc coated.

2.4 Pipe Coatings

See Division 9, Finishes, for coating of exposed pipe.

PART 3 EXECUTION

3.1 General

Pipe shall be installed in accordance with good trade practice. The methods employed in handling and placing of pipe, fittings, and equipment shall be such as to insure that after installation and testing they are in good condition. Should damage occur to the pipe, fitting or equipment, repairs satisfactory to the ENGINEER shall be made. The backfilling of buried pipe is specified in Division 2.

All piping and appurtenances shall be installed in the position and to accurate lines, elevations, and grades as shown on the plans or specified herein. Where possible, piping shall be sloped to permit complete drainage. Where grades are not shown, pipe shall be laid to grade between control elevations shown on the plans.

All buried non-ferrous piping shall be installed with detectable tracer tape. Tape shall be buried 12 inches below the ground and 12 inches above the top of the pipe or as recommended by manufacturer. Tape shall be continuous and labeled the same as the piping system.

3.2 Handling and Storage of Pipe

During loading, transportation and unloading, every precaution shall be taken to prevent injury to the pipe or pipe lining. Any damaged pipe shall be replaced or repaired to the satisfaction of the ENGINEER. Where pipe is placed in stockpiles, it shall be neatly piled and blocked with strips between tiers.

3.3 Pipe Supports and Hangers

A. All pipe shall be secured in place by use of blocking, hangers, brackets, clamps or other approved methods, and the weight thereof shall be carried independently of pump casings or equipment. Special hangers and supports are shown on the drawings. The CONTRACTOR shall be responsible for determining the location of and providing all additional supports.

B. Supports for exposed piping shall conform to the latest requirements of the ANSI Code for Pressure Piping B31.10 and MSS Standard Practice SP-58,

except as supplemented or modified by the requirements of this specification. Designs generally accepted as exemplifying good ENGINEERing practice by use of stock or production parts shall be utilized wherever possible.

C. Hanger supports shall be as noted below with at least one support adjacent to the joint for each length of pipe, at each change in direction and at each branch connection. Sufficient hangers shall be provided to maintain proper slope without sagging. Support spacing shall not exceed manufacturer's recommendations, nor as listed below.

Pipe	Maximum Support Spacing (Feet)
Steel Pipe	
Under 3 inches	6
3 inches and Over	12
Cast or Ductile Iron	
Under 4 inches	6
4 inches and Over	12
Stainless Steel and Galvanized Iron	
Under 1-1/2 inches	4
1-1/2 inches to 4 inches	6
Over 4 inches	12
Copper Pipe	6
PVC Pipe	
Under 2-1/2 inches	4
2-1/2 inches and Over	6

D. Spacing of clamps for support of vertical piping shall be close enough to keep the pipe in alignment as well as to support the weight of the piping and contents unless other vertical support is shown, but in no case shall be more than 12-feet.

E. Provide adjustable hangers for all pipes, complete with adjusters, swivels, rods, etc. Size hangers to clear insulation and guide where required, as well as support piping. All rigid hangers shall provide a means of vertical adjustment after erection. Hanger rods shall be machine-threaded. Continuous threaded rods will not be allowed.

F. Clevis or band-type hangers (B-Line FIG B3100) or approved equal shall be provided by CONTRACTOR. Strap hangers not permitted.

G. Provide floor stands, wall bracing, concrete piers, etc., for all lines running near the floors or near walls and which can not be properly supported or suspended by the walls or floors. Pipe lines near concrete or masonry walls

may also be hung by hangers carried from wall brackets at a higher level than pipe. Hanging of any pipe from another is prohibited.

H. Equipment shall be positioned and aligned so that no strain shall be induced within the equipment during or subsequent to the installation of pipework.

I. When temporary supports are used, they shall be sufficiently rigid to prevent any shifting or distortion of the piping or related work.

J. In erecting the pipe, a sufficient number of screwed unions or flanged joints shall be used to allow any sections or runs of pipe to be disconnected without taking down adjacent runs. Flexible couplings shall be installed where shown on the drawings and at such other points as may be required for ease of installation or removal of the pipe, subject to approval of the ENGINEER. Flexible couplings shall be of the positive lock type where necessary to prevent separation of pipe due to internal pressures.

3.4 Installation at Concrete Walls and Footings

A. Whenever a pipe line of any material terminates at, or through a structural wall or sump, the CONTRACTOR shall install in advance of pouring of concrete the fittings or special casting required for the particular installation.

B. Plastic pipe shall not be cast in concrete or masonry walls.

C. Pipe other than concrete, to be cast in water-bearing walls or more than four feet below grade shall have seep rings.

D. All buried piping entering structures shall have a flexible connection installed less than two feet outside the structure line or as close to the wall as practical.

3.5 Detailed Installation Requirements

A. Mechanical Joint Ductile Iron Pipe -- Mechanical joints shall be made as follows: Gland shall be placed on spigot end of pipe with lip extension toward the joint. The rubber gasket shall then be slipped on the pipe with its thick edge toward the gland. The gasket and joint surfaces shall then be slipped on the pipe with its thick edge toward the gland. The gasket and joint surfaces shall then be thoroughly wetted using a soapy solution made with vegetable soap or similar soap as recommended by the manufacturer. The spigot end of the pipe shall then be inserted to full depth on the mechanical joint socket and the gasket pressed firmly into place in the bell in order to obtain an even “set” all around the joint. The gland shall then be moved into place, the bolts inserted, and the nuts taken up tightly with fingers. The nuts shall then be tightened gradually by a wrench, a half turn at a time, moving wrench from

one nut to another repeating until all nuts are uniformly tight. Final tightness shall be with a torque wrench to the torque recommended by the pipe supplier. Retainer gland wedge screws shall be tightened in a similar fashion until nuts are twisted off.

B. Flanged Pipe -- Flanged joints shall be made up square, with even pressure on the gaskets, and shall be watertight.

C. Threaded Joints -- Threaded joints shall be made using the best quality TFE thread seal tape. All screwed joints shall be made tight with tongs and wrenches; caulking of any kind will not be permitted. Use of thread cement or caulking to make joints tight is prohibited. All cut ends shall be reamed to full bore before assembly.

D. Welded Joints -- Pipe to be joined by welding shall have beveled ends or other suitable ends for welded joints as approved by the ENGINEER. Qualified welders certified in accordance with the latest requirements of the American Welding Society "Standard Qualifications Procedures" shall complete all welding in a workmanlike manner.

Where welded joints are in pipe with protective coating inside pipe, any coating damaged by welding shall be replaced to a condition equivalent to the factory-applied coating to the maximum practicable extent. When pipe is too small to enter, couplings shall be welded into pipe near ends to be welded to provide access for replacing protective coating inside pipe. The protective coating shall be replaced with a similar and equal coating. External protective coatings and wrapping shall be provided at joints similar and equal to the factory-applied pipe coating. Welded joints shall be wire-brushed and free of all scale and loose material before applying protective coating.

E. Copper Piping -- Pipe joints shall be soldered with 95-5 wire solder, ASTM B32, Grade 95 TA, or as required by the UPC. Low temperature solder or screw joints permitted only at equipment subject to damage from heat or high temperature soldering. In making screwed joints, tin male threads with soft solder. Dielectric unions or insulated flanges shall be used for all connections between copper and ferrous materials.

F. PVC Piping -- solvent cementing unless otherwise shown or described herein shall make Pipe joints. Connecting surfaces of pipe and fittings shall be cleaned with methyl ethyl ketone or acetone and then coated with solvent cement and joined. Joints shall be held together until cement takes hold and pipe shall be bottomed in fittings. Sufficient solvent shall be used so that a bead of cement is formed between the pipe and fitting at the socket entrance. Installation shall be in strict conformance with the manufacturer's recommendations.

G. The joining of pipe lines other than specified above shall be by approved first class methods, using applicable procedures outlined above and/or manufacturer's recommended practices.

3.6 Testing

All plant piping systems shall be tested at 100 psi, minimum. Visual observation of all joints shall result in no observable leakage when maintained at the test pressure. Any leakage observed at any joints shall be repaired and the joint retested until no leakage is observed.

END OF SECTION

SECTION 15100

VALVES, GENERAL

PART 1 GENERAL

1.1 Description

A. The CONTRACTOR shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, installing, adjusting, and testing of all valves and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Where buried valves are shown, the CONTRACTOR shall install valve boxes to grade, with covers, and extensions.

B. The provisions of this Section shall apply to all valves and valve operators specified in the various Sections of Division 15 of these Specifications except where otherwise specified in the Contract Documents. Valves and operators in particular locations may require a combination of units, sensors, limit switches, and controls specified in other Sections of these Specifications.

1.2 Reference Specifications, Codes, and Standards

A. Commercial Standards

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inch)
ASTM A 36	Specification for Structural Steel
ASTM A 48	Specification for Gray Iron Castings
ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 536	Specification for Ductile Iron Castings
ASTM B 61	Specification for Steam or Valve Bronze Castings
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings

ASTM B 148	Specification for Aluminum Bronze Castings
ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications
ANSI/AWWA C500	Gate Valves for Water and Sewerage Systems
ANSI/AWWA C502	Dry-Barrel Fire Hydrants
ANSI/AWWA C503	Wet-Barrel Fire Hydrants
ANSI/AWWA C504	Rubber-Seated Butterfly Valves
ANSI/AWWA C507	Ball Valves 6 Inches Through 48 Inches
AWWA C508	Swing-Check Valves for Waterworks Service, 2 Inches Through 24 Inches NPS
ANSI/AWWA C509	Resilient-Seated Gate Valves for Water and Sewerage Systems
ANSI/AWWA C511	Reduced-Pressure Principle Backflow-Prevention Assembly
AWWA C550	Protective Interior Coatings for Valves and Hydrants
SSPC-SP1	Solvent Cleaning
SSPC-SP3	Power Tool Cleaning
SSPC-SP6	Commercial Blast Cleaning

1.3 Submittals

A. Shop Drawings -- Shop drawings of all valves and operators including associated wiring diagrams and electrical data, shall be furnished as specified in the contract documents and if specified in the individual valve sections.

B. Valve Labeling -- The CONTRACTOR shall submit a schedule of valves to be labeled indicating in each case the valve location and the proposed labeling for the label.

C. Lining and Coating Data

D. Manufacturer’s handling, delivery, storage and installation requirements.

E. Applicable material certifications and testing certifications and testing certificates.

1.4 Quality Assurance

A. Valve Testing -- Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. Bronze Parts -- Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62, or, where not subject to dezincification, to ASTM B 584.

C. Certification -- Prior to shipment, the CONTRACTOR shall submit for all valves over 12 inches in size, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc.

D. Unless otherwise noted, all water works materials provided for the project shall be new, of first class quality and shall be made by reputable manufacturers. All material of a like kind shall be provided from a single manufacturer unless otherwise approved by the ENGINEER. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage and handling. Where an item is to be used but does not have its quality specified herein, it shall be equal to that specified in the appropriate American Water Works Association (AWWA) Standard Specification.

1.5 Material Delivery, Storage and Protection

All valves and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials at no cost to the OWNER.

PART 2 PRODUCTS

2.1 General

A. Valve Flanges -- The flanges of valves shall be in accordance ANSI B16.1, ANSI B16.5 and ANSI/AWWA C115/A21.15 as required. CONTRACTOR shall coordinate with pipe, valve and fitting suppliers to make certain that pipe, valve and fitting flanges match in bolt pattern.

B. Valve Boxes -- White, Schedule 40, 8-inch Polyvinyl Chloride, (PVC), and valve box covers as shown on details installed as part of buried valve installations.

C. Protective Coating -- The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior

to shipment, in accordance with these Specifications. Flange faces of valves shall not receive protective coatings.

D. Valve Operators -- Valve operators shall be as shown or as specified for a valve type. Provide operator extensions to 12 inches below grade where depth to valve exceeds three (3) feet.

E. Valve Labeling -- If required by the drawings and/or these specifications, a label shall be provided on all exposed (not buried) shut-off valves exclusive of hose bibbs. The label shall be of 1/16-inch plastic or stainless steel, minimum two (2) inches by four (4) inches in size, and shall be permanently attached to the valve or on the wall adjacent to the valve as directed by the ENGINEER.

F. Bolts, Gaskets, Glands and Nuts -- Bolts, gaskets, glands, retainer glands, nuts and miscellaneous accessories required to install all valves shall be furnished and installed. Bolts and nuts for flanged connections shall be as specified elsewhere with American Standard regular unfinished square or hex heads. Gaskets for flanged connections shall be as specified elsewhere. Jointing materials for mechanical joints shall conform to AWWA C111.

G. Actuators -- Unless otherwise indicated, all valves and gates shall be furnished with manual actuators. Valves in sizes up to and including four (4) inches shall have direct acting lever or handwheel actuators of the Manufacturer's best standard design. Larger valves and gates shall have gear-assisted manual actuators, with an operating pull of maximum 60 pounds on the rim of the handwheel. Actuators shall be sized for the valve design pressure in accordance with AWWA C504. All gear-assisted valves that are buried, submerged or located in below grade vaults and all gates shall have the actuators hermetically-sealed and grease-packed. All valves six (6) inches to 30 inches in diameter may have traveling-nut actuators, worm-gear actuators, spur- or bevel-gear actuators, as appropriate for each valve. All buried valves shall be provided with 2-inch square operating nuts.

PART 3 EXECUTION

3.1 Valve Installation

A. General -- All valves, gates, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified. All gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe. Stem extensions shall be braced at no greater than 10 feet intervals and be provided with double universal joints to allow for misalignment.

B. Access -- All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

C. Valve Accessories -- Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the CONTRACTOR to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

D. Valve boxes -- All buried valves shall be furnished with valve boxes. For valves installed out of paved or otherwise hard surfaced areas shall be set in a concrete pad at finished grade. Concrete valve box pads shall be 18 inches square and be not less than 6 inches thick. Valve boxes, except those of special design as required by the plans, shall be of cast iron of the two-piece extension type with a cast iron cover. Valve boxes shall have walls not less than 3/16-inch thick at any point, and the internal diameter shall be not less than 5 inches. Valve box covers shall have the word “WATER” cast into them as appropriate to their place of use. Valve box covers shall be of design and construction which prevents dislodging and rotation from traffic and shall be of the type which allows a hand held pry bar to be applied for easy removal. Valve boxes shall be constructed of high quality castings and shall be the product of a manufacturer approved by the ENGINEER and/or OWNER.

END OF SECTION

SECTION 15104

PINCH VALVES

PART 1 GENERAL

1.1 Description

A. The CONTRACTOR shall furnish and install pinch valves, complete and operable, as shown on the Drawings and specified herein, including coatings and linings, appurtenances, operators, and accessories, in accordance with the requirements of the Contract Documents.

B. Pinch valves shall me manually actuated, unless shown otherwise on the Drawings. Pinch mechanism shall be mechanical, not pneumatic or hydraulic.

1.2 Submittals

A. As required by Section 15100.

PART 2 PRODUCTS

2.1 General

A. Pinch valves shall be designed to handle abrasive slurries and powders as well as corrosive liquids.

B. Pinch valves up to 12-inch size shall have the standard ASME/ANSI B-16.10 face-to-face dimensions.

C. Flange drilling shall be ANSI Class 125/150.

D. Pinch valves up to 6-inch size shall be full ported when fully open.

E. Valve closure shall be achieved by two mechanical pinch bars simultaneously closing on the valve centerline.

F. Pinch valve liner shall be NSF 61 listed.

2.2 Materials and Manufacturers

A. Valve body shall be cast iron or ductile iron, fully enclosed, split body. Interior and exterior shall have corrosion resistant fusion bonded epoxy coating. Valve shall achieve bi-directional bubble tight, centerline closure at the maximum work pressure.

B. Tube shall be constructed of pure, natural gum rubber reinforced with high strength fabric. Tube shall include positive opening tabs, secured to the outside of the tube by a belly band, to ensure full round configuration in full open position at low pressure conditions.

C. Pinch bar assembly shall be constructed of heavy-duty carbon steel, with the exception of the valve stem which shall be stainless steel.

D. Fasteners for bolting the upper and lower castings of the valve body together shall be stainless steel.

2.3 Operation

A. Valve shall be a mechanical pinch valve with a differential screw mechanism to ensure that both pinch bars simultaneously close on the valve centerline. The top pinch bar shall be raised (or lowered) directly by the threaded valve stem shaft. At the same time, the lower pinch bar shall be lowered (or raised) by a reverse threaded yoke located above the top pinch bar and connected to the lower pinch bar by two pull bars that pass through the ends of the top pinch bar.

B. In-Plant Service

1. Pinch valves for in-plant or exposed service shall meet the above specifications and shall be furnished with handwheel operators.

2.4 Manufacturer

A. Pinch valves shall be as manufactured by Red Valve, Series 75, without exception, to match existing pinch valves at the facility.

PART 3 EXECUTION

3.1 General

A. Valve installation shall be in accordance with Section 15100 and the manufacturer's requirements.

END OF SECTION

SECTION 15105

CHECK VALVES

PART 1 GENERAL

1.1 Scope

The CONTRACTOR shall furnish and install swing and silent check valves complete, as shown on the drawings and specified herein, including coating and lining, appurtenances, operators, and accessories.

1.2 Submittals

As required by Section 15100

PART 2 PRODUCTS

2.1 Materials

A. Swing Check Valves, 1-inch through 3 inch, inclusive

1. Swing check valves under 4 inches shall be Y-pattern check style and have a body constructed of 85-5-5-5 bronze conforming to ASTM B62. Check valves shall be capable of functioning in the vertical position. Swing check valve connections shall be standard threaded or threaded for fire hose connection where shown on plans.

B. Swing Check Valves, 4-inch through 24 inch, inclusive

1. Swing check valves, 4-inch and larger shall conform to all applicable provisions of AWWA C508. Valves shall be full waterway, rubber or metal seated, with end conditions as shown on the drawings. Valves shall close tightly when the pressure downstream of the valve disc exceeds the upstream pressure. Levers with weights or springs shall be provided for valves where shown on the Drawings.

2. Swing check valves 4-inch and larger shall be constructed of heavy cast iron conforming to ASTM A126 Class B or ductile iron conforming to ASTM A395 or A536. Swing check valves shall have bronze or composition rubber seat rings. The valve must be tight seating,

shockless in operation and absolutely prevent the return of water back through the valve. The body seat ring must be renewable.

3. Swing check valve discs shall be constructed of bronze (up to 6 inch) or cast iron and shall be suspended from a non-corrosive hinge pin shaft.

C. Manufacturers

1. Swing check valves 4 inch and larger shall be by M&H, Clow, APCO or approved equal.

2. Check valves 3 inch and under shall be Red-White Toyo, or approved equal.

PART 3 EXECUTION

3.1 General

Valve installation shall be in accordance with Section 15100 and manufacturer's requirements.

END OF SECTION

SECTION 15500

HEATING, COOLING AND VENTILATING

PART 1 GENERAL

1.1 Description

A. The CONTRACTOR shall remove and reinstall an existing relief louver.

B. The CONTRACTOR shall ensure that, after construction of the addition is complete and the existing louver is reinstalled, the ventilation system operates in the same manner as it operates prior to construction of the addition.

C. The CONTRACTOR shall furnish and install the anchors for the relief louver to produce a complete installation in accordance with the Contract Documents.

1.2 Reference Specifications, Codes and Standards

All work and materials shall be in full accordance with the latest rules and regulations or publications of the State Energy Resources Conservation and Development Commission, Sheet Metal and Air Conditioning Contractor's National Association (SMACNA), the State Fire Marshall, the Industry Safety Orders, the Health and Safety Rules (Air Conditioning Systems), the local Building Code and all other local codes. Nothing in the Contract Documents shall be construed to permit work in violation of the above codes, rules and regulations. In the absence of applicable codes, the installation and workmanship shall follow the standards set by the American Society of Heating, Refrigeration and Air Conditioning Engineers.

1.3 Contractor Submittals

A. Shop drawings shall be submitted in accordance with Section 01100 – Special Provisions, unless otherwise specified herein.

B. Submit shop drawings for the installation of the existing louver in its new location. Include details of sections and connections. Show anchorage and accessory items.

PART 2 PRODUCTS

2.1 General

A. All equipment and appurtenances shall be firmly anchored or connected to supporting members. All supports required for the proper installation of the

equipment shall be provided by the CONTRACTOR, unless otherwise indicated.

B. The installed system shall be free of any objectionable vibrations and noise.

C. All equipment supports, anchors and restraint shall be adequately designed for static, dynamic, wind and seismic loads.

PART 3 EXECUTION

3.1 General

A. The CONTRACTOR shall ascertain that all inserts, chassis, shafts and openings are correctly located; otherwise all new openings shall be cut at no additional expense to the OWNER.

B. The CONTRACTOR shall test and make tight all work, furnish all equipment necessary to carry out the tests and thoroughly clean the system before startup.

3.2 HVAC Equipment Installation

A. The installation of HVAC equipment shall conform to local codes and ordinances, NFPA 90A and SMACNA. Mounting and supporting of all equipment including accessories and appurtenances shall be provided; including, but not limited to, structural supports, hangers, vibration isolators, stands, clamps and brackets.

B. Installation shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Equipment shall be installed, leveled and located so that working clearance is available under overhead lines; and so that working space is available for all necessary servicing such as shaft removal, replacing or adjusting drives and motors, lubrication, filter replacement and access to automatic controls.

3.5 Electrical Work

Electric equipment wiring shall be UL listed and comply with requirements of NFPA 70 and Division 16 - Electrical Work

END OF SECTION

SECTION 16010

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 Description of Work

A. The work consists of furnishing all labor, materials, services, tools, and other equipment necessary for the construction, installation, connection, and testing of all electrical work for this project as shown on the drawings or specified herein.

B. The Contractor shall be responsible for provision of equipment including all enclosures, disconnects, package systems, lights, receptacles and the like, unless otherwise specified. In addition, the Contractor shall be responsible for the following:

1. Visit the site of proposed construction. Verify and inspect the existing site to determine all conditions that affect this work.

2. Investigate and be apprized of the applicable codes, rules, and regulations as enforced by Authorities Having Jurisdiction (AHJs).

3. Use this Specification as a guide for workmanship and materials of construction.

C. Costs/charges for installation of all permanent and temporary facilities shall be included in the lump sum bid for each of the pumping stations. This includes any up-front money required by the utility to provide permanent service.

D. Electrical Contractor installs and terminates wiring for I&C system

1.2 Related Work

A. Section 16100 - Basic Materials and Methods

B. Section 16400 – Service and Distribution

C. Section 16450 - Grounding

D. Section 16500 – Lighting

E. Section 16900 – Motors & Controls

1.3 Intent of Drawings and Specifications

A. Riser and other diagrams are schematic only and shall not be used for obtaining quantities.

B. The electrical drawings do not show complete details of the site conditions. The Contractor shall verify actual conditions at the project site.

1.4 Coordination of Work

A. The Contractor shall plan his work in coordination with the power utility authorities.

B. The Contractor shall verify all dimensions of equipment to be installed, whether furnished by Contractor or provided by others, so that correct clearances and connections may be made.

C. The Contractor shall arrange all conduit runs so that they do not interfere with duct work, structural members, etc.

D. All working measurements shall be taken from the sites, checked with those shown on the drawings, and if they conflict, reported to the Engineer at once, and before proceeding with the work. Should the Contractor fail to comply with this procedure, he shall alter his work at his own expense as directed by the Engineer.

E. No extra payments will be allowed where obstructions in the work of other trades, or work under this contract requires offsets to conduit runs.

1.5 Supervision

A. The Contractor shall maintain adequate supervision of the work and shall have a responsible person in charge during all times that work under this contract is in progress, or when necessary for coordination with other work.

1.6 Codes

A. Work shall conform to the National Electrical Code (NEC), State codes, and other applicable codes, even though not specifically mentioned for each item. These shall be regarded as the minimum standard of quality for materials and workmanship.

1.7 Workmanship

A. All work shall be performed by personnel skilled in the particular trade. Workmanship shall conform to National Electrical Contractors' Association (NECA) Standard of Installation.

B. The Engineer shall be the sole judge as to whether or not the finished work is satisfactory; and if in his judgment any material or equipment has not been properly installed or finished, the Contractor shall replace the material or equipment whenever required, and reinstall in a manner entirely satisfactory to the Engineer without any increase in cost to the Owner.

C. The following shall be regarded as the minimum standard of quality for materials and workmanship even though not specifically mentioned for each item:

1. Conform to requirements of the NEC, latest adopted version with amendments by local AHJs.

a. All work shall meet all requirements of the NEC for wet locations. All wiring methods shall conform to NEC requirements for Wet Locations.

2. Obtain and pay for electrical permits and inspections from local AHJs.

3. Furnish products listed by a Nationally Recognized Testing Laboratory (NRTL), such as UL or other testing firm acceptable to AHJ.

4. Conform to requirements of the serving electric, telephone, and internet utilities as they apply.

1.8 Permits, Fees and Service Charges

A. Contractor shall obtain all electrical permits and pay all related fees.

1.9 Contractor's Record Drawings

A. The Contractor shall maintain a neatly marked set of record drawings. In addition, the locations of panels, field mounted instruments and panels, terminal boxes, junction boxes and any other materials included in this contract shall be shown. Drawings shall be kept current with the work as it progresses and shall be subject to inspection by the Engineer at any tine.

PART 2 PRODUCTS

2.1 Materials

A. Provide new electrical materials of the type and quality detailed, listed by UL, bearing their label wherever standards have been established. Indicated brand names and catalog numbers are used to establish standards of performance and

quality. The description of materials listed herein governs in the event that catalog numbers do not correspond to materials described herein.

B. Provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example, provide wet labeled equipment in locations that are wet.

2.2 Portable or Detachable Parts

A. The Contractor shall retain in his possession and shall be responsible for all portable and detachable parts or portions of installations such as fuses, key locks, adaptors, blocking chips, and inserts until completion of his work.

B. These parts shall be delivered to the Engineer and an itemized receipt obtained. This receipt, together with 2 copies of the final inspection certificate, shall be attached to the Contractor's request for final payment.

C. All equipment shall be demonstrated to operate in accordance with the requirements of this specification and the manufacturer's recommendation.

2.3 Rubber Matting

A. Install rubber floor matting in front of all power distribution equipment, motor controllers and control panels.

B. Corrugated non-slip rubber mat of high dielectric strength and long aging qualities. Mat size, minimum of 36 inches wide extending the entire length of each power panel and control panel. Comply with ASTM Specification D178.24. 10,000 volt minimum dielectric strength, 3/16” thick.

2.4 Accessories

A. Include special features, finishes, accessories, and other requirements as described in the Contract Documents regardless of the item's listed catalog number.

B. Provide incidentals not specifically mentioned herein or noted on Drawings, but needed to complete the system or systems, in a safe and satisfactory working condition.

PART 3 EXECUTION

3.1 Examination

A. Construction Documents:

1. Drawings are diagrammatic with symbols representing electrical equipment and wiring.

2. Electrical symbols indicating wiring and equipment shown in the Contract Documents are included in the Contract unless specifically noted otherwise.

3. Examine the entire set of Drawings to avoid conflicts with other systems. Determine exact route and installation of electrical wiring and equipment with conditions of construction.

B. Clarification:

1. The Drawings govern in matters of quantity, the Specification in matters of quality. In event of conflict on Drawings or in the Specifications, the greater quantity and the higher quality apply.

2. Should the Electrical Documents indicate a condition conflicting with the governing codes and regulations, refrain from installing that portion of the work until clarified by Engineer.

3.2 Protection During Construction

A. Throughout this Contract, provide protection for materials and equipment against loss or damage in accordance with provisions elsewhere in these Contract Documents. Protect everything from the effects of weather.

B. Prior to installation, store items in clean, dry, indoor locations. Store in clean, dry, indoor, heated locations items subject to corrosion under damp conditions, and items containing electrical insulation, such as transformers, and conductors. Energize all space heaters furnished with equipment.

C. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction. Energize all space heaters furnished with equipment.

3.3 Installation

A. Install electrical equipment complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of the electrical equipment, examine the instructions thoroughly. When requirements of the installation instructions conflict with the Contract Documents, request clarification from Engineer prior to proceeding with the installation.

B. Do not install electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block the area passage's intended usage.

C. Do not install outlet boxes back to back. Do not use straight through boxes.

D. Earthwork:

1. Perform excavation and backfill for the installation of electrical work.

E. Support Backing:

1. Provide any necessary backing required to properly support all fixtures and equipment installed under this contract.

F. Cutting, Patching, and Framing:

1. The Contractor shall determine in advance the locations and sizes of all sleeves, chases, and openings necessary for the proper installation of his work.

2. Whenever practical, inserts or sleeves shall be installed prior to covering work. Cutting and patching shall be held to a minimum. All required holes in concrete construction shall be made with a core drill and patched with non-shrink grout.

3. Cutting, fitting, repairing, and finishing of carpentry work, metal work, or concrete work, and the like, which may be required for this work shall be done by craftsmen skilled in their respective trades. When cutting is required, it shall be done in such a manner as not to weaken walls, partitions, or floors; and holes required to be cut in floors must be drilled without breaking out around holes.

G. Cleaning and Touchup Painting:

1. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from

premises and from interior and exterior of all devices and equipment. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the color, consistency, and type of surface of the original finish.

3.4 Field Quality Control

A. Inspection

1. All materials, equipment, and workmanship shall be subject to inspection at any time by the Engineer, or his representatives. Correct work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the Engineer.

B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified in Division 16. Refer to individual Specification Sections for required tests. Document tests and include in Closeout Documents.

2. During site evaluations by Engineer provide an electrician with tools to remove and replace trims, covers, devices, and the like, so that a proper evaluation of the installation can be performed.

3. The Contractor shall furnish all labor, material, instruments and tools to make all connections for testing of the electrical and instrumentation installation. All equipment shall be demonstrated as operating properly prior to the acceptance of the work. All protective devices shall be operative during testing of equipment.

4. General:

a. Perform the tests as described below. Upon completion of all tests, submit written test results in duplicate for approval by the Engineer prior to acceptance.

b. After visual inspection of joints and connections and the application of tape and other insulating materials, all sections of the entire wiring system shall be thoroughly tested for shorts and grounds. A log of results for each circuit shall be kept by the Contractor and presented to the Engineer.

c. Equipment shall be tested by operating all electric motors, relays, controls, switches, heaters, etc. sufficiently to demonstrate proper installation and electrical connections. Control and emergency conditions shall be artificially simulated where necessary for complete system or subsystem tests.

d. Insulation resistance measurements of each circuit shall be made with loads connected and contactors, if any, blocked closed to give complete circuits. Insulation resistance of complete circuit shall be measured from the circuit breaker load terminals with the breaker open. A log of complete results shall be prepared by the Contractor and presented to the Engineer. Values of resistance shall be 10 megaohms or greater.

3.5 Cleaning

A. Remove dirt and debris caused by the execution of the electrical work.

B. Leave the entire electrical system installed under this Contract in clean, dust-free and proper working order.

C. Vacuum clean interiors of electrical equipment enclosures.

END OF SECTION

SECTION 16100

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 Description of Work

A. The work consists of furnishing all labor, materials, and equipment required for electrical work shown on the drawings and as further described in these specifications.

1.2 Related Work

A. Section 16010 – General Electrical Requirements

B. Section 16400 – Service and Distribution

C. Section 16450 - Grounding

D. Section 16500 – Lighting

E. Section 16900 – Motors & Controls

1.3 Regulations and Permits

A. The Contractor shall comply with all applicable codes, ordinances, and regulations, including the National Electrical Code, National Electrical Safety Codes, and the State of Oregon.

B. The Contractor shall obtain a Certificate of Electrical Inspection from the local inspecting authority and submit to the owner upon completion of the project.

1.4 Submittals After Award of Contract

A. Submittals after award of Contract shall be made in accordance with Section 01300, SUBMITTALS.

PART 2 PRODUCTS

2.1 Raceways

A. All raceways shall be UL approved for the application.

B. Rigid Steel Conduit (RGS): Provide zinc-coated rigid steel conduit conforming to Federal Specification WW-C-581 for exposed use.

C. PVC Coated Rigid Galvanized Steel (PVC-RGS): Provide rigid polyvinyl chloride (PVC) coated conduit for exposed use in corrosive environments. Rigid conduit used in the coating process shall be hot dipped galvanized inside and out in accordance with of the latest edition of Federal Specification WW-C-581-E, ANSI Standard C-80.1, and UL Standard #6. Finished conduit shall conform to the current NEMA RN-1 Standard and shall have label affixed indicating compliance with UL Standard #6.

D. Rigid PVC Conduit (PVC): Provide rigid polyvinyl chloride conduit, schedule 40, UL listed for concrete encasement and for direct burial underground. Rigid PVC conduit, including couplings, elbows and nipples, shall conform to the requirements of the latest edition of Federal Specification WW-C-1094, NEC, and UL standards.

E. Flexible Metallic Conduit (FLEX): Provide liquid tight flexible conduit, zinc-coated steel core, extruded gray PVC cover, UL approved, Sealtite type "UA" or Liquatite type "LA," or approved equivalent.

2.2 Conduit Fittings and Accessories

A. Provide conduit fittings as follows unless otherwise noted or detailed. Catalog numbers shown are Appleton Electric Company unless otherwise noted. Other brands of the same construction will be accepted.

B. Fittings

Rigid Conduit 90 Degrees Elbows	Series LMFL, ELMF
Rigid Conduit Pulling Ells	Series LB, LL, LR, FFL, MFL
Rigid Conduit Expansion Unions	UNY, UNF, Expansion Series
Sheet Steel and Fiberglass Enclosures	Watertight HUB Series
Liquidtight Insulated Connectors Throat	-STB, STN, STL, STNMSeries

C. PVC Conduit Fittings

1. Provide conduit fittings as follows unless otherwise noted or detailed. Catalog numbers shown are Carlon Electrical Products. Other brands of the same construction will be accepted.

2. Conduit body, type T, 1/2 inch, part no. E983D

3. Conduit body, type LL, 1/2 inch, part no. E984D

4. Conduit body, type LR, 1/2 inch, part no. E985D

5. Conduit body, type LB, 1/2 inch, part no. E986D

6. Strain relief connectors and grommets, part no. H978E

7. PVC locknut, 1/2 inch, part no. LT9LD

8. Schedule 40 long line coupling, 2 inch, part no. E941J

2.3 Junction, Pull and Outlet Boxes

A. Provide metallic outlet boxes as follows unless otherwise noted or detailed. No nonmetallic boxes will be permitted.

1. Boxes on rigid conduit systems shall have threaded hubs and case gasketed cover, meeting F.D. W-C-586. Any type, design, form, and style will be acceptable unless otherwise specified or shown on the drawings.

2.4 Wiring Devices

A. Provide wiring devices indicated. Catalog numbers shown are Hubbell-Bryant unless otherwise noted. Equivalent devices by other manufacturers may be substituted. All devices shall be submitted for approval. Provide all similar devices of same manufacturer unless indicated otherwise.

B. Switches: Provide flush switches, AC-type, rated 20 amp or higher suitable for the type load to be controlled.

1. 3-Way: 4903B-GRY

C. Receptacles: Provide grounding-type receptacles as follows, all receptacles shall be Ground Fault Interrupter (GFI).

1. Ground fault interrupter:

a. Unit shall be furnished with internal, solid state, ground fault current sensing and tripping.

b. The receptacles shall include built-in "TEST" and "RESET" switches and "TRIPPED" indicator and shall be rated 20-amp, 120-volt.

c. The "GFI" receptacle shall be the "feed-thru" type and shall protect all receptacles on the same circuit.

d. Heavy-duty commercial grade: GFTR20GY

2.5 Plates

A. Provide plates for all wiring devices. Where devices are installed in exposed fittings or boxes, use Appleton, Pyle-National, Crouse-Hinds, or equal, "FSK" covers. Where weatherproof devices are specified or required, provide UL-Listed NEMA 3R, cast aluminum, in-use, weatherproof covers. Hubbell WP26M or approved. Provide stainless-steel plates in all other finished areas.

Conductors and Cables

A. This specification covers all conductors not specifically specified in other sections. Furnish conductors and cable conforming to UL, Federal Specification J-C-30, or IPCEA as applicable. Provide new cable manufactured within 1 year prior to installation. Deliver to jobsite in original cartons bearing UL label.

B. Lighting and Control Circuits: Provide stranded copper conductors. Aluminum will not be allowed. Copper conductors shall conform to Federal Specification J-C-30. For type THHN/THWN, provide thermoplastic insulation conforming to ICEA S-73-532. Color code insulation for wire sizes No. 14 through No. 6.

C. Power and Distribution Circuits: For type XHHW, provide insulation conforming to ICEA S-66-524.

D. Provide control cable with 600 volt TW type insulation for all multi-conductor, Class 1 remote control and signal wiring unless otherwise specified. Provide overall jacket complying with ICEA S-61-402. Color code control cable in accordance with ICEA S-61-402, Table 5-1.

E. Minimum conductor size: Provide No. 12 AWG minimum branch circuit wire size. Provide No. 14 AWG control circuits unless otherwise specified or required by over-current protection. Provide smaller conductor sizes for specific applications where minimum size requirements cannot physically be accommodated.

F. Class 2 remote control and signal conductors: Provide cables UL approved for such use. Voltage rating shall be not less than 600 volts. Utilize multi-conductor cables with like or related functions generally grouped together. Unless otherwise specified or shown on the drawings, utilize No. 14 AWG conductors.

G. Instrumentation cables: Multi-conductor cables shall have the quantity and size of conductors shown on the plans. Individual conductors shall be bare soft annealed copper Class B, 7-strand concentric per ASTM B-8. Individual

conductor insulation shall be flame-retardant per UL 13, 15 mils nominal thickness, with a 105 degree C temperature rating. Conductor pairs shall be uniquely identified according to manufacturer's standard method. Overall cable assembly shall have 2.35 mil (minimum) aluminum-polyester tape shield overlapped for 100% coverage and provided with a 7-strand tinned copper drain wire the same size as an individual conductor. The jacket shall be flame-retardant per UL 13, with a 105 degree C temperature rating and a rip cord laid longitudinally under the jacket to facilitate removal. Conductors shall be twisted pairs and the cable shall be rated for operation to 600 volts.

H. Twisted shielded pairs (TSP) shall be 7 or 19-strand, No. 16 AWG, tinned-copper conductors, 600 volt, individually insulated with color-coded cross-linked polyethylene, insulated conductors twisted into a pair, pair-shielded with a spirally applied aluminum/mylar tape shield and a 7-strand drain wire. Cable to have an overall 45 mil jacket.

2.6 Mounting Hardware

A. Provide stainless steel mounting hardware in exposed locations.

PART 3 EXECUTION

3.1 Conduit Installation

A. Conduit buried in earth: Install raceways to provide not less than 30 inches cover to finished grade. Pitch to drain away from buildings; avoid trapped runs. Grade trenches and place pipe bedding material to provide uniform trench bottom for raceway support. Buried raceway (including raceway installed under slab) shall not be smaller than 1 inch and shall be Schedule 40 PVC as specified. All underground elbows shall be PVC coated RGS. All interior stub-up conduit sections shall be RGS; make transition from PVC to RGS under slab.

B. Provide rigid steel conduit for raceways embedded in structural reinforced concrete, for all exposed installations unless otherwise directed in the contract documents; for sizes 1.25-inch and larger; and at all locations not otherwise specified.

C. Provide flexible (FLEX) connections at all motors and transformers plus other equipment connections subject to vibration. Utilize suitable fittings, keep route neat, at nominal right angles, and in conformance with equipment lines.

D. Exposed conduit shall be run in straight lines parallel to column lines, walls, or beams. Where conduit is grouped, the bends and fittings shall be installed to

present an orderly appearance. Unnecessary bending or crossing shall be avoided.

E. Supports for exposed conduit runs shall be furnished and installed within 3 feet of each box. Supports shall be secured by means of expansion inserts in concrete.

F. Conduit and fittings shall be properly protected during the construction period against mechanical injury from any cause. Conduit which extends out of floors, walls or slabs shall be boxed or otherwise protected and ends shall be capped with metal pipe plugs.

G. Rigid conduit joints and connections shall be made thoroughly watertight and rustproof by means of thread compound which will not insulate the joint. Each threaded joint shall be thoroughly cleaned to remove all the cutting oil before the compound is applied. Running threads will not be allowed. Erickson couplings may be used in dry and exposed locations provided that they are installed with fixed threaded connection at the top of vertical runs.

H. Size: Use raceways no smaller than 3/4-inch, but in no instance shall raceways be smaller than as shown in the circuit schedule.

I. Raceways in reinforced concrete: Do not displace reinforcing steel to accommodate the installation of raceways and outlet boxes. In general, locate all embedded conduits in the physical center of the particular section of concrete. Wooden plugs inserted in concrete or masonry are not acceptable as a base for raceway fastenings.

3.2 Wire and Cable Installation

A. Conduit shall be thoroughly cleaned of all foreign material just prior to pulling the wire or cable. Lubricants shall be compounds specifically prepared for cable pulling and shall not contain petroleum or other products that will affect cable insulation. Lubrications shall be UL approved.

B. Splicing of conductors No.8 AWG or smaller shall be by pre-insulated spring-pressure connectors, such as "Scotchlok" Types Y, R and B, or Ideal "Wingnut." Similar products by other manufacturers may be considered for use on this project based on comparison to these lines. Approval of substitutions is solely at the discretion of the Engineer. All uninsulated splices, joints, and free ends of conductors shall be covered with rubber and friction tape or high-dielectric strength, plastic tape. All splices in underground boxes or direct buried shall be insulated and waterproofed, using scotchcast epoxy splicing compounds suited for the purpose.

C. Terminal strips in panels shall be identified throughout the equipment utilizing unique numbering system at the equipment enclosures and control panels.

D. Wires terminating on terminal strips shall be tagged with the designation of the terminal strip and the number of the terminal to which they are connected. Wires shall be numbered with Brady heat shrink wire markers at all accessible locations. Wire markers shall be permanent type. Submit shop drawings of the type to be used for approval.

E. Wiring diagram shall show the terminal strips, terminals, and their identifying designations.

F. Color code

1. All secondary service, feeder, and branch circuit conductors shall be color coded as follows:

240/120 Volt	Phase	480/277
Black	A	Brown
Red	B	Orange
N/A	C	Yellow
White	Neutral	Gray

2. All No. 12 and No. 10 branch circuit conductors shall have solid color compound or solid color coating. All neutral sizes shall have solid color compound or solid color coating.

3. No. 8 AWG and larger phase conductors shall have either:

a. Solid color compound or solid color coating.

b. Stripes, bands, or hashmarks of colors specified above.

c. Colored pressure-sensitive plastic tape. Tape shall be applied in half overlapping turns for a minimum of 3 inches for all terminal points, and in all junction boxes, pull boxes, troughs, manholes, and handholes. Tape shall be 3/4-inch wide with colors as specified above. The last two laps of tape shall be applied with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.

G. Installation: Keep all conductors within the allowable tension limits during installation. Lubricants for wire pulling, if used, shall be approved for the insulation and raceway material. Observe cable manufacturer's and industry standard cable bending radius recommendations. For type THHN/THWN

conductors, avoid abrasion and damage to outer jacket. Wiring showing damage after installation shall be replaced by the Contractor at his own expense.

H. Observe code restrictions with respect to wet and dry locations. At the Contractor's option, conductors with insulation systems rated for high operating temperatures may be substituted for lower temperature rated conductors. However, no reduction in conductor size will be permitted from that indicated. When using small diameter wire, do not reduce conduit size below that required for Type THW as shown in NEC Table 3A.

I. 600 volt conductors: Provide one of the conductor types indicated for the function and location listed below unless otherwise indicated on the drawings or approved by the Engineer. Provide ground and neutral wires identical to circuit wires.

LOCATION	THHN/THWN	XHHW
Lighting Circuits Interior: General	X	
Special fixture requirements	X	
Within 3 inches of ballast	X	
Receptacle and single-phase	X	
Single Phase Motor circuits:		X
Polyphase motor circuits		X
Motor controls	X	
Power outlets		X
Feeders		X
Underground-in raceway		X

J. Wire Pulling:

1. Provide suitable installation equipment to prevent cutting or abrasion of conduits during pulling of feeder.

2. Ropes used for pulling feeders shall be made of suitable non-metallic material.

3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Engineering.

4. All cables in a single conduit shall be pulled in together.

5. The cable jacket and/or conduit walls shall be completely lubricated when cable is pulled into conduit. The lubricant shall be applied

immediately before or during a pull. Minimum quantities of lubricant are as follows:

a. One (1) quart of lubricant per 100 feet of 1-inch conduit

b. Two (2) quarts of lubricant per 100 feet of 2-inch conduit.

c. Three (3) quarts of lubricant per 100 feet of 3-inch conduit.

d. One (1) gallon of lubricant per 100 feet of 4-inch conduit.

e. This quantity shall be increased as needed for difficult pulling situations (high temperatures, multiple bends, poorly placed conduit, etc.)

K. Cable Installation:

1. Pull conductors simultaneously where more than one cable is indicated in same raceway. Use NRTL-listed and manufacturer-approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

2. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables at intervals adequate to prevent sag.

3. Install terminations at ends of conductors with standard kits. Conform to manufacturer's written instructions. Comply with classes of terminations indicated.

END OF SECTION

SECTION 16400

SERVICE AND DISTRIBUTION

PART 1 GENERAL

1.1 Description of Work

A. Work consists of providing the complete service and distribution system shown on the drawings and specified herein. The requirements of all other sections of the specification are equally applicable to the work to be performed under this section.

1.2 Related Work

A. Section 16010 – General Provisions

B. Section 16100 - Basic Materials and Methods

C. Section 16450 - Grounding

D. Section 16500 – Lighting

E. Section 16900 – Motors & Controls

1.3 Submittals

A. Submit product data and shop drawings of the following for approval of the Engineer:

1. Safety Switches and Disconnects

PART 2 PRODUCTS

2.1 Safety Switches and Disconnecting Means

A. Furnish safety switches and disconnecting means where required by the NEC, state and local codes or where required by the AHJ. All equipment shall conform to NEMA standards latest revision as applicable.

B. Switches shall be heavy-duty class, quick-make, quick-break, safety-type, externally operable, with by-passable interlock to prevent opening of cover in

"ON" position. Switch shall have positive indication of "OFF" and "ON" position. Devices shall have visible blades unless molded-case breaker mechanism is used. Switches shall be so constructed as to preclude single phasing of switch blades due to mechanical failure. Switches shall be padlockable in the "OFF" position.

C. Switches shall be of the proper horsepower, ampere and voltage rating with number of poles required to open all ungrounded conductors and with a solid neutral (S/N) bar where required. Provide auxiliary switch contacts in all disconnect switches to monitor the status of the disconnect switch.

D. Unless otherwise indicated, individually-mounted switches shall be in NEMA type 12 enclosures except in wet locations or where indicated as weatherproof, in which case NEMA type 4 stainless steel enclosures shall be provided.

PART 2 EXECUTION

3.1 Equipment Bases

A. Provide equipment bases for all floor-mounted electrical equipment. Unless otherwise indicated, bases shall be poured-in-place concrete, nominally four inches high, and be one inch larger on all exposed edges than the equipment to be mounted. On all equipment bases in interior locations, unless otherwise noted, provide two or more parallel, cast-in-place continuous-slot channel erection system concrete inserts for equipment mounting. Bolt equipment to channels. Provide additional surface-mounted channels where required to match and lineup with existing equipment. Provide concrete pads and mounting provisions for all exterior equipment as indicated on the drawings or specified in other portions of the specifications.

3.2 Supports

A. Provide hangers or other devices such as pads, channels, struts, joists, anchors, etc., necessary for the support of electrical equipment. Provide the design, fabrication and erection of supplementary structural framing electrical equipment. Show on shop drawing supplementary framing including design loads, member size and location. When supplementary framing is indicated, verify that dimensions are suitable for the equipment furnished. Provide additional strength when equipment furnished is heavier than that specified.

3.3 Damp and Wet Location

A. Provide 1/4-inch air space behind all electrical equipment mounted in damp and wet locations and on concrete walls below grade. Use corrosion-resistant washers, bolts and anchors.

3.4 Mechanical Equipment

A. Provide convenience receptacle and disconnect for each mechanical device as required by NEC 210.63, and NEC 430.101 through 430.113.

3.5 Start-Up and Testing

A. Inspect for proper wiring and functionality.

END OF SECTION

SECTION 16450

GROUNDING

PART 1 GENERAL

1.1 Related Work

A. Section 16010, General Electrical Requirements

B. Section 16100, Basic Electrical Materials and Methods.

C. Section 16400, Service and Distribution.

D. Section 16500, Lighting.

E. Section 16900, Motors and Controls.

1.2 System Description

A. Provide grounding and bonding of circuits, equipment, signal, and control systems.

B. Performance Requirements: Supplement the grounded neutral of the secondary distribution system with an equipment grounding system to properly safeguard the equipment and personnel. Install equipment grounding such that all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in close proximity with electrical circuits operate continuously at ground potential and provide a low impedance path for possible ground fault currents.

1.3 Submittals

A. Provide Shop drawings and product data for the grounding material.

1.4 Regulatory Requirements

A. Conform to requirements of the NEC, latest adopted version with amendments by local AHJ's.

B. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 PRODUCTS

2.1 Materials

A. Ground Rods: Copperclad steel, 3/4-inch diameter, 10-feet long, tapered point, chamfered top. Manufacturers: Weaver, Thomas & Betts, Talley, or approved.

B. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors. Mechanical type of connectors are not acceptable. Manufacturers: Burndy Hyground Compression System, Erico/Cadweld, Amp Ampact Grounding System or approved.

C. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe. Burndy GAR Series, O-Z Gedney, Thomas & Betts or approved.

D. Telecommunications Grounding Bar: 1/4-inch thick by 4-inch high by 20-inch long copper ground bar with insulators. Manufacturers: Erico/Cadweld or approved.

E. Grounding Electrode Conductor: Bare copper stranded conductor.

PART 3 EXECUTION

3.1 General

A. Provide all grounding systems and make connections mechanically secure and electrically continuous. Ground all line voltage electrical systems completely and effectively as required by code and as specified herein.

B. Ground all raceway systems and equipment enclosures. Where not otherwise indicated, grounding conductor size shall conform to the most stringent of the governing codes, except that no grounding conductor shall be smaller than 12 AWG.

1. Ground the service and transformers in an approved manner.

2. Provide grounding where indicated on the drawings. All ground mat conductors shall be bare soft drawn copper, sized as noted. Bury all conductors approximately 12-inches below grade.

3. Grounding conductor connections shall be bolted except at inaccessible ground rods, buried ground conductors and reinforcing steel grounding conductor connections, where connections shall be brazed. Consideration will be given to bolted connections in lieu of brazed connections, subject to the Engineer's approval. Exothermic welded connections may be substituted for brazed connections subject to the Engineer's approval and demonstration on the project with actual test connections that the connections will be successfully made.

4. Equipment grounding conductors, unless otherwise noted, shall be the same insulation type as the circuit conductors and shall be run in conduit.

5. Continuity of equipment ground shall be maintained throughout the entire raceway, cabinet and equipment enclosure system. Ground bushings and jumpers shall be used wherever normal conduit termination does not insure continuity. Where nonmetallic conduit is used for distribution or where direct burial cables are employed, install a green insulated equipment ground conductor with each circuit.

6. Metal parts of lighting fixtures not otherwise grounded by bolted fastenings shall be bonded to conduit system with green ground wire. Receptacles shall be grounded to outlet boxes with green ground wire and machine screw.

7. Motors and equipment shall be bonded to the equipment grounding system by a continuous green insulated equipment ground conductor run with each circuit through approved flexible conduit connections as permitted by code. Where flexible conduit size exceeds the code approved limits, provide a separate green grounding conductor inside each flexible conduit, bonded to the inside of the connection box and to the nearest accessible supply end conduit junction box.

8. Where concrete pad is provided for utility-furnished transformers, suitable grounding systems shall be provided under this section, including driven ground rods. Installation shall conform with the serving utility company requirements.

3.2 Installation

A. Raceways:

1. Ground all metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger grounding conductor is included with circuit, use grounding bushing with lay-in lug.

2. Connect all metal raceways, which terminate within an enclosure but without mechanical connection to the enclosure, by grounding bushings and ground wire to the grounding bus.

3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.

4. Install equipment grounding conductor, code size minimum unless noted on Drawings, in all nonmetallic and metallic raceway systems.

B. Feeders and Branch Conduits:

1. Install continuous insulated equipment copper ground conductors within the following circuits; feeders, circuits for computer systems and other circuits as indicated on Drawings.

2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment ground conductors for feeders and branch circuits sized in accordance with Table 250-95.

C. Boxes, Cabinets, Enclosures and Panelboards:

1. Bond grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.

2. Bond all sections of service equipment enclosure to service ground bus.

D. Motors, Equipment and Appliances: Install code size equipment grounding conductor from outlet box to (motor) equipment frame or manufacturer's designated ground terminal.

E. Receptacles: Connect ground terminal of receptacle to equipment ground system by No. 14 conductor bolted to outlet box except isolated grounds where noted. Self grounding nature of receptacle devices does not eliminate conductor bolted to outlet box.

F. Separately Derived Systems: Ground each separately derived system per NEC 250-26.

END OF SECTION

SECTION 16500

LIGHTING

PART 1 GENERAL

1.1 Related Work

A. Section 16010 – General Electrical Requirements

B. Section 16100 – Basic Electrical Materials and Methods

C. Section 16400 – Service and Distribution

D. Section 16450 - Grounding

1.2 Submittals

A. Submit for:

1. Luminaires: Include electrical ratings, dimensions, mounting, material, required clearances, terminations, wiring and connection diagrams, photometric data, diffusers, and louvers.

2. Ballasts.

3. Lamps.

4. Emergency lighting equipment.

B. Provide the following operating and maintenance instructions from the manufacturer for project closeout, see Project Closeout Requirements in Division 1:

1. Luminaires.
2. Ballasts.
3. Lamps.
4. Emergency lighting equipment.

1.3 Quality Assurance

A. Regulatory Requirements:

1. Provide luminaires acceptable to code authority for application and location as indicated.

2. Comply with applicable ANSI standards pertaining to lamp materials, lamp ballasts and transformers, and luminaires.

3. Comply with applicable NEMA standards pertaining to lighting equipment.

4. Provide luminaires and lampholders which comply with UL standards and have been UL listed and labeled for location and use indicated.

5. Comply with NEC 410 as applicable to installation and construction of luminaires.

6. Comply with fallout and retention requirements of UBC 52 for diffusers, baffles, louvers, and the like.

1.4 Warranty

A. Ballast Manufacturer's Warranty: Not less than 2 years for LED drivers and 5 years for electronic ballasts, based on date of manufacturer embossed on ballast, current with installation date. Warranty includes normal cost of labor for replacement of ballast or driver.

B. Lamp Warranty: 12 months for fluorescent and HID lamps, minimum. 36 months for LEDs, minimum.

1.5 MAINTENANCE

A. Furnish (2) extra lens or louvers for each size and type of fluorescent luminaire.

B. Furnish (4) extra lamps for each size and type of fluorescent lamp installed.

C. Furnish (2) extra ballasts for each size and type of fluorescent luminaires.

PART 2 PRODUCTS

2.1 Luminaires

A. Luminaires: Refer to description and manufacturers in Luminaire schedule.

B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.

C. Luminaires installed under canopies, roof or open porches and similar damp or wet locations, UL labeled as suitable for damp or wet locations.

D. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper trim, frame and modify luminaire to fit location and ceiling material.

E. Finishes:

1. Manufacturer's standard finish (unless otherwise indicated) over a corrosion resistant primer.

2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectances.

3. Exterior Finishes: As detailed in luminaire schedule or on Drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.

2.2 Ballasts

A. Ballasts, General:

1. Provide ballasts rated for specified lamps, i.e., T-8 rated ballasts where T-8 lamps specified.

2. Thermal Protection: Internal UL Class P with automatic reset.

3. Power Factors: Not less than 90 percent unless otherwise indicated.

4. Sound Ratings: Rating A, except where not available as standard products from any manufacturer. Provide quietest ratings available.

5. Input Voltage: Match branch circuit supply voltage; refer to Drawings.

B. Fluorescent Electronic Ballasts:

1. Provide ballasts which meet requirements of UL 935 and bear the appropriate UL label.

2. Electrical Characteristics:

a. Provide electronic ballasts which withstand input power line transients as defined in ANSI C62.41, Category-A and IEEE 587. Ballasts tolerate a line voltage variation of plus or minus 10 percent.

b. Power Factor: 95 percent or higher.

c. Lamp Crest Factor: 1.7 or less for rapid start ballasts and 1.85 or less for instant start ballasts.

d. Total Harmonic Distortion: Not to exceed 10 percent of the input current.

e. Comply with FCC rules and regulations Part 18, Class A concerning generation of both electromagnetic interference and radio frequency interference.

f. Provide relative light output equal to electromagnetic ballasts in a 2-light lensed luminaire using energy saving ballasts and energy saving lamps. Average ballast factor (BF) is a minimum of 0.88.

3. Performance Characteristics:

a. Input Wattage: Not to exceed 85 percent of the value for their energy efficient core and coil counterparts.

b. Start and operate lamps at 50F and energy savings lamps at 60F. Ballast case temperature is 25C rise above a 40C ambient.

c. Provide constant light output throughout minimum input voltage variations of plus or minus 20 percent from nominal 120 volt or 277 volt.

4. Manufacturer: Advance RCN/VCN Series, Motorola, Magnetek, Universal, or approved.

2.3 Lamps

A. Provide lamps for all luminaires.

B. Fluorescent Lamps:

1. Provide the fluorescent lamps indicated in the luminaire schedule.

2.4 Emergency Lamp Power Supply

A. Manufacturers: Bodine, Iota, Lithonia.

B. Description: Self-contained battery-operated power supply for operating one T8 or compact fluorescent lamp for a minimum output of 90 minutes.

C. Provide access hatches, for emergency battery backup ballasts, adjacent to recessed 6-inch or less diameter downlights installed in inaccessible ceilings.

PART 3 EXECUTION

3.1 Coordination

A. Verification of Conditions: Verify ceiling construction, recessing depth and other construction details prior to release of luminaire for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment.

B. Provide all lighting to provide maximum foot candles allowed by Oregon Energy Code and appropriate for location.

3.2 Installation

A. Install luminaire in accordance with manufacturer's written instructions and with recognized industry practices; to ensure that luminaires comply with requirements and serve intended purposes.

B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.

C. Avoid interference with and provide clearance for equipment. Where intended locations for luminaires conflict with locations of equipment, change locations for luminaire by minimum distance necessary.

D. Suspended Luminaires: Mounting heights indicate clearances between bottom of luminaire and finished floors.

E. Interior Luminaire Supports:

1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.

2. Maintain luminaire positions after cleaning and relamping.

3. Support luminaires without causing ceiling or partition to deflect.

4. Comply with all related Division 16 sections.

F. Exterior Luminaire Supports:

1. Provide concrete footings for pole mounted lighting units and bollard lights at locations shown on site plan Drawings. Provide concrete footings as shown on Drawings or as recommended by manufacturer if not shown on Drawings. Minimum base height above grade in automobile areas is 30-inches. Install luminaire poles plumb and straight.

2. Install pole concrete footings in undisturbed or compacted soil. Where soil is disturbed provide backfill and compaction per Division 2 Earthwork requirement.

G. Wiring:

1. Recessed luminaires to be installed using flexible metallic conduit with luminaire conductors to branch circuit conductors in a nearby accessible junction box over ceiling. Junction box fastened to a building structural member within 6-feet of luminaire.

2. Install luminaires for lift-out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.

3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.

4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.

H. Relamp luminaires which have failed lamps at completion of work.

3.3 Adjusting

A. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Engineer, at such time of day or night as required.

B. Align luminaires that are not straight and parallel/perpendicular to structure.

3.4 Cleaning

A. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.

B. Where finish of luminaires has been damaged, touch up finish as directed by manufacturer's instructions.

END OF SECTION

SECTION 16900

MOTORS AND CONTROLS

PART 1 GENERAL

1.1 Description of Work

A. Work consists of all motors and controls specified herein and in other divisions of the specifications. In general, all motors shall be furnished with the driven equipment. The requirements of all other sections of the specifications are equally applicable to the work to be performed under this section. Motors and controls are specified in this and other divisions of the specifications. In the event of conflicts, the more restrictive specifications shall apply.

B. The Contractor shall be ultimately responsible and shall provide for all labor, equipment, and materials not provided by others that are necessary for the supply, installation, certification, adjustment, testing, and start-up of a complete coordinated system that shall reliably perform the specified functions. In addition, the Contractor shall participate and aid in all testing required for system integration with the Owner's existing PLC and SCADA control system.

1.2 Related Work

A. Section 16010 – General Electrical Requirements
B. Section 16100 - Basic Electrical Materials and Methods
C. Section 16400 – Service and Distribution
D. Section 16450 - Grounding

1.3 Reference Standards

A. National Electrical Manufacturers Association (NEMA).

1.4 Shop Drawings

A. Submit shop drawings of the following, as applicable, for approval of the Engineer:

1. Combination Motor Starters

2. Pilot control devices

3. Prewired systems

a. General descriptive literature of the manufacturer's standard equipment.

b. Complete equipment layout including construction details.

c. Complete bill for materials.

d. Schematic and ladder diagrams of internal control wiring of each unit and connections and functioning of outside control devices required in the particular installation.

e. Complete composite diagram showing wiring of power and control, interconnections between sections, terminal markings and wire size.

4. Complete schedule of nameplate legends.

PART 2 PRODUCTS

2.1 Service Conditions

A. All equipment shall be designed and built for industrial service and be capable of operating successfully under the following applicable conditions.

1. 40 degrees C maximum ambient temperature.

2. Voltage variations to +/- 10% of nameplate rating.

3. Frequency variations to +/- 5% of nameplate rating.

4. Combined voltage and frequency variations to +/- 10% total, as long as frequency does not exceed +/- 5%.

5. 3,300 foot maximum altitude.

2.2 Motor Control

A. General:

1. Furnish and install a complete motor control system as specified, shown on the drawings or required for the control and protection of all motors and motor-operated equipment in conformance with manufacturer's recommendations and applicable codes.

2. This section of the specification applies to all motor controls specified herein and in other sections of the specification.

3. All controls shall conform to the requirements of NEMA standards latest revision.

4. Motor control shall be manufactured by Allen-Bradley, General Electric, Square D, Cutler-Hammer or equal.

B. Control requirements: Provide for each motor a suitable controller and devices that will perform the functions specified or shown on the drawings for

the respective motor. Each motor shall be provided with thermal overload protection.

1. Single-phase motors shall be self-protected and control shall be through manual switches or automatic contacts as specified or indicated on the drawing.

2. Polyphase motors shall have thermal overload heater elements provided integral in the motor controller for each ungrounded conductor.

C. Overload relays:

1. Single-phase motor protection provided integral with the motor controller shall utilize fixed-type melting alloy or bimetallic thermal overload units sized to trip at the motor-rated service factor current but not more than 125 percent of normal full load current.

2. Polyphase motor protection shall utilize electronic overloads with adjustment range from 85 percent to 115 percent of the unit's basic current rating. Utilize standard trip characteristic units unless otherwise recommended by the manufacturer. Make the initial setting of overload units to provide a maximum of 115 percent protection or equal to the motor-rated service factor current whichever is less.

3. Adjust overload units initially provided under this contract as required to provide the closest possible, trouble-free, thermal overload protection consistent with the motor, control and driven equipment manufacturer's recommendations and sound application practice including but not limited to consideration of motor service factor, special motor characteristics and ambient temperature conditions at the motor and controller locations.

4. Manual reset shall be utilized for all overload relays installed integral with motor controllers and shall have external reset pushbuttons.

D. Controller:

1. Manual controllers shall be utilized where specifically indicated on the drawings or specified. Provide switches that are horsepower rated for the load served.

2. Automatic controllers such as thermostats, float or pressure switches shall control motors directly where indicated. Provide devices that are designed for the purpose, properly rated for the load served and provide the control functions indicated.

3. Magnetic motor starters shall be utilized at all locations unless otherwise noted. Controllers shall be AC full-voltage non-reversing type unless otherwise noted or required, NEMA Size 1 or larger.

E. Pilot:

1. Operate 120-volts unless otherwise noted.

2. Pushbutton, selector switches and pilot lights shall be as follows unless otherwise indicated.

   a. Push-buttons: Oil tight, heavy-duty type.

   b. Pilot Lights: Provide oil tight heavy-duty, 125-volt full voltage push-to-test type with LED lamp and lens colors.

3. Running time meter (H): Provide a semi-recessed running time meter for all pump motors. Utilize a non-resettable unit with four registers to indicate up to 9,999 hours.

4. Control relays and contacts: Provide control relays as specified and as required to accomplish the control functions indicated. Relays shall be industrial control relays conforming to NEMA Standard ICS, Part ICS 2-12. Contacts shall have current and voltage rating as required by the application but not less than required in NEMA Standard ICS for Class B1. Contact arrangement shall be Subclass B.

F. Combination starters: Combine the above specified or indicated control functions in a common enclosure with a "magnetic only " molded-case circuit breaker.

G. Enclosure: Provide NEMA 12 enclosures except in wet locations, where exposed to weather or where weatherproof is indicated, in which case, provide NEMA 4X enclosures. All enclosures shall be provided with engraved phenolic nameplates indicating equipment controlled and indicating warnings where required.

2.3 Prewired Systems

A. Prewired systems shall be complete in all respects and shall provide all required functions. All components of the system shall conform in all respects to all portions of the specification. It is desired to take the fullest possible advantage of the manufacturer's standard methods and therefore, the drawings indicated general functions without details and the specifications generally call for the system, to be the “manufacturer's standard”. Such specifications and drawings do not relieve the manufacturer from the requirement to alter his “standard” components and methods and usual scope of work in order to provide the completeness, quality, quantity, function and interchangeability with the function specified herein and shown on the drawings. Prewiring of systems shall be complete including all required interconnections, integral wiring and inter-unit conduit and wiring, ready for the indicated external connections. It is the Contractor's responsibility to review the extent of electrical work and connections shown on the electrical drawings and to

provide compatible prewired systems for a complete, coordinated and proper functioning system.

B. Contractor shall make all field wiring connections, as required, for proper operation.

2.4 Control Panel Wiring

A. All electric wiring 115 volts or greater in the panels shall be in accordance with the standards of the NEC. Wires shall be Type THWN stranded, 600-volt insulation and shall be in sizes not less than No. 16 gage, suitable for the currents to be carried. All wiring shall be enclosed in either sheet metal raceway or plastic wiring duct. Connections to the terminal strips shall be made using pressure type lugs. Locate all fuses on a common fuse block with circuit designations. Terminate all connections to external equipment at numbered terminal blocks. One 20-amp circuit shall be extended to the panel.

B. All electrical wiring shall be identified at each end with imprinted Mylar adhesive back wire markers. Show terminal numbers on as-built wiring diagram.

2.5 Motor Control Systems

A. The contractor shall coordinate with the equipment supplier, as required, for proper installation and operation of motor control systems.

B. The contractor shall install equipment and make all control and power field connections, as required, for proper operation of the system.

PART 3 EXECUTION

3.1 General

A. Install equipment and materials in a neat and workmanlike manner and align, level and adjust for satisfactory operation. Install equipment so that all parts are easily accessible for inspection, operation, maintenance, and repair.

B. Provide trip settings of all main and feeder circuit breakers as directed by the Engineer.

C. After the equipment is installed, touch up any scratches, marks, and the like, incurred during shipment or installation of equipment. If required by the Engineer because of undue amount of scratches, repaint the entire assembly at no additional cost to the Owner.

3.2 Field Tests

A. Functional test: Prior to plant startup, all equipment shall be inspected for proper alignment, proper connection, and satisfactory performance by operation of each starter and feeder.

3.3 Wiring

A. Arrange wiring in cabinets, panels and motor control centers neatly cut to proper length, and remove surplus wire. Apply stak-on or similar terminals to control wiring for connection to terminals, and bridle and secure in an approved manner. List all circuits emanating from power, distribution, and lighting panelboards by function on the directory card. Identify all circuits entering motor control centers or other control cabinets by directory card listing terminal block number and function or by means of tags securely fastened to the conductors.

3.4 Start-Up, Testing, and Training

A. Start-up and testing shall be witnessed by the Engineer. The Contractor shall notify the Engineer a minimum of two weeks prior to any start-up or testing activities.

B. The Contractor shall provide factory certified training. An on-site training course of 1 training day shall be provided to City operations personnel. The Contractor shall coordinate the training date schedule with the Water District a minimum of four weeks in advance.

3.5 Equipment Bases

A. Provide equipment bases for all floor-mounted electrical equipment. Unless otherwise indicated, bases shall be poured-in-place concrete, nominally four inches high, and be one inch larger on all exposed edges than the equipment to be mounted. On all equipment bases in interior locations, unless otherwise noted, provide two or more parallel, cast-in-place continuous-slot channel erection system concrete inserts for equipment mounting. Bolt equipment to channels. Provide additional surface-mounted channels where required to match and line up with existing equipment. Provide concrete pads and mounting provisions for all exterior equipment. Equipment shall be anchored to equipment pad so that it is secure and meets the equipment manufacturer's installation recommendations for outdoor installations. Adhere to specific directions indicated on the drawings or specified in other portions of the specifications. Provide engineered calculations for anchorage of any self-supporting enclosure pad stamped and signed by a registered professional structural engineer licensed in the state of Oregon.

3.6 Supports

A. Provide hangers or other devices such as pads, channels, struts, joists, anchors, etc., necessary for the support of electrical equipment. Provide the design, fabrication and erection of supplementary structural framing required for attachment of hangers or other devices supporting electrical equipment.

END OF SECTION

SUPPLEMENTAL INFORMATION

FOR

RAW WATER PUMP STATION
SAND REMOVAL IMPROVEMENTS

FOR

CITY OF ALBANY, OREGON

OCTOBER 2016

12-1397.223

Foundation Engineering, Inc.
Professional Geotechnical Services

Andy Szatkowski, P.E.
Senior Engineer
Murray, Smith & Associates, Inc.
121 SW Salmon Street, Suite 900
Portland, OR 97204-2919

November 17, 2015

Albany-Millersburg WTP Intake
Sand Removal Improvements
Geotechnical Investigation
Linn County, Oregon

Project 2151085

Dear Mr. Szatkowski:

We have completed the requested geotechnical investigation for the above-referenced project. Details of our investigation and findings are summarized below.

BACKGROUND

An addition is planned to the existing Albany-Millersburg water intake structure located on the South Santiam River east of Millersburg, Oregon. The site location is shown on Figure 1A (Appendix A). The site layout and proposed addition footprint is shown on Figure 2A (Appendix A). Photo 1A (Appendix A) shows the current conditions in this area.

The addition will be a ±14x20-foot, single-story structure which will support a new sand classifier. The terrain in the north half of the planned addition slopes down to the north. Therefore, a short retaining wall will be required on the north edge of the addition.

The City of Albany (City) is the project owner and Murray, Smith and Associates, Inc. (MSA) is the lead designer. MSA retained Foundation Engineering to complete a foundation investigation for the planned addition. Our work scope was outlined in a proposal dated March 30, 2015, and authorized by a signed Task Order dated August 4, 2015.

LITERATURE REVIEW

Prior to our field exploration, we reviewed available project information including as-built plans prepared by CH2M Hill, Inc., and photos provided by the City showing the intake construction in 2004.

The plans indicate the existing intake structure has a ground floor finish elevation of El. 234.0. The bottom of the pump station, immediately adjacent to the planned addition, lies at ±El. 181.0, ±53 feet below the ground surface in the southern portion of the proposed addition footprint. The plans do not provide any indication of the type of material used to backfill the excavation or the method of placement.

Selected construction photos (Photos 2A thorough 7A) are included in Appendix A. The photos indicate the lower portion of the excavation was made with near-vertical cuts in weathered rock. The cuts extend just outside the footprint of the building and were reinforced with soil-nails and shotcrete. The lower portion of the intake structure walls appear to have been cast against the shotcreted cut slopes. The upper portion of the intake walls were formed. The photos do not show the placement of the backfill at this location, but it appears that native material and imported granular fill were used to backfill other portions of the structure (Photos 6A and 7A).

FIELD EXPLORATION

We completed a site reconnaissance on September 29, 2015 to observe the surface conditions. We also evaluated the site access and selected boring locations.

We drilled two exploratory boreholes at the site on November 3, 2015. The drilling was completed using a CME-75, truck-mounted drill rig with mud-rotary drilling techniques. Casing was used, as needed, to limit caving and drilling fluid loss.

Both borings were completed in the asphaltic concrete (AC) paved parking area in the southern portion of the proposed addition. The locations are shown on Figure 2A. BH-1 was drilled ±5 feet from the existing intake wall and BH-2 was drilled ±14 feet from the existing intake wall, along the west wall of the proposed addition. The borings were used to evaluate the variation in the depth and composition of the fill across the planned addition and to examine the underlying native soil and bedrock.

BH-1 was drilled to a depth of ±31.0 feet and BH-2 was drilled to a depth of ±41.4 feet. Sampling was completed at 2.5-foot intervals to a depth of ±20 feet and at 5-foot intervals thereafter. Disturbed samples were obtained in conjunction with Standard Penetration Testing (SPT). The SPT provides an indication of the relative stiffness or density of the foundation soils.

The borings were continuously logged during drilling. The final logs (Appendix B) were prepared based on a review of the field logs and an examination of the soil and rock samples in our office. The ground surface elevations shown on the logs were estimated based on the available topographic map and are approximate.

Upon completion of drilling, the boreholes were backfilled with bentonite chips in accordance with OWRD requirements. The backfill was capped with compacted crushed rock and AC cold patch to match the surrounding pavement.

LABORATORY TESTING

No laboratory testing was completed, since the fill is comprised of predominantly granular soil.

SURFACE AND SUBSURFACE CONDITIONS

Surface Conditions

The southern half of the proposed addition footprint is relatively level and currently paved with AC. The north half is gravel surfaced and dips to the north at a ±2.3(H):1(V) slope. The grade change between the southern edge of the building and the northern edge is ±6.6 feet.

A concrete slab supporting a sand dumpster is located at the toe of the slope adjacent to the northwest corner of the existing intake structure. During our initial site reconnaissance, we observed ±¾ inch of apparent differential settlement between the short retaining wall at the south edge of the slab and the wall of the intake structure (Photo 1A). Measurements with a level indicated the slab is dipping toward the intake structure, suggesting the slab is bearing partly on compressible wall backfill.

Subsurface Conditions

The drilling at both borings began at ±El. 233.5. The explorations encountered fill to ±17 feet in BH-1 and ±15 feet in BH-2. The fill is comprised of medium dense uncrushed gravel with some sand to ±5 feet, followed by loose to medium dense, uncrushed silty, sandy gravel and loose to medium dense, angular to rounded gravel.

During drilling at BH-1, ±60 gallons of drilling fluid were lost in the fill between depths of ±2.5 and 4 feet and ±30 gallons were lost at ±17 feet (immediately above the contact with the residual soil). To limit caving and reduce fluid loss, casing was installed in BH-1 to ±10 feet after the initial fluid loss was observed. The casing was advanced to a depth of ±20 feet after the deeper fluid loss was noted. BH-2 was continually cased while drilling through the fill using casing advancer drilling methods. No fluid loss was observed in this boring.

The fill is underlain by residual soil, which is sandstone that has decomposed in place. The residual soil has the consistency of stiff to very stiff clayey silt grading to very stiff silt with rock fragments.

The residual soil is underlain by extremely weak to very weak (R0 to R1), moderately weathered silty sandstone at ±20 feet (±El. 213.5) in both borings. The silty sandstone extended to the bottom of BH-1 (±31.0 feet) and to ±30 feet in BH-2. In BH-2, extremely weak (R0), slightly weathered to fresh sandstone was encountered from ±30 to 40 feet, followed by extremely weak (R0), moderately to slightly weathered sandy siltstone to ±41.4 feet (the bottom of the boring).

Figures 3A and 4A (Appendix A) show estimated subsurface cross-sections through the proposed addition based on the recent borings and our review of the plans and construction photos.

Ground Water

The use of mud-rotary drilling techniques precluded measurement of ground water levels at the time of drilling. Based on the conditions, we anticipate runoff likely perches on the residual soil and collects within the granular backfill. The perched ground water level likely varies seasonally.

DISCUSSION OF SITE CONDITIONS AND FOUNDATION OPTIONS

Based on our review of the photos (Photos 2A through 5A) and our exploratory drilling, we have concluded the intake structure was constructed by digging a large excavation extending to or just above the bedrock contact (±15 to 20 feet below the current grade in the proposed addition area). The excavation in the bedrock below this depth was cut near-vertical and supported by shotcrete and soil nails. It appears the lower walls of the intake structure were poured against the shotcrete and the upper walls (above the large excavation) were formed and then backfilled.

The backfill in the proposed addition area consists of predominantly silty, sandy gravel capped with cleaner gravel in the upper ±5 feet of the profile. The drilling fluid loss in BH-1 suggests the fill may also include lenses of open-graded gravel. The relatively low and variable SPT N-values in both borings suggest the fill density varies with depth, but the fill is predominantly loose to medium dense. Based on this information and photos of the backfill placed around other parts of the building (Photos 5A and 6A), we have concluded the fill was placed without formal compactive effort.

Photos 2A and 4A indicate the large excavation extended just north of the intake building and likely terminated within the limits of the sand dumpster slab. Therefore, we anticipate the northern portion of that slab is supported on stiff native soil, while the southern portion is supported on loose backfill. This would explain the differential settlement observed between the south edge of the slab and the building.

Considering the condition of the fill, we have concluded it would not be prudent to construct the new addition with shallow foundations bearing on the fill, as there would be a significant risk of differential settlement similar to that observed at the sand dumpster slab. The fill in the addition area could be excavated, moisture-conditioned and recompacted or replaced with imported crushed rock. However, that would require a relatively deep excavation and significant vibrations from compaction equipment. We anticipate it would be more practical to construct the addition with the east edge attached to existing intake structure wall and the western portion supported on grade beams and deep foundations extending below the fill.

Micropiles could be used to support the addition. However, the drilling fluid loss noted in BH-1 suggests drilling and grouting micropiles may be problematic and expensive. For micropiles, permanent casing would likely be required through the backfill zone to reduce the grout take.

Based on the conditions, we believe driven piles would be the most viable deep foundation option. It should be possible to drive small H-piles with only modest resistance through the loose granular fill and attain relatively high end-bearing resistance with relatively shallow penetration into the underlying bedrock. The foundation options were discussed with the structural designer and driven H-piles were selected.

SEISMIC DESIGN

Site Response Spectrum

A spectral acceleration response spectrum for the site was developed using the general procedure in Section 1613 of the 2014 Oregon Structural Specialty Code (OSSC). The design maximum considered earthquake ground motion maps provided in the 2014 OSSC are modified 2008 USGS maps with a 1% probability of exceedance in 50 years (i.e., a ±4,975-year return period). The modifications include factors to adjust the spectral accelerations to account for directivity and risk.

Based on our borings, we have concluded a Site Class C is appropriate for design. The IBC 2012/OSSC 2014 site response spectrum and seismic design parameters for a Site Class C are summarized on Figure 5A (Appendix A).

Liquefaction Assessment

Liquefiable soils typically consist of loose, fine sands and non-plastic silt below the ground water table. The loose to medium dense gravel underlying the proposed addition is expected to have low risk of liquefaction due to its coarse grain size and the absence of shallow ground water. It is our opinion the risk of lateral spreading at the site is also very low.

FOUNDATION ANALYSIS AND DESIGN RECOMMENDATIONS

Foundation Layout and Design Loads

In consultation with the structural designer, driven H-piles were selected to support the western portion of addition. A total of six (6) piles is currently planned, with three (3) piles located on the west wall (corners and middle) and three (3) piles located ±5 feet from the existing structure. The maximum estimated axial load (D+L) is ±35 kips per pile.

Pile Type and Material Specifications

HP10x42 piles are recommended based on the design loads. The piles will be driven through loose granular fill and the tips will be seated into extremely weak to very weak rock with only modest required driving resistances. Therefore, the risk of tip damage is considered low, and no tip protection is required. The recommended pile properties are summarized in Table 1.

Table 1. Recommended Pile Properties

Pile Properties	HP10x42
Steel Grade	ASTM A36
Yield Stress (F_y)	36 ksi
Area Steel (A_s)	12.4 in^2
Nom. Structural Resistance (F_y x A_s)	446 kips
End Condition	No tip protection

Downdrag

At least ± ½ inch of ground settlement around the pile is typically required to induce downdrag loads on deep foundations following their installation. The fill required to grade the terrain beneath the addition is not expected to mobilize downdrag loads on the piles.

Ultimate and Allowable Axial Capacity

Axial pile analysis was completed using Allowable Stress Design (ASD) with side friction and end-bearing resistances calculated using the β method in the granular fill and the α method in the underlying residual soil and rock. A typical factor of safety of 3 was used, assuming the FHWA Gates Equation would be used to establish the final driving criteria. An ultimate axial capacity of 105 kips is required based on the estimated maximum axial load (35 kips) and a factor of safety of 3.

The estimated ultimate and allowable axial capacities are plotted versus embedment on Figure 6A (Appendix A). The calculations indicate the piles should drive through the fill with relatively modest resistance and attain the required ultimate axial capacity with ±1 to 2 feet of penetration into the bedrock.

Minimum/Estimated Pile Tip Elevations and Estimated Pile Lengths

The pile tips should be driven to bedrock. A minimum tip elevation of El. 213.5 was establish based on the bedrock surface elevation in the borings. Our calculations indicate the piles should attain the required driving resistances with ±1 to 2 feet of penetration into the bedrock. We recommend assuming an estimated tip elevation of El. 211 to account for penetration into the bedrock and possible variation in the bedrock surface elevation.

Preliminary information provided by the structural designer indicates the cut-off elevation for the piles will likely be ±12 inches below the finish floor elevation (i.e., at El. 233). A 22-foot finished pile length was estimated based on the assumed cut-off elevation and estimated tip elevation. The cut-off elevations and estimated finished pile lengths may need to be adjusted depending on the actual layout of the pile caps. We recommend delivering piles with a total length of at least 25 feet to allow some stickup during driving.

Ultimate Uplift Capacity

The estimated ultimate uplift capacity versus embedment is shown on Figure 6A. An ultimate uplift capacity of ±45 kips was calculated based on the estimated skin friction mobilized in the soil above the minimum tip elevation.

Pile Settlement

The piles will be relatively lightly-loaded and will be seated into bedrock, which has low compressibility characteristics. Therefore, pile settlement is expected to be minor and limited to the elastic compression of the pile section.

Lateral Pile Analysis

The addition will be attached to the existing intake structure, which is relatively rigid. We assume the lateral resistance for the addition will develop predominantly through the connection to the existing building. Therefore, we did not complete lateral analysis for the piles.

Driving Criteria and Drivability Analysis

The piles may be driven using a vibratory hammer or an impact hammer. If a vibratory hammer is used, the hammer should be capable of driving the piles through the fill and residual soil and seating the tips into the bedrock. We recommend providing a vibratory hammer with at least a 50-ton capacity (e.g., an APE 50).

The FHWA Gates equation was used to determine a range of impact hammer field energies required to drive the piles to an ultimate axial capacity of ±105 kips with a final driving resistance in the range of 3 to 15 blows per inch. Based on the calculations and recommendations in the ODOT Standard Specifications (ODOT, 2015), we recommend a minimum rated hammer field energy of 6.5 foot-kips. The required final driving resistance should be established using the FHWA Gates equation after the hammer information is submitted by the contractor. Driving should be halted if the pile meets practical refusal (defined herein as a driving resistance exceeding 15 blows/inch for 3 consecutive inches) at or below the minimum tip elevation.

A monitoring program is recommended during construction to confirm that all pile driving criteria are followed. We anticipate a construction inspector will log each pile for driving resistance and hammer efficiency.

Potential Obstructions

We observed no potential obstructions. However, the contractor should anticipate a significant increase in driving resistance once the pile tips reach the bedrock surface. Preboring should not be required. Jetting is not recommended.

Set Period and Redriving

The piles will be driven to bedrock. Therefore, a set period will not be required.

RETAINING WALL

A retaining wall will be required on the north side of the addition to accommodate the sloping terrain and retain the new fill under the addition slab. We understand the design is currently under consideration. A soldier pile wall may be used, incorporating the foundation piles.

We assume the wall will be relatively rigid. Therefore, we recommend designing the wall assuming at-rest (k_o) earth pressures. We assume compacted Base Rock will be used in the zone behind the walls. A friction angle of 34 degrees and a unit weight of 125 pcf were assumed for the compacted wall backfill. A k_o of 0.44 was calculated using the assumed backfill parameters. The lateral earth pressure on the wall may be estimated using an equivalent fluid density of 55 pcf. If a soldier pile wall is constructed, this fluid pressure will act over the tributary area of the lagging.

If a soldier pile wall is used, the passive resistance on the buried portion of soldier piles will be provided by the existing granular fill. A friction angle of 32 degrees and a unit weight of 120 pcf were assumed for this material. A k_p of 3.25 was calculated using the assumed backfill parameters. The passive lateral earth pressure on the soldier piles may be estimated using an equivalent fluid density of 390 pcf. This fluid pressure should be assumed to act over the width of the piles.

The recommended fluid density assumes drained conditions. The wall will be underlain by a relatively thick granular backfill, which appears to be relatively free draining. Therefore, a formal wall foundation drain is not required.

CONSTRUCTION RECOMMENDATIONS

Excavations/Shoring/Dewatering

We anticipate excavations for the addition foundations will be shallow. However, if deep trenching is needed for utilities, shoring or benching should be provided to protect workers from sloughing or caving soils. The existing loose to medium dense gravel fill corresponds to an OR-OSHA Type C soil. OSHA recommends a maximum cut slope of 1½(H):1(V) in Type C soils.

Utility construction during wet weather may encounter perched ground water and require dewatering. It is the responsibility of the contractor to maintain stable and safe temporary slopes and provide a plan for dewatering of site excavations prior to construction.

Materials and Compaction Recommendations

The existing granular fill may be reused for grading beneath the new addition, provided it is free of high plasticity clay, organic matter and construction debris. The silty, sandy gravel may be moisture-sensitive and may not be suitable for reuse during wet weather.

Imported Base Rock should consist of ¾ or 1-inch minus, clean (i.e., less than 5% passing the #200 U.S. Sieve), well-graded, angular crushed gravel or quarry rock. We should be provided a gradation analysis for the intended fill for approval, prior to delivery to the site.

Compact all fill in loose lifts not exceeding 12 inches. Thinner lifts (maximum 8 inches) will be required where light or hand-operated equipment is used. Compact all fill and subgrade to a minimum of 95% relative compaction, based on the maximum dry density of ASTM D 698. The moisture content of the fill should be adjusted to within ±2% of its optimum value prior to compaction.

Field density tests should be run frequently to confirm adequate compaction of the fill. Adequate compaction of fill that is too coarse or variable for effective field density testing should be verified by a Foundation Engineering representative based on observation of the compaction method.

DESIGN REVIEW/CONSTRUCTION OBSERVATIONS

We should be provided the opportunity to review all drawings and specifications that pertain to site preparation and foundation construction. We recommend Foundation Engineering be present during construction to observe the pile installation and confirm the tip elevations and final driving resistances. Any geotechnical engineering judgment in the field should be provided by Foundation Engineering.

Field density tests should be run on all compacted fill. Adequate compaction of materials that are too coarse or variable for density testing will need to be verified by observation of the compaction method. Any geotechnical engineering judgment in the field should be provided by a Foundation Engineering representative.

VARIATION OF SUBSURFACE CONDITIONS, USE OF THIS INFORMATION AND WARRANTY

The analysis, conclusions and recommendations contained herein assume the subsurface profiles encountered in the borings are representative of the site conditions. The above recommendations assume Foundation Engineering will have the opportunity to review final drawings and be present during construction to observe pile driving and confirm the assumed foundation conditions. No changes in

the enclosed recommendations should be made without our approval. We will assume no responsibility or liability for any engineering judgment, inspection, or testing performed by others.

This report was prepared for the exclusive use of Murray Smith and Associates, Inc., the City of Albany and their design consultants for the Albany-Millersburg WTP Intake Sand Removal Improvements project in Linn County, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent. This memorandum is intended for planning and design purposes. Contractors using this information to estimate construction quantities or costs do so at their own risk. Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or ground water by hazardous or toxic materials. We assume those services, if needed, have been completed by others.

This work was done in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

It has been a pleasure assisting you with this phase of your project. Please do not hesitate to call if you have any questions or if you require further assistance.

Sincerely,

FOUNDATION ENGINEERING, INC.

David L. Running, P.E., G.E.
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
62647PE
OREGON
NOV. 9, 1999
DAVID L. RUNNING
Expires: 12/31/16

DLR/wg
Enclosure

REFERENCES

CH2M Hill, Inc. 2004; As-Built Plans for the Albany-Millersburg Joint Water Supply Project.

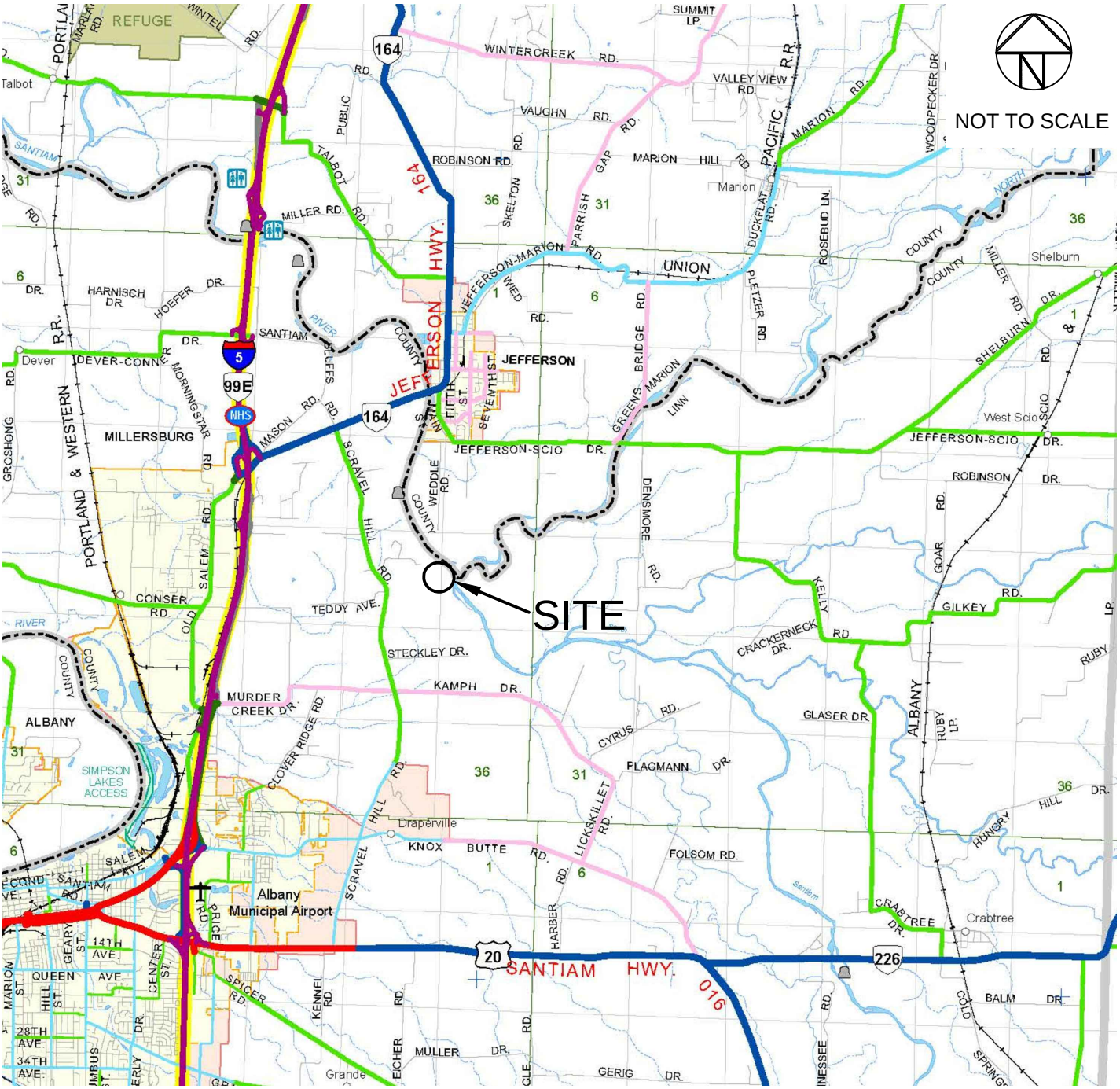
Oregon Department of Transportation, Highway Division, 2015, Oregon Standard Specifications for Construction.

Appendix A

Figures and Photos

Professional
Geotechnical
Services

Foundation Engineering, Inc.



DATE	NOV 2015
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APPR.	
REVIS.	
PROJECT NO.	2151085

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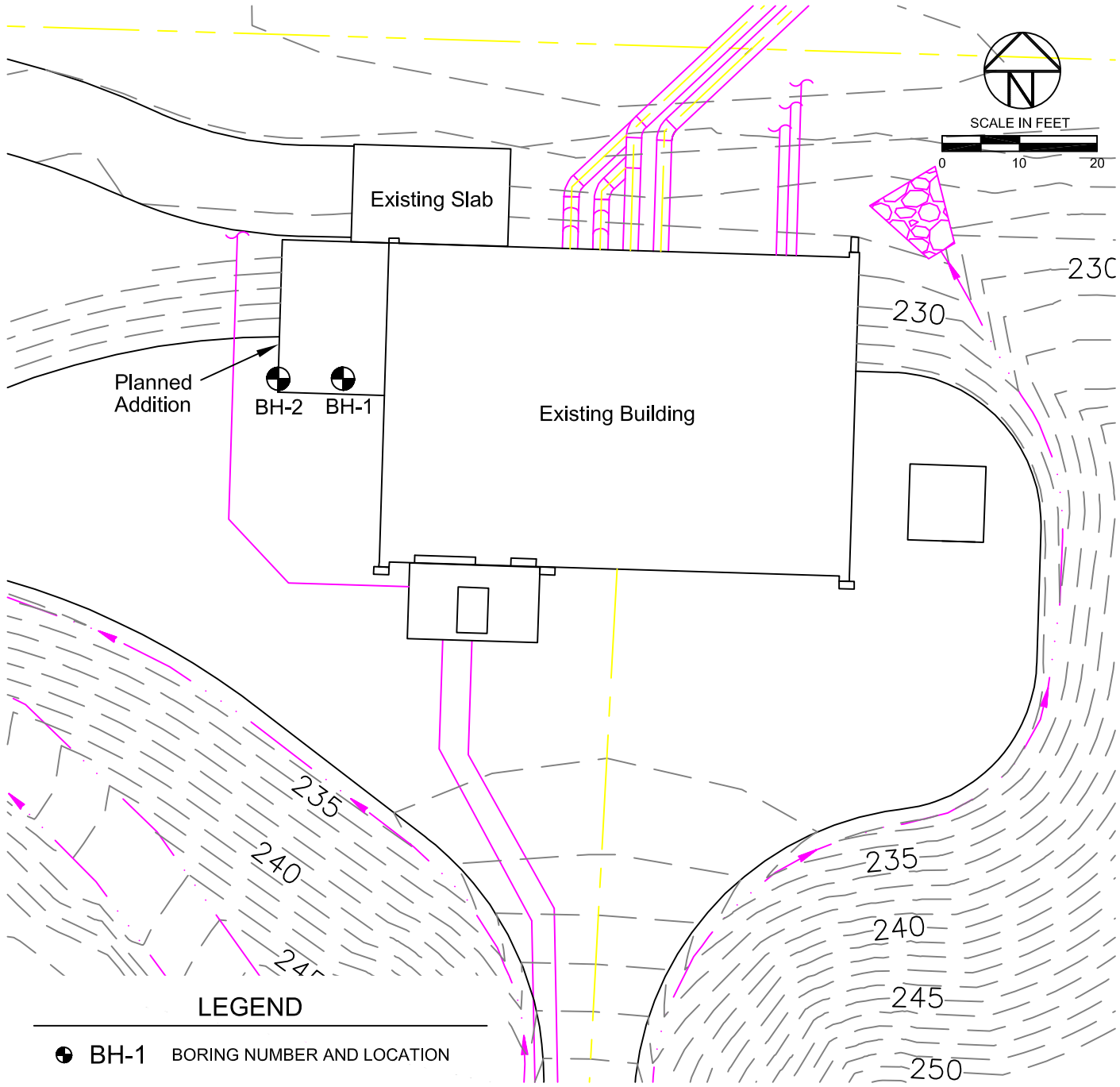
VICINITY MAP
ALBANY-MILLERSBURG WTP INTAKE
SAND REMOVAL IMPROVEMENTS
LINN COUNTY, OREGON

FIGURE NO.
1A

FILE NAME: FIG 1A



NOTES:
1. BORING LOCATIONS WERE ESTABLISHED USING CLOTH AND METAL TAPES AND ARE APPROXIMATE.
2. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.
3. BASE MAP WAS PROVIDED BY MSA.

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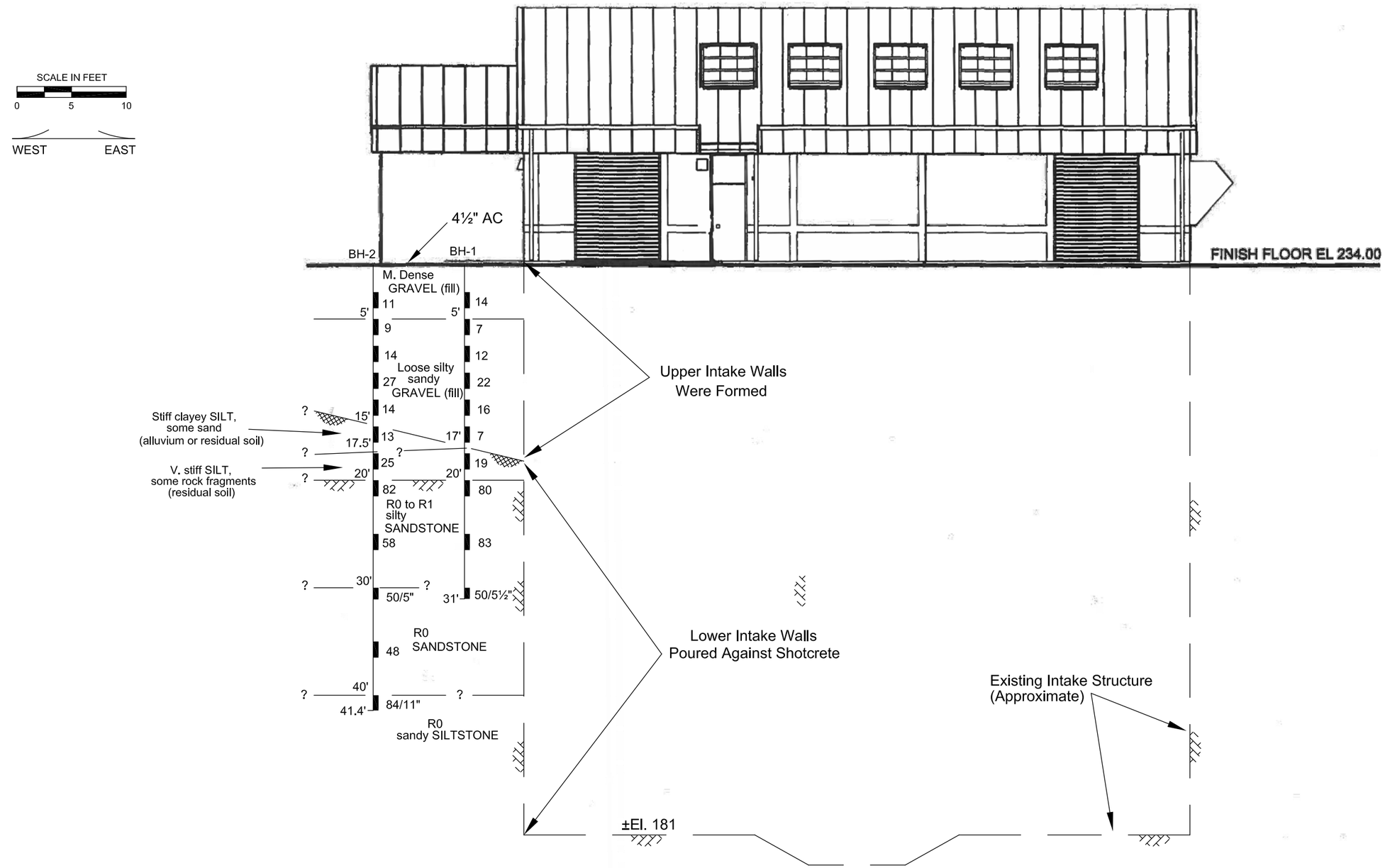
SITE LAYOUT AND BORING LOCATIONS
ALBANY-MILLERSBURG WTP INTAKE
SAND REMOVAL IMPROVEMENTS
LINN COUNTY, OREGON

FIGURE NO.
2A

FILE NAME: FIG 2A



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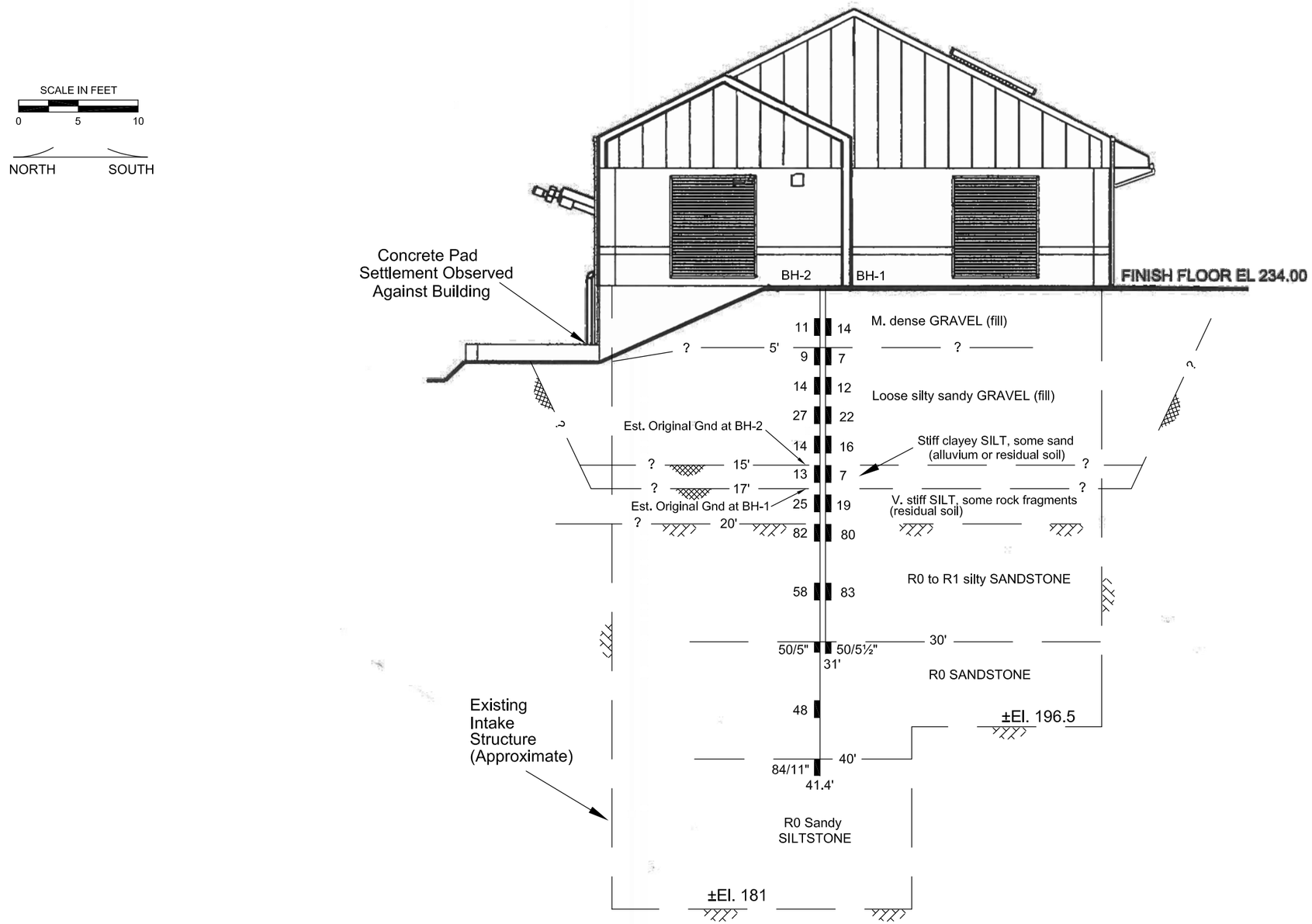
EAST-WEST CROSS-SECTION
ALBANY-MILLERSBURG WTP INTAKE
SAND REMOVAL IMPROVEMENTS
LINN COUNTY, OREGON

FIGURE NO.
3A

FILE NAME:FIG 3A



NOTES:
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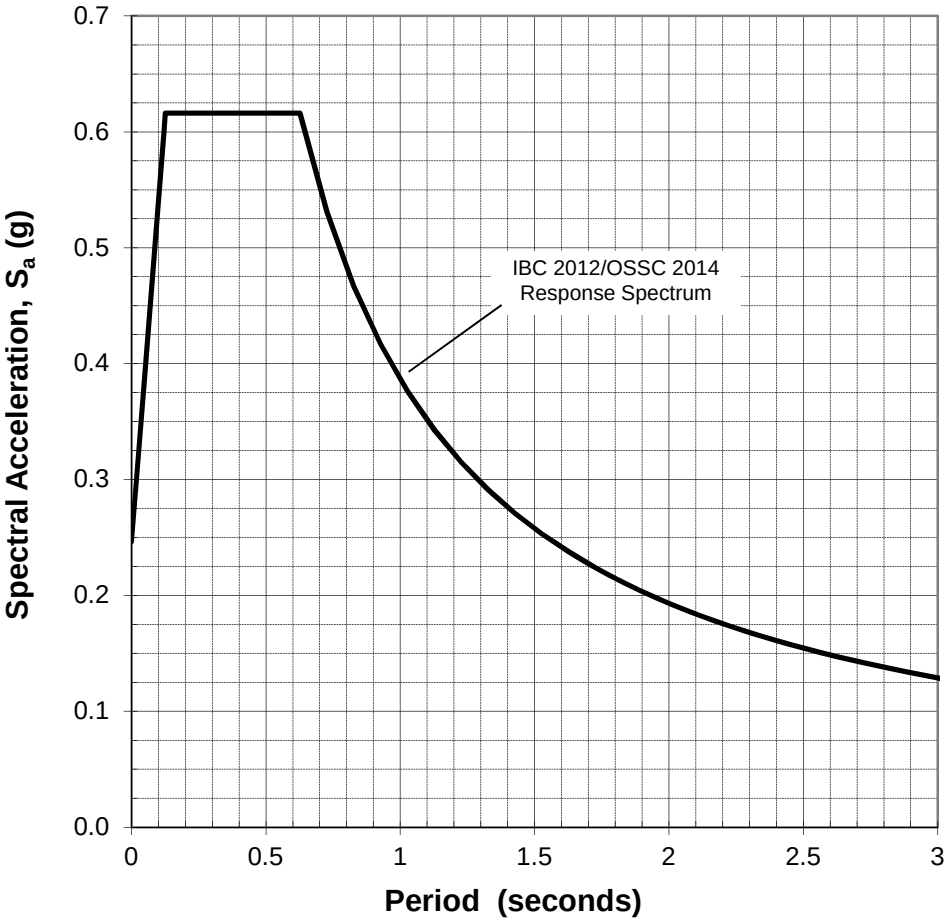
NORTH-SOUTH CROSS-SECTION
ALBANY-MILLERSBURG WTP INTAKE
SAND REMOVAL IMPROVEMENTS
LINN COUNTY, OREGON

FIGURE NO.
4A

FILE NAME:FIG 4A



Notes:

1. The Design Response Spectrum is based on IBC 2012 Section 1613.

2. The following parameters are based on the modified USGS 2008 maps provided in IBC 2012/OSSC 2014:

   Site Class= C Damping = 5%

S_S =	0.88	F_a =	1.05	S_{MS} =	0.92	S_{DS} =	0.62
S_1 =	0.42	F_v =	1.38	S_{M1} =	0.58	S_{D1} =	0.39

3. S_S and S_1 values indicated in Note 2 are the mapped, risk-targeted maximum considered earthquake spectral acclerations for 1% probability of exceedence in 50 years.

4. F_a and F_v were established based on IBC 2012, Tables 1613.3.3(1) and 1613.3.3(2) using the selected S_S and S_1 values. S_{DS} and S_{D1} values include a 2/3 reduction on S_{MS} and S_{M1} as discussed in IBC 2012 Section 1613.3.4.

5. Site location is: Latitude 44.688, Longitude -123.010.

FIGURE 5A
IBC 2012/OSSC 2014 SITE RESPONSE SPECTRUM
Albany-Millersburg WTP Intake Sand Removal Improvements
Linn County, Oregon
Project 2151085

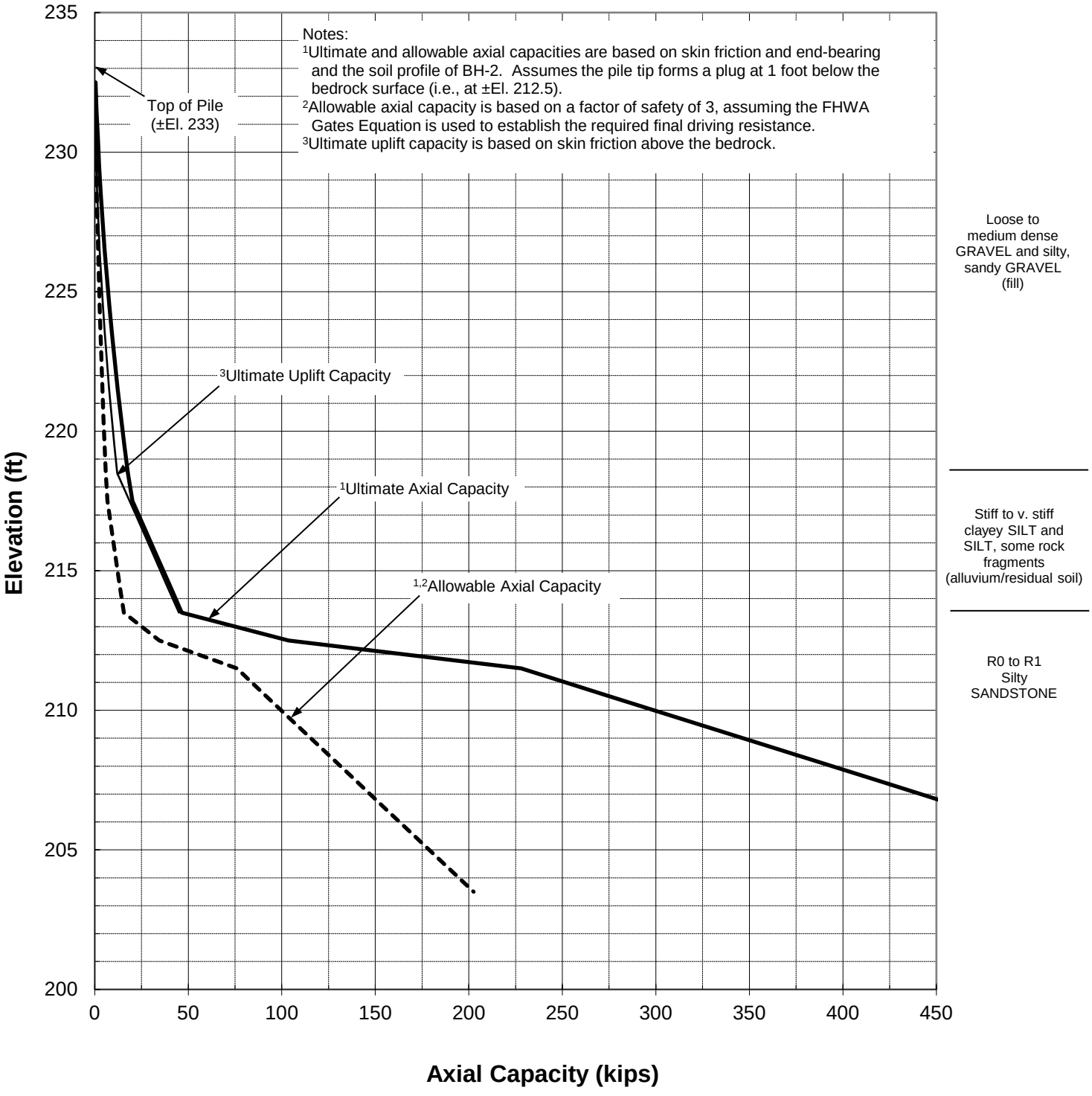


FIGURE 6A
AXIAL CAPACITY vs. ELEVATION - HP10x42 PILES
Albany-Millersburg WTP Intake Sand Removal Improvements
Linn County, Oregon
Project 2151085

Photo 1A. View of current conditions in addition area facing southwest.

Photo 2A. View of addition area during construction facing northwest.

Photo 3A. View of intake structure excavation facing southwest.

Photo 4A. View of intake structure excavation facing north.

Photo 5A. Aerial view of intake excavation facing south.

Photo 6A. View of backfill for the intake structure south wall facing northeast.

Photo 7A. View of Access road construction and wall backfill at intake southeast corner facing northeast.

Appendix B

Boring Logs

Professional
Geotechnical
Services

Foundation Engineering, Inc.

DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for each boring or test pit by our field representative. The log contains information concerning sampling depths and the presence of various materials such as gravel, cobbles, and fill, and observations of ground water. It also contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the laboratory examinations and tests. Our recommendations are based on the contents of the final logs and the information contained therein and not on the field logs.

VARIATION IN SOILS BETWEEN TEST PITS AND BORINGS

The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

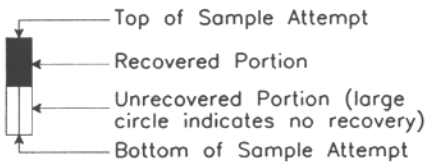
TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines designating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS

SH-3-4

- Sample Number
- Boring or Test Pit Number
- Sample Type



S – Grab Samples
SS – Standard Penetration Test Sample (split-spoon)
SH – Thin-walled Shelby Tube Sample
C – Core Sample
CS – Continuous Sample

▲ Standard Penetration Test Resistance equals the number of blows a 140 lb. weight falling 30 in. is required to drive a standard split-spoon sampler 1 ft. Practical refusal is equal to 50 or more blows per 6 in. of sampler penetration.

● Water Content (%).

UNIFIED SOIL CLASSIFICATION SYMBOLS

G – Gravel	W – Well Graded
S – Sand	P – Poorly Graded
M – Silt	L – Low Plasticity
C – Clay	H – High Plasticity
Pt – Peat	O – Organic

FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or pocket penetrometer devices.

TYPICAL SOIL/ROCK SYMBOLS

Sand	Silt
Clay	Gravel
Basalt	Siltstone

WATER TABLE

▼ Water Table Location

(1/31/00) Date of Measurement

Piezometer Tip Location (if used)

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SYMBOL KEY
BORING AND TEST PIT LOGS

Explanation of Common Terms Used in Soil Descriptions

Field Identification	Cohesive Soils			Granular Soils	
	SPT	S_u* (tsf)	Term	SPT	Term
Easily penetrated several inches by fist.	0 – 1	< 0.125	Very Soft	0 – 4	Very Loose
Easily penetrated several inches by thumb.	2 – 4	0.125–0.25	Soft	5 – 10	Loose
Can be penetrated several inches by thumb with moderate effort.	5 – 8	0.25 – 0.50	Medium Stiff (Firm)	11 – 30	Medium Dense
Readily indented by thumb but penetrated only with great effort.	9 – 15	0.50 – 1.0	Stiff	31 – 50	Dense
Readily indented by thumbnail.	16 – 30	1.0 – 2.0	Very Stiff	> 50	Very Dense
Indented with difficulty by thumbnail.	31 – 60	> 2.0	Hard		

* Undrained shear strength

Term	Soil Moisture Field Description
Dry	Absence of moisture. Dusty. Dry to the touch.
Damp	Soil has moisture. Cohesive soils are below plastic limit and usually moldable.
Moist	Grains appear darkened, but no visible water. Silt/clay will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grain surfaces. Sand and cohesionless silt exhibit dilatancy. Cohesive silt/clay can be readily remolded. Soil leaves wetness on the hand when squeezed. "Wet" indicates that the soil is wetter than the optimum moisture content and above the plastic limit.

Term	PI	Plasticity Field Test
Nonplastic	0 – 3	Cannot be rolled into a thread.
Low Plasticity	3 – 15	Can be rolled into a thread with some difficulty.
Medium Plasticity	15 – 30	Easily rolled into thread.
High Plasticity	> 30	Easily rolled and rerolled into thread.

Term	Soil Structure Criteria
Stratified	Alternating layers at least 1 inch thick – describe variation.
Laminated	Alternating layers at less than 1 inch thick – describe variation.
Fissured	Contains shears and partings along planes of weakness.
Slickensides	Partings appear glossy or striated.
Blocky	Breaks into lumps – crumbly.
Lensed	Contains pockets of different soils – describe variation.

Term	Soil Cementation Criteria
Weak	Breaks under light finger pressure.
Moderate	Breaks under hard finger pressure.
Strong	Will not break with finger pressure.

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COMMON TERMS
SOIL DESCRIPTIONS

Explanation of Common Terms Used in Rock Descriptions

Field Identification		UCS (psi)	UCS (MPa)	Strength (Hardness)
Indented by thumbnail.	R0	< 100	0.25–1.0	Extremely Weak (Extremely Soft)
Crumbles under firm blows with geological hammer, can be peeled by a pocket knife.	R1	100–1000	1.0–5.0	Very Weak (Very Soft)
Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with geological hammer.	R2	1000–4000	5.0–25	Weak (Soft)
Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of geological hammer.	R3	4000–8000	25–50	Medium Strong (Medium Hard)
Specimen requires more than one blow of geological hammer to fracture it.	R4	8000–16000	50–100	Strong (Hard)
Specimen requires many blows of geological hammer to fracture it.	R5	16000–36000	100–250	Very Strong (Very Hard)
Specimen can only be chipped with geological hammer.	R6	> 36000	> 250	Extremely Strong (Extremely Hard)

Term	Weathering Field Identification
Fresh	Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric.
Slightly Weathered	Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric.
Moderately Weathered	Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits.
Highly Weathered	Rock can be excavated with geologist's pick. All dicontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water.
Decomposed	Rock mass is completely decomposed. Original rock "fabric" may be evident. May be reduced to soil with hand pressure.

Spacing (meters)	Spacing (feet)	Spacing Term	Bedding/Foliation
< 0.06	< 2 in.	Very Close	Very Thin
0.06 – 0.30	2 in. – 1 ft.	Close	Thin
0.30 – 0.90	1 ft. – 3 ft.	Moderately Close	Medium
0.90 – 3.0	3 ft. – 10 ft.	Wide	Thick
> 3.0	> 10 ft.	Very Wide	Very Thick (Massive)

Vesicle Term	Volume
Some	3 – 20%
Highly	20 – 50%
Scoria	> 50%

Stratification Term	Description
Lamination	<0.39 in. thick beds
Fissile	Preferred break along laminations
Parting	Preferred break direction
Foliation	Metamorphic layering of minerals

RQD %	Designation	RQD %	Designation
0 – 25	Very Poor	75 – 90	Good
25 – 50	Poor	90 – 100	Excellent
50 – 75	Fair		

Rock Quality Designation (RQD) is the percent of a core run with intact lengths greater than 4.0 in. excluding breaks caused by drilling.

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COMMON TERMS
ROCK DESCRIPTIONS

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	SPT, N-Value ▲ / Recovery ⬚ / Moisture, % ● / RQD., % ⊞ (0 – 50 – 100)	Installations/ Water Table
			233.5			
	ASPHALTIC CONCRETE (±4.5 inches).		233.1			Capped with AC cold patch and gravel
1	Medium dense GRAVEL, some sand, trace silt (GP); grey-brown, wet, fine to coarse sand, fine to coarse gravel, subrounded to rounded gravel, (fill).		0.4			
2						
3	Lost ±60 gallons of drilling fluid from ±2 to 4 feet; set casing to ±10 feet.			SS-1-1	▲ 14	
4						
5			228.5			Backfilled with bentonite chips and caved material
6	Loose silty, sandy GRAVEL (GM); grey-brown and iron-stained, moist to wet, low plasticity silt, fine to coarse sand, fine to coarse gravel, subrounded to rounded gravel, (fill).		5.0	SS-1-2	▲ 7	
7						
8	Medium dense below ±7 feet.			SS-1-3	▲ 12	
9						
10				SS-1-4	▲ 22	
11						
12	Angular to rounded gravel from ±12 to 15 feet.					
13				SS-1-5	▲ 16	
14						
15	Loose and moist to wet below ±15 feet.			SS-1-6	▲ 7	
16						
17			216.5			
18	Lost ±30 gallons of drilling fluid at ±17 feet; set casing to ±20 feet.		17.0	SS-1-7	▲ 19	
19	Very stiff SILT, some rock fragments (ML); brown and iron and manganese-stained, wet, low plasticity, sand to gravel-sized rock fragments, moderately weathered sandstone rock fragments, (alluvium or residual soil).					
20			213.5			
21			20.0	SS-1-8	▲ 80	
22	Extremely weak to very weak (R0 to R1) silty SANDSTONE; dark grey, slightly to moderately weathered, fine sand, (Eugene Formation).					
23						
24						
25	Slightly weathered below ±30 feet.			SS-1-9	▲ 83	
26						
27						
28						
29						
30	Fine gravel-sized, moderately weathered Siltstone clasts.			SS-1-10	▲ 50/5½"	
31	BOTTOM OF BORING		202.5 31.0			

Project No.: 2151085

Surface Elevation: 233.5 feet (Approx.)

Date of Boring: November 3, 2015

Foundation Engineering, Inc.

Boring Log: BH-1

Albany-Millersburg WTP Intake

Sand Removal Improvements

Linn County, Oregon

Depth Feet	Soil and Rock Description and Comments	Elev. Depth (233.5)	Samples	SPT, N-Value ▲ / Recovery ⬚ / Moisture, % ● / RQD., % ⊞ (0–50–100)	Installations/ Water Table
	ASPHALTIC CONCRETE (±4.5 inches).	233.1			Capped with AC cold patch and gravel
1–4	Medium dense GRAVEL, some sand, trace silt (GP); grey-brown, wet, fine to coarse sand, fine to coarse gravel, subrounded to rounded gravel, (fill).	0.4	SS-2-1	11	
5–6	Stiff SILT, trace to some sand (ML); grey-brown, moist, low plasticity, fine to medium sand, (fill).	228.5 / 5.0	SS-2-2	9	Backfilled with bentonite chips
7–9	Loose silty, sandy GRAVEL (GM); grey-brown and iron-stained, moist to wet, low plasticity silt, fine to coarse sand, fine to coarse gravel, subrounded to rounded gravel, (fill). Medium dense below ±7 feet.	227.9 / 5.6	SS-2-3	14	
10–12	Angular to rounded gravel below ±15 feet.		SS-2-4	27	
13–14			SS-2-5	14	
15–17	Stiff clayey SILT, some sand (MH); brown and iron-stained, wet, medium plasticity, fine sand, (alluvium or residual soil).	218.5 / 15.0	SS-2-6	13	
18–19	Very stiff SILT, some rock fragments (ML); brown and iron-stained, moist to wet, low plastcity, sand to gravel-sized rock fragments, slightly weathered sandstone rock fragments, (residual soil).	216.0 / 17.5	SS-2-7	25	
20–23	Extremely weak to very weak (R0 to R1) silty SANDSTONE; dark grey, moderately weathered, fine sand, (Eugene Formation). Slightly weathered below ±21 feet.	213.5 / 20.0	SS-2-8	82	
25–29			SS-2-9	58	
30–32	Extremely weak (R0) SANDSTONE; grey to light grey, slightly weathered to fresh, fine sand, tuffaceous, (Eugene Formation).	203.5 / 30.0	SS-2-10	50/5"	
35–39			SS-2-11	48	
40–41	Extremely weak (R0) sandy SILTSTONE; dark grey, moderately to slightly weathered, fine to medium sand, tuffaceous, (Eugene Formation).	193.5 / 40.0	SS-2-12	84/11"	
	BOTTOM OF BORING	192.1 / 41.4			

Project No.: 2151085

Surface Elevation: 233.5 feet (Approx.)

Date of Boring: November 3, 2015

Boring Log: BH-2

Albany-Millersburg WTP Intake

Sand Removal Improvements

Linn County, Oregon

Foundation Engineering, Inc.

LINN COUNTY PLANNING AND BUILDING DEPARTMENT

Robert Wheeldon, Director

Room 114, Linn County Courthouse
PO Box 100, Albany, Oregon 97321
Phone 541-967-3816 Fax 541-926-2060
www.co.linn.or.us

NOTICE OF DECISION
CONDITIONAL USE PERMIT

July 14, 2016

City of Albany Public Works
Attn: Nolan Nelson
PO Box 490
Albany, OR 97321

RE: PD16-0146; a conditional use permit application for a utility facility on a 4.20-acre parcel zoned Exclusive Farm Use (EFU) (T10S, R03W, Section 23, Tax Lot 815).

Dear Mr. Nelson:

The Linn County Planning and Building Department completed review of your conditional use permit application on July 14, 2016. The Department finds your application, pursuant to Linn County Code Section 928.320(B)(5), complies with the specified decision criteria in Section 933.330(B). Your application is approved, subject to the following permit conditions and Code requirements:

CONDITIONS:

1. A conditional use permit for a utility facility to construct a 315 square foot addition to an existing pump station to house additional equipment, and to extend a sediment containment area is approved. Future expansions, modifications of any approved use or structure associated with the utility facility, or modifications to operating characteristics may require a new land use review.
2. The additions to the utility facility shall be constructed and shall at all times operate in compliance with the applicable permits and regulations administered by the State Water Resources Department, the Oregon Department of Fish and Wildlife, the Oregon Health Division, the Department of Environmental Quality, and any other affected state or federal agency.

REQUIREMENTS:

1. All appropriate building, mechanical, electrical, and plumbing permits shall be obtained from the Linn County Planning and Building Department for the proposed additions. The new structures are required to meet all applicable codes for the type of occupancy proposed. Plans must be prepared and stamped by an Oregon licensed architect or engineer. Please contact the Linn County Building Official at 541-967-3816 for additional information.

2. Pursuant to LCC 933.330(B)(1)(d), the owner/operator of the utility facility shall be responsible for restoring the site as nearly possible, to its former resource use and associated improvements that are damaged or otherwise disturbed by the siting, maintenance, repair or reconstruction of the utility facility. The restoration of the site shall be completed within three months.
3. Structures on the subject property shall be located at least 30 feet from the front (west) property line, 50 feet from the east (rear), north and south (side) property lines. A 50-foot riparian setback shall be maintained from all riparian habitat areas on the subject property.

This decision is effective unless an appeal to the Linn County Planning Commission is filed with the Department before 5:00 p.m., July 28, 2016. Appeals will be accepted only when based upon identified inadequacies, omissions, or errors in the decision's findings and conclusions. A $250.00 filing fee must accompany an appeal.

Your proposal may be initiated up to two years after the date of decision. Please note that a 14-day period exists during which this decision may be appealed. Permits may be obtained only after the appeal period expires on July 28, 2016 and **after the approval conditions and requirements have been met**. An appeal prevents initiation of the proposal; you will be notified of an appeal filed by another party. Please contact Alyssa Boles in our Department at (541) 967-3816, ext. 2360 if questions arise or if we may be of assistance.

Sincerely,

Robert Wheeldon

Robert Wheeldon
Director

RW:AB

C: Linn County Assessor's Office
GIS
Linn County Building Official
Oregon DSL
ODFW
Oregon WRD
Oregon DEQ
OHD – Public Drinking Water Program
Farm/Forest Reporting

DECISION CRITERIA, FINDINGS, AND CONCLUSION

I. DECISION CRITERIA

Section 933.330(B) of the Linn County Land Development Code contains the applicable decision criteria.

II. FINDINGS

(B) Decision Criteria

(1) A utility facility that is necessary for public service.

(a) The approval criterion for this use is limited to a finding that the utility facility is necessary for public service and the approval is not subject to LCC 933.310.

The applicant is proposing a utility facility to construct a 315 square foot addition to an existing pump station to house additional equipment, and to extend a sediment containment area; therefore, this criterion applies to this proposal. In accordance with this Section of the Code the applicant is required to submit evidence illustrating that siting the utility facility on farmland is necessary to provide public service. The application must show that reasonable alternatives were considered, and that the utility facility must be sited on an Exclusive Farm Use (EFU) zoned property due to one or more of the factors found in the criteria below. The application states that the proposed addition must be sited in an exclusive farm use zoning district due to technical/engineering feasibility and locational dependence, as the facility relies on being located in close proximity to a water source, in this case the Santiam River. The intent of the addition is to house additional equipment to improve redundancy and efficiency on site. The addition is proposed at an existing utility facility approved per land use action PD02-0162.

The applicant has proposed to locate the proposed additions within the developed portion of the property within the existing facility. The use of an existing site is less of an impact on EFU land than a new utility facility. In summary, due to technical requirements, the utility facility is locationally dependent and there are limited properties with non-resource designations within reasonable proximity to the existing pump station that could be developed and support a utility facility. Therefore, based on the information provided in this application, the applicant has shown that reasonable alternatives were considered, and that the utility facility must be sited on the subject exclusive farm use property due to technical and engineering feasibility, locational dependence and lack of non-resource lands.

The Director finds the application adequately addresses this criterion. This criterion is met.

(b) "Necessary for public service," as that term is used in this paragraph, means that a utility facility must be situated in the EFU zoning district in order to provide the public service. To demonstrate that a utility facility is necessary, an applicant must show that reasonable alternatives have been considered and that the facility must be sited in an exclusive farm use zone due to one or more of the following factors:

(i) Technical and engineering feasibility;

As determined above, it is necessary to locate the addition in proximity to the existing pump station and its associated equipment, as well as in close proximity to a

water source. Locating the addition further away from the existing facility diminishes the efficiency and effectiveness of the facility the further the various components are placed from each other. Additionally, the construction of the addition adjacent to existing development is less of a development impact on the subject property.

The Director finds the application adequately addresses this criterion. This criterion is met.

(ii) The proposed facility is locationally dependent. A utility facility is locationally dependent if it must cross land in one or more areas zoned for exclusive farm use in order to achieve a reasonably direct route or to meet unique geographical needs that cannot be satisfied on other lands;

As determined above, it is necessary to locate the addition within close proximity to the existing pump station and its associated equipment, as well as in close proximity to a water source. Locating the addition further away from the existing facility diminishes the efficiency and effectiveness of the facility the further the various components are placed from each other. Additionally, the construction of the addition adjacent to existing development is less of a development impact on the subject property.

The Director finds the application adequately addresses this criterion. This criterion is met.

(iii) Lack of available urban and non-resource lands;

As indicated on the Linn County Zoning map, adjacent land to the south of the subject property is zoned Exclusive Farm Use (EFU). Adjacent properties to the north and west of the subject property are zoned Rural Residential; however, these properties are predominately developed with dwellings and related accessory structures. The addition is proposed at an existing pump station facility. There are no potentially usable properties within reasonable distance of the existing pump station that are either zoned or designated through the Comprehensive Plan, as urban or non-resource land.

The Director finds the application adequately addresses this criterion. This criterion is met.

(vi) Availability of existing rights of way;

The existing utility facility is currently served by a 60' wide private easement, approved per land use action PD05-0061, and will continue to serve the site for the proposed addition.

The Director finds the application adequately addresses this criterion. This criterion is met.

(v) Public health and safety; and

A dependable and reliable source of public drinking water is a significant public health and safety issue. Reliability in the public drinking water system is critical to ensuring drinking water is provided for public health. Improvements proposed at the existing pump station would further provide dependable and reliable services to local residents.

The Director finds the application adequately addresses this criterion. This criterion is met.

(vi) Other requirements of state and federal agencies.

Construction of the proposed improvements must comply with all requirements found in State building, mechanical, electrical, and plumbing codes. The proximity of the property to the Santiam River, a wetland and sensitive fish habitat, may require that the operators obtain applicable permits or approvals from Oregon Department of State Lands or Oregon Department of Fish and Wildlife for the proposed additions. Other affected state agencies include Oregon Water Resources Department, Oregon Health Division Public Drinking Water Program, and Oregon Department of Environmental Quality. No comments were received from affected state and federal agencies regarding the proposed addition. As a condition of approval, the applicant is required to comply with any applicable state and federal regulations that affect operating characteristics of the utility facility.

The Director finds the application adequately addresses this criterion. This criterion is met through compliance with permit conditions and Code requirements.

(c) Costs associated with any of the factors listed in subparagraph (b) of this paragraph may be considered, but cost alone may not be the only consideration in determining that a utility facility is necessary for public service. Land costs shall not be included when considering alternative locations for substantially similar utility facilities and the siting of utility facilities that are not substantially similar.

This criterion allows for the cost of an alternative to be one of the factors considered, but it may not be the sole deciding factor. The applicant could consider an alternative that was more costly but that would not impact EFU designated land if such an alternative were technically feasible. Because the proposed additions must be constructed in conjunction with the existing pump station facility in order to operate efficiently, cost was not considered as a factor in locating the communications facility on EFU land.

The Director finds the application adequately addresses this criterion. This criterion is met.

(d) The owner of a utility facility approved under this section shall be responsible for restoring, as nearly as possible, to its former condition any agricultural land and associated improvements that are damaged or otherwise disturbed by the siting, maintenance, repair or reconstruction of the facility. Nothing in this subsection shall prevent the owner of the utility facility from requiring a bond or other security from a contractor or otherwise imposing on a contractor the responsibility for restoration.

A requirement of approval is included as part of this decision that the owner/operator of the utility facility shall be responsible for restoration of the property to its former condition within three months should the facility ever be permanently abandoned. The primary use of the property continues to be farm use.

The Director finds the application adequately addresses this criterion. This criterion is met.

(e) The Director shall impose clear and objective conditions on an application for utility facility siting to mitigate and minimize the impacts of the proposed facility, if any, on surrounding lands devoted to farm use in order to prevent a significant change in accepted farm practices or a significant increase in the cost of farm practices on surrounding farmlands.

Pursuant to LCC Section 933.100, any decision resulting from a review required by the Code may be subject to the imposition of permit conditions. These permit conditions are those determined to be reasonably necessary to ensure compliance with the intent of the Code and the *Comprehensive Plan* and to aid in achieving compatibility with the applicable decision criteria. Conditions and Code requirements were included as part of this decision in order to mitigate potential impacts of the proposed addition to the utility facility.

The Director finds the application adequately addresses this criterion. This criterion is met.

(f) Utility facilities necessary for public service may include on-site and off-site facilities for temporary workforce housing for workers constructing a utility facility. Such facilities must be removed or converted to an allowed use under OAR the EFU zone or other statute or rule when project construction is complete. Off-site facilities allowed under this paragraph are subject to 660-033-0130(5). Temporary workforce housing facilities not included in the initial approval may be considered through a minor amendment request. A minor amendment request shall have no effect on the original approval.

According to the application, following construction of the proposed additions, there will be no increase in trips to the utility facility. No permanent employees are needed on-site for maintenance or operational purposes. Therefore, no workforce housing is needed or proposed.

The Director finds the application adequately addresses this criterion. This criterion is met.

(g) In addition to the provisions in subparagraphs (b) through (f) of this paragraph, the establishment or extension of a sewer system as defined by OAR 660-011-0060 (1) (f) in an exclusive farm use zone shall be subject to the provisions of OAR 660-011-0060.

No sewer is needed nor planned for the proposed additions; therefore, this criterion is met.

(h) The provisions of subparagraphs (b) through (f) of this paragraph do not apply to interstate natural gas pipelines and associated facilities authorized by and subject to regulation by the Federal Energy Regulatory Commission.

The proposal does not include anything associated with a natural gas pipeline; therefore, this criterion is met.

III. CONCLUSION

Sufficient information is available to conclude the proposal is consistent with the applicable decision criteria, subject to permit conditions and Code requirements. Therefore, the conditional use permit application for a utility facility to construct a 315 square foot addition to an existing pump station to house additional equipment, and to extend a sediment containment area is approved.