permit City of West Linn	**INVITATION FOR BID** CONSTRUCTION PROJECT	**Public Works Department** 22500 Salamo Road West Linn, Oregon 97068 Telephone: (503) 722-5500 Fax: (503) 656-4106

City of West Linn

Plans and Bid Documents

VOLUME 1 OF 2

Project Number: **PW-14-06**

Project Description: **Bolton Reservoir Replacement**

Prospective Bidders' Conference: September 22, 2015 10:00 a.m., local time

Due Date: October 6, 2015 2:00 p.m., local time

Plans and Specifications are available for download at no charge from the City's website at http://westlinnoregon.gov/rfps

Alternately, copies may be reviewed or picked-up for a $150.00 fee per set at:

Public Works Department
Engineering Division
22500 Salamo Road
West Linn, Oregon 97068

PROSPECTIVE BIDDERS' CONFERENCE ATTENDANCE IS REQUIRED

It is highly encouraged that Contractors and Subcontractors visit the site.

Contractors currently qualified for inclusion in the Bid Proposal as the **Reservoir Contractor**, the **Reservoir Prestressor**, the **Earthwork Contractor**, the **Water Main Contractor**, and the **Aggregate Pier Contractor** are listed in the Appendix B Technical Special Provisions Section 01100-1.45 through 1.49. Other Contractors that are not listed and who desire to be qualified for bidding shall submit a Statement of Qualifications (SOQ) Form to the ENGINEER no later than **September 23, 2015.** SOQ Forms are included in Appendix A of these Contract Documents.

City of West Linn, Oregon
Notice of Invitation for Bid and Contract

VOLUME 1 OF 2:

GENERAL

APPENDIX A

FORMS REQUIRED FOR SUBMITTAL PRIOR TO BID

1. WATER MAIN CONTRACTOR STATEMENT OF QUALIFICATIONS FORM
2. EARTHWORK CONTRACTOR STATEMENT OF QUALIFICATIONS FORM
3. AGGREGATE PIER CONTRACTOR STATEMENT OF QUALIFICATIONS FORM
4. RESERVOIR CONTRACTOR STATEMENT OF QUALIFICATIONS FORM
5. RESERVOIR PRESTRESSOR STATEMENT OF QUALIFICATIONS FORM

FORMS REQUIRED FOR SUBMITTAL WITH BID
(In addition to Notice of Invitation to Bid and Contract and any addenda)

6. BID PROPOSAL FORM
7. BID BOND
8. NONCOLLUSION AFFADAVIT
9. THREE YEAR EXPERIENCE RECORD
10. FIRST-TIER SUBCONTRACTOR DISCLOSURE (WH-179)
    Submit within 2 hours of bid closing.

FORMS NOT REQUIRED AT TIME OF BID

1. PERFORMANCE BOND
2. PAYMENT BOND
3. CONTRACTOR'S AFFADAVIT, SETTLEMENT OF CLAIMS
4. PUBLIC WORKS FEE INFORMATION FORM (WH-39)
   To be completed and paid by City upon award
5. NOTICE OF PUBLIC WORKS (WH-81)
   To be completed by City upon award.
6. PUBLIC WORKS FEE ADJUSTMENT FORM (WH-40)
   To be completed by City after final completion of project.
7. PAYROLL INSTRUCTIONS (WH-38A)
8. PAYROLL/CERTIFIED STATEMENT FORM (WH-38)
9. CURRENT PREVAILING WAGE RATE COVER AND AMENDMENTS
   The complete prevailing wage rate documents can be downloaded from the Oregon Bureau of Labor and Industries website at http://www.oregon.gov/boli/WHD/PWR/pages/pwr_state.aspx

APPENDIX B

TECHNICAL SPECIAL PROVISIONS FOR ALL WORK (ALL SCHEDULES)

APPENDIX C

TECHNICAL SPECIAL PROVISIONS FOR RESERVOIR SITE, PUMP STATION, AND OFF-SITE WATER MAIN REPLACEMENTS (SCHEDULES A, B, & C)

APPENDIX D

TECHNICAL SPECIAL PROVISIONS TO ODOT/APWA 2015 STANDARD SPECIFICATIONS FOR SKYLINE DRIVE STREET AND STORMWATER IMPROVEMENTS (SCHEDULE D)

APPENDIX E

SUPPLEMENTARY INFORMATION

VOLUME 2 OF 2

PLANS

City of West Linn, Oregon
Notice of Invitation for Bid and Contract

Project Number:	**PW-14-06**	Bid Due Date:	**October 6, 2015**
Project Name:	Bolton Reservoir Replacement	Bid Due Time:	2:00 p.m.
Bid Opening Location:	City of West Linn – City Hall Council Chambers 22500 Salamo Rd., West Linn, OR 97068	Contact: Title:	Jim Whynot Operations Supervisor
Time of Completion:	See Special Terms and Conditions Item 3.	Phone:	(503) 742-8615

Project Description: The work contemplated generally consists of the following:

Schedule A – Reservoir Site: The Work includes a new 4.0 million gallon (MG) partially buried circular prestressed concrete reservoir and associated appurtenances, site work including demolition of the existing 2.5 MG concrete Bolton Reservoir and other building demolitions, earthwork and site grading, foundation improvements, water main and stormwater improvements, valve vault, access road, fencing and landscaping, and associated electrical, instrumentation, controls and telemetry systems integration work.

Schedule B – Pump Station: The Work includes improvements to the existing Bolton Pump Station, consisting of a new pitched wood framed roof with metal roofing, relocating an existing 200 HP vertical turbine pump into an existing vacant pump barrel, installing two new pump control valves, a new surge valve, a new 100 HP vertical turbine pump into an existing pump barrel, with a new VFD, and piping, and associated mechanical, electrical, instrumentation, and controls work.

Schedule C – Water Main Replacement: The Work includes approximately 3,100 linear feet of 24-inch diameter potable water supply main, including valves, fittings, appurtenances, pressure reducing valve vault, connections to existing distribution system, pavement and surface restoration.

Schedule D – Skyline Drive Street and Stormwater improvements: The Work includes approximately 3,800 linear feet of roadway improvements consisting of roadway widening and grading, curb and sidewalk, drainage improvements, retaining walls, asphalt paving, pavement striping and landscaping.

Sealed bids for the project identified and described above will be received by the City of West Linn at the specified location above until the date and time cited above. Bids received by the correct date and time shall be publicly opened and the bid price read. Bids shall be in the actual possession of the identified bidding department on or prior to the exact date and time indicated above. Late bids will not be considered, except as provided in the City of West Linn Procurement Policy. ***Bids shall be submitted in a sealed envelope with the Invitation for Bid Project Number, Project Description, and the bidder's name and address clearly indicated on the front of the envelope***. All bids shall be completed in ink or typewritten. This Bid is for a public works project subject to ORS 279C.800 to 279C.870. Bidders are strongly encouraged to carefully read the ***entire*** Invitation for Bid Package.

BIDDER

To the City of West Linn:

The undersigned hereby Bids and agrees to furnish materials and/or services in compliance with all terms, conditions, specifications and addenda in the Notice of Invitation for Bid except for any written exceptions in the Bid. The signature below also certifies his or her understanding and compliance with The City of West Linn Standard Terms and Conditions.

Is the Bidder a "Resident" Bidder per ORS 279A.120? _____
Construction Contractors Board Yes/No

Registration Number: _____

Federal Employer
Identification Number: _____

For clarification of this Bid contact:

Name: _____

Telephone: _____

_____
Company Name

_____
Address

_____
City State Zip Code

_____
Authorized Signature for Bidder

_____
Printed Name

_____
Title

City of West Linn, Oregon
Notice of Invitation for Bid and Contract

ACCEPTANCE OF BID AND CONTRACT AWARD (For City of West Linn Use Only)

Your bid is hereby accepted. The Contractor is now bound to sell the materials and/or services listed by the attached award notice based upon the solicitation, including all terms, conditions, specifications, plans, addendum, amendments, etc., and the Contractor's Bid as accepted by the City.

Approved as to form:

_____
City Attorney

City of West Linn, Oregon.

Awarded on _____, _____.

_____
City Manager

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

1. **PREPARATION OF BID:**

   a. All bids shall be submitted on the forms provided in this *Invitation to Bid* package. It is permissible to copy these forms if required. Telegraphic (facsimile), electronic or mailgram bids will not be considered.

   b. The Bid and Contract Award document shall be submitted with an original ink signature by a person authorized to sign the Bid.

   c. Erasures, interlineations, or other modifications in the bid shall be initialed in original ink by the authorized person signing the Bid.

   d. If price is a consideration and in case of error in the extension of prices in the bid, the unit price shall govern. No bid shall be altered, amended, or withdrawn after the specified bid due date and time.

   e. Periods of time, stated as a number of days, shall be calendar days.

   f. Bid due date and time is stated as local Oregon time.

   g. The following items must be completed as part of the Bid submittal; Notice of Invitation for Bid and Contract (indicating Oregon Construction Contractors Board License Number), Bid Form, Bid Guaranty (Bond), Non-Collusion Affidavit, Three-Year Experience, and Addenda. Within two (2) hours of the Bid submittal, or with the Bid submittal, the First Tier Subcontractor Disclosure Form must be submitted if the bid is greater than $100,000.

   h. It is the responsibility of all Bidders to examine the entire *Invitation For Bid* package and seek clarification of any item or requirement that may not be clear and to check all responses for accuracy before submitting a bid. Negligence in preparing a Bid confers no right of withdrawal after bid due date and time.

2. **INQUIRIES:** Any question related to the *Invitation For Bid* (*IFB*) shall be directed to the Buyer whose name appears as the Contact on the *IFB*. The Bidder shall not contact or ask questions of the department for which the requirement is being procured. Questions should be submitted in writing when time permits. The Buyer may require any and all questions be submitted in writing at the Buyer's sole discretion. Any correspondence related to an *Invitation For Bid* should refer to the appropriate *IFB* number, page, and paragraph number. All requests for additional information or interpretation of the *IFB* shall be submitted to the Buyer no later than five (5) calendar days before the deadline for submission of bids. If, in the opinion of the City, additional information or clarification is required, an addendum will be issued to all plan holders on record. Any addenda issued by the City seventy-two (72) hours or more before the scheduled closing time for filing bids shall be binding upon the Bidder. Addenda may be downloaded from the City's website. Bidders shall frequently check the City's website until closing including at least daily the week of the closing. Failure of the Bidder to receive or obtain such addenda shall not excuse them from compliance therewith if they are awarded the contract. Oral instructions or information given by City Officers, employees or agents to Bidders concerning this *IFB* or the work in general shall not bind the City.

3. **PROSPECTIVE BIDDERS CONFERENCE (REQUIRED):** A prospective Bidders conference will be held. If scheduled, the date and time of this conference will be indicated on the cover page of this document. The purpose of this conference will be to clarify the contents of this *Invitation For Bid* in order to prevent any misunderstanding of the City's position. Any doubt as to the requirements of this *Invitation For Bid* or any apparent omission or discrepancy should be presented to the City at this conference. The City will then determine if any action is necessary and may issue a written addendum to the *IFB*.

4. **LATE BIDS:** Late Bids received after the scheduled bid due date and time will be returned to the Bidder unopened.

5. **WITHDRAWAL OF BID:** At any time prior to the specified bid due date and time, a Bidder (or designated representative) may withdraw the bid.

6. **ADDENDUM OF BID:** Receipt of Addendum shall be acknowledged by signing and returning the document with the Bid at the specified bid due date and time.

7. **CONSTRUCTION CONTRACTORS REGISTRATION:** A person shall not submit a bid or proposal to work as a construction contractor unless that person is first registered with the Construction Contractors Board as required by ORS 701.021 or licensed by the State Landscape Contractor's Board as required by ORS 671.530. Bids from persons who fail to comply with this requirement shall be deemed non-responsive and be rejected.

8. **AWARD OF CONTRACT:**

   a. Notwithstanding any other provision of this *Invitation For Bid*, The City expressly reserves the right to: waive any immaterial defect or informality, reject any bids that do not comply with the prescribed public contracting procedures (including the requirement to demonstrate the bidder's responsibility under ORS 279C.375 (3)(b)), reject all bids for good cause if in the public interest, or reissue an *Invitation For Bid*.

   b. A response to an *Invitation For Bid* is a Bid to contract with the City based upon the terms, conditions and specifications contained in the City's *Invitation For Bid* and the written addenda thereto, if any. Bids do not become contracts unless and until they are accepted and executed by the **City Local Contract Review Board, City Manager or Department Director** in accordance with the City of West Linn Procurement Policy. A contract is formed when written notice of award(s) is provided to the successful Bidder(s). The contract has its inception in the award document, eliminating a formal signing of a separate contract. For that reason, all of the terms and conditions of the procurement contract are contained in the *Invitation For Bid*; unless modified by an Addendum.

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

THE FOLLOWING TERMS AND CONDITIONS ARE AN EXPLICIT PART OF THE SOLICITATION AND ANY RESULTANT CONTRACT.

1. **APPLICABLE LAW:** In the performance of this agreement, contractors shall abide by and conform to any and all laws of the United States, State of Oregon and City of West Linn including but not limited to federal and state executive orders providing for equal employment and procurement opportunities, the Federal Occupational Safety and Health Act and any other federal or state laws applicable to this agreement.

   Attention is called to the requirements of Oregon Revised Statutes (O.R.S.) Chapter 279A, 279B, and 279C. This contract shall be governed by the laws of the State of Oregon. Any action or suits pertaining to this contract may be brought only in courts in the Circuit Court of Clackamas County or the U.S. District Court in Portland. Each and every provision of law and any clause required by law to be in the contract will be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the contract will forthwith be physically amended to make such insertion or correction.

   The City may cancel this contract without penalty or further obligations by the City or any of its departments or agencies if any person significantly involved in initiating, negotiating, securing, drafting or creating the contract on behalf of the City or any of its departments or agencies, is at any time while the contract or any extension of the contract is in effect, an employee of any other party to the contract in any capacity or a consultant to any other party of the contract with respect to the subject matter of the contract.

2. **AMERICANS WITH DISABILITIES ACT, DISCRIMINATION & AFFIRMATIVE ACTION:** Bidders agree that if awarded a contract, the successful Bidder will comply with all applicable provisions of the Americans with Disabilities Act of 1990, 42 UFC Section 12101 et seq. If any Bidder requires special assistance or auxiliary aids during the bidding process, please notify the City of West Linn, 503-657-0331 or TDD 503-657-7845 at least two (2) business days prior to the required assistance. To the extent applicable, the Contractor represents that it will comply with Executive Order 11246 as amended, Executive Order 11141, Section 503 of the Vocational Rehabilitation Act of 1973 as amended and the Age Discrimination Act of 1975, and all rules and regulations issued pursuant to the Acts. It is the policy of the City of West Linn that suppliers of goods or services to the City adhere to a policy of equal employment opportunity and demonstrate an affirmative effort to recruit, hire, and promote regardless of race, color, religion, gender, national origin, age or disability. By submitting the first tier subcontractor disclosure form, Bidder certifies that it has complied with ORS 279A.110(1), which states that a bidder may not discriminate against a subcontractor in awarding a subcontract because the subcontractor is a minority, women or emerging business enterprise certified under ORS 200.055 or a business enterprise that is owned or controlled by, or that employs a disabled veteran.

3. **BUSINESS LICENSE:** A current business license is required before doing business with the City. Information related to complying with the business license requirements is available by contacting the City Finance Department at 503-657-0331 or online at https://westlinnoregon.gov/finance/online-business-license-registration.

4. **CONSTRUCTION AND LANDSCAPE CONTRACTORS BOARDS:** Construction contractors must be licensed with the State of Oregon Construction Contractors Board in accordance with O.R.S. 701.005 and any other specialty licensing as required in the bid specification prior to submitting a bid to the City. For information contact:

   CONSTRUCTION CONTRACTORS BOARD
   700 Summer St. NE, Suite #300, Salem, OR 97310
   (503) 378-4621 (website) http://www.ccb.state.or.us

   A Landscape Contractors Board license is required in accordance with O.R.S. 671.510 if the bid specification includes landscape work as defined by O.R.S. 671.510. For information contact:

   LANDSCAPE CONTRACTORS BOARD
   2111 Front St. NE, Suite #2-101, Salem, OR 97310
   (503) 378-5909 (website) http://www.oregon.gov/LCB/

5. **LEGAL REMEDIES:** All claims and controversies shall be subject to resolution according to the terms of the City of West Linn Procurement Policy.

6. **BID GUARANTY:** All construction contracts shall be accompanied by a bid guaranty. No bid for construction will be considered unless accompanied by a certified check, cashier's check, or a bid bond for an amount not less than ten percent (10%) of the aggregate amount of the bid by a surety company authorized to issue such bonds in the State of Oregon. It shall be payable to the City of West Linn as a guaranty that the bid shall be irrevocable for a period of sixty (60) calendar days, unless otherwise specified, after the bid opening date and time and as liquidated damages should the Bidder fail or neglect to furnish the required performance bond and insurance and execute a contract within ten (10) calendar days after receiving said contract from the City for execution. The City will hold all bid security during the evaluation process. As soon as is practical after the completion of the evaluation, the City will issue a contract award notice for those Bids accepted by the City and return all checks to those who have not been issued a contract award notice.

   All bid security from contractors who have been issued an award notice shall be held until the successful execution of all required contractual documents and bonds (performance bond, insurance, etc.). If the contractor fails to execute the required contractual documents and bonds within the time specified, or ten (10) days after notice of award if no period is specified, the contractor may be found to be in default and the contract terminated by the City. In case of default, the City reserves all rights inclusive of, but not limited to, the right to purchase material and/or to complete the required work in accordance with the City of West Linn Procurement Policy and to recover any actual excess costs from the contractor. Collection against the bid security shall be one of the measures available toward the recovery of any excess costs.

7. **CONFLICT OF INTEREST:** A Bidder submitting a bid hereby certifies that no officer, agent or employee of the City who has a pecuniary interest in this bid has participated in the contract negotiations on the part of the City, that the bid is made in good faith without fraud, collusion, or connection of any kind with any other Bidder of the same Invitation for Bids, and that the Bidder is competing solely in its own behalf without connection with, or obligation to, any undisclosed person or firm. No bid will be considered unless accompanied by the notarized Non-Collusion Affidavit form included in the Invitation for Bid.

8. **PRE-BID REQUIREMENTS:** Before submitting a bid, each Bidder shall carefully examine the Drawings, read the Specifications and all Addenda and visit the work site, if applicable. Each Bidder shall fully inform themselves prior to submitting a bid as to all existing conditions and limitations under which the Work is to be performed, and shall include in the bid a sum to cover all costs of all items necessary to perform the Work as set forth in the Bid Documents. No allowance will be made to any Bidder because of lack of such examination or knowledge. Submission of a bid will be construed as conclusive evidence that the Bidder has made such examination.

9. **LOCAL BUSINESS PREFERENCE:** ORS 279A.120 requires that, in all public contracts, the public contracting agency shall prefer good or services that have been manufactured or produced in this State if price, fitness, availability and quality are otherwise equal. As such the City desires to employ local businesses in the purchase, lease, or sale of any personal property, public improvements or services that have been manufactured or produced by a local business if price, fitness, availability and quality are otherwise equal. When a public contract is awarded to a nonresident bidder and the contract price exceeds $10,000, the bidder shall promptly report to the Department of Revenue on forms provided by the department all information as required by ORS 279A.120(3).

10. **COST OF BID/PROPOSAL PREPARATION:** The City shall not reimburse the cost of developing, presenting, or providing any response to this solicitation. Bids submitted for consideration should be prepared simply and economically, providing adequate information in a straightforward and concise manner. The Invitation For Bid does not commit the City to pay any costs incurred by a Bidder in the submission of their bid, or in making any necessary studies or designs for the preparation thereof.

11. **CONTRACT:** The contract between the City and the Contractor shall consist of (1) the Invitation for Bid, including instructions, all terms and conditions, specifications, scopes of work, attachments, price sheet(s) and any amendments thereto, and (2) the Bid submitted by the Contractor in response to the Invitation for Bid (IFB). In the event of a conflict in language

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between the IFB and the Bid, the provisions and requirements in the IFB shall govern. However, the City reserves the right to clarify, in writing, any contractual terms with the concurrence of the Contractor, and such written contract shall govern in case of conflict with the applicable requirements stated in the IFB or the Vendor's Bid. The IFB shall govern in all other matters not affected by the written contract. The contract, if awarded, will be made to the lowest, responsive and responsible Bidder offering the lowest unit price base bid. Determination of the lowest responsive, responsible bid is subject to review by the City. Adversely affected or aggrieved bidders shall have seven calendar days after notice of award to submit to the City a written protest of the notice of award. Any written protest must be submitted in accordance with the adopted City Local Contract Review Board Rules.

12. **CONTRACT AMENDMENTS:** This contract may be modified only by a written Contract Amendment signed by persons duly authorized to enter into contracts on behalf of the City and the Contractor.

13. **CONTRACT APPLICABILITY:** The Bidder shall substantially conform to the terms, conditions, specifications and other requirements found within the text of this IFB. All previous agreements, contracts, or other documents, which have been executed between the Bidder and the City are not applicable to this IFB or any resultant contract.

14. **DRUG TESTING PROGRAM:** Pursuant to O.R.S. 279.505 (2) (1), the Contractor awarded the contract shall demonstrate that an employee drug-testing program is in place. The Contractor demonstrates that a drug-testing program is in place by signing of the contact. The drug testing program will apply to all employees and will be maintained for the duration of the Contract awarded. Failure to maintain a program shall constitute a material breach of contract.

15. **RELATIONSHIP TO PARTIES:** It is clearly understood that each party will act in its individual capacity and not as an agent, employee, partner, joint venturer, or associate of the other. An employee or agent of one party shall not be deemed or construed to be the employee or agent of the other for any purpose whatsoever. The Contractor is advised that taxes or Social Security payments will not be withheld from any City payments issued hereunder and that the Contractor should make arrangements to directly pay such expenses, if any.

16. **INTERPRETATION-PAROL EVIDENCE:** This contract represents the entire agreement of the Parties with respect to its subject matter, and all previous agreements, whether oral or written, entered into prior to this contract are hereby revoked and superseded by this contract. No representations, warranties, inducements or oral agreements have been made by any of the Parties except as expressly set forth herein, or in any other contemporaneous written agreement executed for the purposes of carrying out the provisions of this contact. This contract may not be changed, modified or rescinded except as provided for herein, absent a written agreement signed by both Parties. Any attempt at oral modification of this contract shall be void and of no effect.

17. **SUBCONTRACTS – ASSIGNMENT & DELEGATION:** Contractor shall submit a list of Subcontractors for approval by the City, and Contractor shall be fully responsible for the acts or omissions of any Subcontractors and of all persons employed by them, and neither the approval by City of any Subcontractor nor anything contained herein shall be deemed to create any contractual relation between the Subcontractor and City.

    This agreement, and all of the covenants and conditions hereof, shall inure to the benefit of and be binding upon the City and the Contractor respectively and their legal representatives. Contractor shall not assign any rights nor delegate any duties incurred by this contract, or any part hereof without the written consent of City, and any assignment or delegation in violation hereof shall be void.

18. **APPROVAL OF SUBSTITIONS:** The materials, products, and equipment described in the Documents and Addenda establish a standard or required function, dimension, appearance, and quality to be met by any proposed substitution. No substitute will be considered unless written request for approval has been received by the City or its representative at least five (5) days prior to the scheduled closing time for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including any drawings, cuts, performance, and test data and any other information necessary for evaluation of the substitute. If a substitute is approved, the approval shall be acknowledged in writing. Bidder shall not consider approvals made in any other manner.

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19. **RIGHTS AND REMEDIES:** No provision in this document or in the vendor's Bid shall be construed, expressly or by implication, as waiver by the City of any existing or future right and/or remedy available by law in the event of any claim of default or breach of contract. The failure of the City to insist upon the strict performance of any term or condition of the contract or to exercise or delay the exercise of any right or remedy provided in the contract, or by law, or the City's acceptance of and payment for materials or services, shall not release the Contractor from any responsibilities or obligations imposed by this contract or by law, and shall not be deemed a waiver of any right of the City to insist upon the strict performance of the Contract.

20. **INDEMNIFICATION:** Contractor warrants that all its work will be performed in accordance with generally accepted professional practices and standards as well as the requirements of applicable federal, state and local laws, it being understood that acceptance of a contractor's work by City shall not operate as a waiver or release.

    Contractor agrees to indemnify and defend the City, its officers, agents and employees and hold them harmless from any and all liability, causes of action, claims, losses, damages, judgments or other costs or expenses including attorney's fees and witness costs and (at both trial and appeal level, whether or not a trial or appeal ever takes place) that may be asserted by any person or entity which in any way arise from, during or in connection with the performance of the work described in this contract, except liability arising out of the sole negligence of the City and its employees. If any aspect of this indemnity shall be found to be illegal or invalid for any reason whatsoever, such illegality or invalidity shall not affect the validity of the remainder of this indemnification. The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

21. **EARLY TERMINATION:** This agreement may be terminated without cause prior to the expiration of the agreed upon term by mutual written consent of the parties and for the following reasons:

    a. If work under the Contract is suspended by an order of a public agency for any reason considered to be in the public interest other than by a labor dispute or by reason of any third party judicial proceeding relating to the work other than a suit or action filed in regard to a labor dispute; or

    b. If the circumstances or conditions are such that it is impracticable within a reasonable time to proceed with a substantial portion of the Contract.

    Payment of Contractor shall be as provided by ORS 279C.660 and shall be prorated to and include the day of termination and shall be in full satisfaction of all claims by Contractor against City under this Contract. Termination under any provision of this paragraph shall not affect any right, obligation, or liability of Contractor or City which accrued prior to such termination.

22. **CANCELLATION WITH CAUSE:** City may terminate this Contract effective upon delivery of written notice to Contractor, or at such later date as may be established by City, under any of the following conditions:

    a. If City funding from federal, state, local, or other sources is not obtained and continued at levels sufficient to allow for the purchase of the indicated quantity of services. This Contract may be modified to accommodate a reduction in funds,

    b. If Federal or State regulations or guidelines are modified, changed, or interpreted in such a way that the services are no longer allowable or appropriate for purchase under this Contract,

    c. If any license or certificate required by law or regulation to be held by Contractor, its subcontractors, agents, and employees to provide the services required by this Contract is for any reason denied, revoked, or not renewed,

    d. If Contractor becomes insolvent, if voluntary or involuntary petition in bankruptcy is filed by or against Contractor, if a receiver or trustee is appointed for Contractor, or if there is an assignment for the benefit of creditors of Contractor, or

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e. If Contractor fails to maintain reasonable relations with the public. Verbal abuse, threats, or other inappropriate behavior towards members of the public constitutes grounds for termination.

Any such termination of this agreement under this section shall be without prejudice to any obligations or liabilities of either party already accrued prior to such termination.

City, by written notice of default (including breach of contract) to Contractor, may terminate the whole or any part of this Contract:

f. If Contractor fails to provide services called for by this Contract within the time specified herein or any extension thereof, or

g. If Contractor fails to perform any of the other provisions of this Contract, or so fails to pursue the work as to endanger performance of this Contract in accordance with its terms, and after receipt of written notice from City, fails to correct such failures within ten (10) days or such other period as City may authorize.

The rights and remedies of City provided in the above clause related to defaults (including breach of contract) by Contractor shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

If City terminates this Contract per clause f or g above, Contractor shall be entitled to receive as full payment for all services satisfactorily rendered and expenses incurred, an amount which bears the same ratio to the total fees specified in this Contract as the services satisfactorily rendered by Contractor bear to the total services otherwise required to be performed for such total fee; provided, that there shall be deducted from such amount the amount of damages, if any, sustained by City due to breach of contract by Contractor. Damages for breach of contract shall be those allowed by Oregon law, reasonable and necessary attorney fees, and other costs of litigation at trial and upon appeal.

23. **SEVERABILITY:** In the event any provision or portion of this Contract is held to be unenforceable or invalid by any court of competent jurisdiction, the remainder of this Contract shall remain in full force and effect and shall in no way be affected or invalidated thereby.

24. **FORCE MAJEURE:** Neither City nor Contractor shall be considered in default because of any delays in completion of responsibilities hereunder due to causes beyond the control and without fault or negligence on the part of the party so disenabled, including, but not restricted to, an act of God or of a public enemy, volcano, earthquake, fire, flood, epidemic, quarantine, restriction, area-wide strike, freight embargo, unusually severe weather or delay of Subcontractor or suppliers due to such cause; provided that the party so disenabled shall within ten (10) days from the beginning of such delay, notify the other party in writing of the causes of delay and its probable extent. Such notification shall not be the basis for a claim for additional compensation. Each party shall, however, make all reasonable efforts to remove or eliminate such a cause of delay or default and shall, upon cessation of the cause, diligently pursue performance of its obligation under Contract.

25. **RIGHT TO ASSURANCE:** Whenever one party to this contract in good faith has reason to question the other party's intent to perform he may demand that the other party give a written assurance of this intent to perform. In the event that a demand is made and no written assurance is given within five (5) days, the demanding party may treat this failure as an anticipatory repudiation of the Contract.

26. **RIGHT TO ACCESS RECORDS:** City shall have access to such books, documents, papers and records of Contractor and Subcontractors as are directly pertinent to this Contract for the purpose of making audit, examination, excerpts, and transcripts.

27. **WARRANTIES:** All work shall be guaranteed by the Contractor for a period of 18 months after the date of final acceptance of the work by the Owner. Contractor warrants that all practices and procedures, workmanship, and materials shall be the best available unless otherwise specified in the profession. Neither acceptance of the work nor payment therefore shall relieve Contractor from liability under warranties contained in or implied by this contract. Additional warranty requirements may be set forth in the solicitation.

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28. **TITLE AND RISK OF LOSS:** The title and risk of loss of material and/or service shall not pass to the City until the City actually receives the material or service at the point of delivery, unless otherwise provided within this Contract.

29. **CONFLICT BETWEEN TERMS:** It is expressly agreed by and between the parties hereto that should there be any conflict between the terms of this instrument and the bid of the Contractor, this instrument shall control and nothing herein shall be considered as an acceptance of the said terms of said bid conflicting herewith.

30. **NONWAIVER:** The failure of the City to insist upon or enforce strict performance by Contractor of any of the terms of this contract or to exercise any rights hereunder shall not be construed as a waiver or relinquishment to any extent of its right to assert or rely upon such terms or rights on any future occasion.

31. **LIENS:** All materials, service or construction shall be free of all liens, and if the City requests, a formal release of all liens shall be delivered to the City.

32. **LICENSES:** Contractor shall have at the time of bid submittal, and shall maintain in current status, all Federal, State and Local licenses and permits required for the operation of the business conducted by the Contractor as applicable to this Contract. The conclusion of the issuing authority in each case is to be deemed conclusive for the purposes of complying with this provision. By submitting a bid for this public contract, you agree that, with respect to the contract, substantial compliance does not meet the minimum requirements of this or any provision hereof, or of any applicable law or other authority, and that strict compliance alone is adequate to meet those requirements, unless the City consents to such substantial compliance in writing at the time of bid submittal. The determination shall be made by the City.

33. **ATTORNEY'S FEES:** In case suit or action is instituted to enforce the provisions of this contract, the parties agree that the losing party shall pay such sum as the Court may adjudge reasonable attorney's fees and court costs including attorney's fees and court costs on appeal.

34. **PUBLIC RECORD:** All Bids submitted in response to this solicitation shall become the property of the City and shall become a matter of public record available for review, subsequent to the award notification, in accordance with the City's Procurement Policy.

35. **WORK IS PROPERTY OF THE CITY:** All work performed by Contractor under this Contract shall be the property of the City.

36. **ADVERTISING:** Contractor shall not advertise or publish information concerning this Contract, without prior written consent of the City.

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1. **DEFINITIONS**: The terms, as used in or pertaining to the contract, are defined as follows:

   CITY: The word *"City"* shall refer to the City of West Linn, Oregon.

   CONTRACTOR: The word *"Contractor"* is defined as the person, firm or corporation with whom the contract is made by the City.

   CONTRACT: The word *"Contract"* will include; the Invitation to Bid Notice and Contract, Instructions to Bidders, Bid Form, Bid Guaranty, Performance Bond, Payment Bond, Notice of Award, Notice to Proceed, Change Order, Certificate of Insurance, Certificate of Completion, Contractor's Affidavit Regarding Settlement of Claims, Contractor's Affidavit Certifying Non-Collusion in Bidding, Standard Terms & Conditions, General Terms & Conditions, Special Terms & Conditions, Technical Provisions, Plans and Addenda thereto.

   ENGINEER: The word *"Engineer"* is defined as the person, firm or corporation duly authorized by the City to act as agent in providing professional services including studies, planning, engineering design and construction administration services, inspecting materials and construction, and interpreting plans and specifications.

   MATERIALS: The word *"Materials"* will include, in addition to materials incorporated in the project, equipment and other material used and/or consumed in the performance of the work.

   SUBCONTRACTOR: The word *"Subcontractor"* is defined as those persons or groups of persons having a direct contract with the contractor and those who furnish material worked to a special design according to the plans and/or specifications for this work, and includes those who merely furnish materials not so worked.

   WORK: The word *"Work"* shall include all labor necessary to accomplish the construction required by the Contract and all materials and equipment incorporated or to be incorporated in said construction.

2. **REFERENCE STANDARDS**:

   a. The "2010 City of West Linn Public Works Standards" which are sponsored and distributed by the City of West Linn Engineering Division, and which are hereinafter referred to as the *"COWL Specifications,"* are hereby adopted as part of these contract documents.

   b. The "2015 Oregon Standard Specifications for Construction" which are available online or in print from the Oregon Department of Transportation (ODOT), and which are hereinafter referred to as the *"Standard Specifications,"* are hereby adopted as part of these contract documents.

   c. If any contradiction exists between "COWL Specifications" and this solicitation document, the solicitation language shall prevail.

3. **LAWS AND REGULATIONS**: The Contractor shall keep himself fully informed of all existing and future City and County ordinances and regulations and state and federal laws and Occupational Safety and Health Standards (OSHA) in any manner affecting the work herein specified. He shall at all times observe and protect and indemnify the City of West Linn, Oregon, and its officers and agents against any claim or liability arising from or based on the violation of any such ordinances, regulations or laws. It is the responsibility of the Contractor to obtain any and all information regarding the laws and regulations which may be referenced in the Specifications.

4. **RIGHTS OF WAY:** The Contractor shall not enter or occupy with workers, tools, equipment or materials any private ground outside the property or easement right of the City of West Linn, without the consent of the owner.

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The Contractor, at his own expense, is responsible for the acquisition of any additional easements or rights-of-way that he may desire to complete the work of this contract.

5. **PROPOSAL QUANTITIES**: It is expressly understood and agreed by the parties hereto that the quantities of the various classes of work to be done and the material to be furnished under this Contract, which have been estimated as stated in the Bids, are only approximate and are to be used solely for the purpose of comparing, on a consistent basis, the bids for the work under this Contract. The Contractor further agrees that the City of West Linn will not be held responsible if any of the quantities shall be found incorrect; and the Contractor will not make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done. If any error, omission, or misstatement is found to occur in the estimated quantities, the same shall not invalidate this Contract or the whole or any part of the work in accordance with the Specifications and Plans herein mentioned, and for the prices herein agreed upon and fixed therefore, or excuse him from any of the obligations or liabilities hereunder, or entitle him to any damage or compensation except as may be provided in this contract.

6. **PREVAILING WAGE RATE DETERMINATION**: The Contractor shall pay the applicable prevailing wage rates that are in effect at the time the Contract is bid. If the contract price exceeds $50,000 and is not otherwise exempt, workers shall be paid not less than the specified minimum hourly rate of wage in accordance with ORS 279C.838 and ORS 279C.840. Hard copies of the prevailing wage rates publication may be obtained by contacting the Oregon Bureau of Labor and Industries via telephone at: (971) 673-0839. The applicable prevailing wage rates may be accessed via the internet at: http://www.oregon.gov/BOLI/WHD/PWR/pwr_book.shtml. If the Project is subject to the Davis-Bacon Act and the state prevailing rate of wage is higher than the federal prevailing rate of wage, the contractor and every subcontractor on the Project shall pay at least the state prevailing rate of wage as determined under ORS 279C.815.

   The Contractor and all subcontractors must have a public works bond filed with the Oregon Construction Contractors Board before starting work on the Project, unless exempt under ORS 279C.836(4), (7), (8) or (9). If the contractor fails to pay for labor or services, the City can pay and withhold these amounts from payments due the contractor in accordance with ORS 279C.515. Daily, weekly, weekend, and holiday overtime will be paid as required in ORS 279C.540. The Contractor shall provide workers with a written schedule showing the number of hours per day and days per week the employee may be required to work in accordance with ORS 279C.520. Contractor must promptly pay for any medical services they have agreed to pay per ORS 279C.530.

   The City will not receive or consider a bid unless the bid contains a statement by the bidder that the bidder will comply with ORS 279C.838, ORS 279C.840, or 40 U.S.C. 3141. By signing and submitting the Bid, the Contractor agrees to comply with ORS 279C.838 or 279C.840 and/or 40 U.S.C. 3141 et seq. for a public works project subject to the state prevailing wage rates under ORS 279C.800 to 279C.870, the federal prevailing wage rates under the Davis-Bacon Act (40 U.S.C. 3141 et seq.) or both.

   For contracts $50,000 or greater, the City shall pay a fee to the Bureau of Labor and Industries and shall be mailed or otherwise delivered to the Bureau in accordance with Form WH-81 & WH-39.

7. **PAYMENTS TO CONTRACTOR**: City agrees to pay Contractor for performance of those services provided hereunder, which payment shall be based upon the following applicable terms:

   a. Payment: Payment shall be based upon the unit prices bid by the Contractor, as listed in attached bid. Contractor shall prepare and submit each month to the Buyer identified in the Invitation for Bid at the address listed, a statement of services rendered, (indicating the description of each service used in the bid and the dollar amount of each service completed through the stated date), together with a request for payment duly verified by the Contractor's Representative.

      Payment by the City shall release the City from any further obligation for payment to Contractor for services performed or expenses incurred as of the date of the statement of services. Payment of installments shall not be considered

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acceptance or approval of any work or waiver of any defects therein. City certifies that sufficient funds are available and authorized for expenditure to finance costs of this contract. Contractor shall include proof of payment to any and all subcontractors and suppliers with each statement submitted to the City. The City shall retain the right to withhold payments if required proof of payment to subcontractor and suppliers is not included with a statement.

b. Timing of Payments: Progress payments, less a five percent retainage as authorized by ORS 279C.555, shall be made to the Contractor within twenty (20) days of the City's receipt of the statement of services.

c. Final Payment: The Contractor shall notify the City in writing when the Contractor considers the project complete, and the City shall, within 15 days after receiving the written notice, either accept the work or notify the Contractor of work yet to be performed on the contract. If accepted by the City, the remaining balance due to the Contractor, including the retained percentage, shall be paid to the Contractor by the City within 30 days after the date of said acceptance.

The City shall pay to the Contractor interest at the rate of one and one-half percent per month on the final payment due the Contractor, to commence 30 days after the work under the Contract has been completed and accepted and to run until the date when final payment is tendered to the Contractor. If the City does not, within 15 days after receiving written notice of completion, notify the Contractor of work yet to be performed to fulfill contractual obligations, the interest provided by this subsection shall commence to run 30 days after the end of the 15-day period.

As a further condition of final acceptance, the City may require the Contractor to submit evidence, satisfactory to the City's Representative, that all payrolls, material bills, and other indebtedness connected with the project have been paid. If any indebtedness or liens are in dispute, the Contractor may submit a surety bond satisfactory to the City guaranteeing payment of all such disputed amounts if such payment has not already been guaranteed by surety bond.

All notices, bills and payments shall be made in writing and may be given by personal delivery or by mail. Notices, bills and payments sent by mail should be addressed to the attention of the Buyer and/or Authorized Bidder at the addresses identified in the Invitation for Bid and shall be deemed given upon deposit in the United States mail, postage paid. In all other instances, notices, bills and payments shall be deemed given at the time of actual delivery. Changes may be made in the names and addresses of the person to whom notices, bills, and payments are to be given by giving written notice pursuant to this paragraph.

8. **LIQUIDATED DAMAGES:** The Contractor agrees that the "Time of Completion" is defined in the Bid and agrees to complete the work by said date. The Contractor and City agree that the City will suffer damages each day the work remains uncompleted after the Time of Completion and that the amounts of those damages are difficult to calculate. Contractor and City agree that a reasonable amount of damages for late completion is **$500 per calendar day** and Contractor agrees to pay such amounts as liquidated damages if the work is not completed by the Time of Completion. Contractor agrees that the liquidated damages specified herein are a fair way of ascertaining damages to the City and are not a penalty for late completion.

9. **STATUS OF CONTRACTOR AS INDEPENDENT CONTRACTOR:** Contractor certifies that:

a. Contractor acknowledges that for all purposes related to this Agreement, Contractor is and shall be deemed to be an Independent Contractor as defined by ORS 670.600 and not an employee of City, shall not be entitled to benefits of any kind to which an employee of City is entitled and shall be solely responsible for all payments and taxes required by law. Furthermore, in the event that Contractor is found by a court of law or any administrative agency to be an employee of City for any purpose, City shall be entitled to offset compensation due, or to demand repayment of any amounts paid to Contractor under the terms of this Agreement, to the full extent of any benefits or other remuneration Contractor receives (from City or third party) as a result of said finding and to the full extent of any payments that City is required to make (to Contractor or to a third party) as a result of said finding.

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b. The Contractor hereby represents that no employee of the City, or any partnership or corporation in which a City employee has an interest, has or will receive any remuneration of any description from Contractor, either directly or indirectly, in connection with the letting or performance of this Agreement, except as specifically declared in writing.

c. If payment is to be charged against Federal funds, Contractor certifies that he or she is not currently employed by the Federal Government and the amount charged does not exceed his or her normal charge for the type of service provided.

d. Contractor and its employees, if any, are not active members of the Oregon Public Employees Retirement System and are not employed for a total of 600 hours or more in the calendar year by any public employer participating in the Retirement System.

e. Contractor certifies that it currently has a City business license or will obtain one prior to delivering services under this Agreement.

f. Contractor is not an officer, employee, or agent of the City as those terms are used in ORS 30.265.

10. **CERTIFIED PAYROLL:** The Contractor shall make payment promptly, as due, to all persons supplying to such Contractor labor or material for the performance of the work provided for in this contract. The Contractor will pay all contributions or amounts due the Industrial Accident Fund under the Worker's Compensation Law from such Contractor or Subcontractor incurred in the performance of this contract. The Contractor will pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167. The Contractor shall not permit any lien or claim to be filed or prosecuted against the City of West Linn on account of any labor or material furnished.

The Contractor or the Contractor's Surety and every Subcontractor or the Subcontractor's Surety shall file certified statements with the City in writing on a form prescribed by the Commissioner of the Bureau of Labor and Industries, certifying the hourly rate of wage paid each worker which the Contractor or the Subcontractor has employed upon such public work, and further certifying that no worker employed upon such public work has been paid less than the prevailing rate of wage or less that the minimum hourly rate of wage specified in the contract, which certificate and statement shall be verified by the oath of the Contractor or the Contractor's Surety or Subcontractor or the Subcontractor's Surety that the Contractor or Subcontractor has read such statement and certificate and knows the contents thereof and that the same is true to the Contractor's or Subcontractor's knowledge.

a. The certified statements shall set out accurately and completely the payroll records, including the name and address of each worker, the worker's correct classification, rate of pay, daily and weekly number of hours worked, and the gross wages the worker earned during each week identified in the certified statement.

b. Each certified statement required herein shall be delivered or mailed by the Contractor or Subcontractor to the City. A true copy of the certified statements shall also be filed at the same time with the Commissioner of the Bureau of Labor and Industries. Certified statements shall be submitted as set forth in ORS 279C.845.

c. The City shall retain 25 percent of any amount earned by Contractor until the certified statements as required by this section have been filed. City shall pay Contractor the amount retained under this subsection within 14 days after Contractor files the certified statements as required by this section, regardless of whether a subcontractor has failed to file certified statements as required by this section. City is not required to verify the truth of the contents of certified statements filed by Contractor.

The Contractor agrees that if the Contractor fails, neglects or refuses to make prompt payment of any claim for labor or services furnished to the Contractor or a Subcontractor by any person in connection with this contract as such claim becomes due, the proper office of the City of West Linn may pay such claim to the person furnishing the labor or services and charge the amount

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of the payment against funds due or to become due to the Contractor by reason of such contract. Payment of a claim in this manner shall not relieve the Contractor or the Contractor's Surety from obligation with respect to any unpaid claims.

Contractor agrees that no person shall be employed for more than ten (10) hours in any one day, or forty (40) hours in any one week, except in cases of necessity, emergency or when public policy absolutely requires it, and in such cases the laborer shall be paid at least time and a half pay for all overtime in excess of eight (8) hours in any one day or forty (40) hours in any one week when the workweek is five consecutive days, Monday through Friday, or ten (10) hours in any one day and or forty (40) hours in any one week when the workweek is four consecutive days, Monday through Friday and for all work performed on Saturday and on any legal holiday as specified in ORS 279C.540.

Contractor agrees to pay promptly as due, to any person, co partnership, association or corporation furnishing medical, surgical, and hospital care or other needed care and attention incident to sickness or injury to the Contractor's employees, of all sums which the Contractor agreed to pay for such services and all money and sums which the Contractor collected or deducted from employee wages pursuant to any law, contract or agreement for the purpose of providing or paying for such service.

11. **PRE-CONSTRUCTION CONFERENCE:** Within 30 days of the issuance of the Notice of Award, the Contractor is required to attend a Pre-construction Conference. The City will contact the Contractor to schedule a specific date, time and location for the Pre-construction conference. The purpose of the meeting is to outline specific construction items and procedures and to address items which require special attention on the part of the Contractor. The Contractor may also present proposed variations in procedures which the Contractor believes may improve constructability of the project, reduce cost, or will reduce inconvenience to the public. Any necessary coordination and procedures for Construction inspection and staking will be addressed during the Pre-construction Conference. The Contractor will be required to provide the following information at the Pre-construction Conference:

    a. Names and emergency telephone numbers of key personnel involved in the project.

    b. Names and telephone numbers of all subcontractors proposed for use on the project.

    c. A construction progress schedule showing the estimated time for start and completion of the major items of work.

    d. A written proposal outlining the intended plans for maintaining continuous access to residences and businesses along the construction site, and traffic control.

    e. An itemized list of all required shop drawings, material and equipment submittals and a schedule indicating the dates each of these items will be transmitted to the City for review.

    Each of the above items is subject to the review and approval by the City.

12. **INSURANCE REQUIREMENTS:** The Contractor, at Contractor's own expense, shall purchase and maintain the herein stipulated minimum insurance with companies licensed to do business in the State of Oregon with policies and forms satisfactory to the City. The City reserves the right to reject all or any insurance carrier(s) with an unacceptable financial rating. All insurance required herein shall be maintained in full force and effect until all work required to be performed under the terms of the Contract is satisfactorily completed and formally accepted; failure to do so may, at the sole direction of the City, constitute a material breach of this Contract. The Contractor's insurance shall be primary insurance, and any insurance or self insurance maintained by the City shall not contribute to it.

    Any failure to comply with the claim reporting provisions of the policies or any breach of an insurance policy warranty shall not affect coverage afforded under the policy to protect the City. The insurance policies shall contain a waiver of transfer

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rights of recovery (subrogation) against the City, its agents, representatives, directors, officers, and employees for any claims arising out of the Contractor's work or service.

The City reserves the right to request and to receive, within 10 working days, certified copies of any or all of the herein required insurance policies and/or endorsements. The City shall not be obligated, however, to review same or to advise Contractor of any deficiencies in such policies and endorsements, and such receipt shall not relieve Contractor from, or be deemed a waiver of the City's right to insist on, strict fulfillment of Contractor's obligations under this Contract.

The insurance policies required by this Contract shall name the City, its agents, representatives, officers, directors, officials and employees as Additional Insured with respect to this contract. All Liability Insurance policies will be endorsed to show this additional coverage. A cross-liability clause or separation of insured clause will be included in general liability policy.

The policy or policies of insurance maintained by the Contractor and its subcontractors shall provide at least the following limits and coverage:

a. Commercial General Liability Insurance: Includes all liability including all major divisions of coverage, but not limited to, Premises/Operations, Completed Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability (including coverage for the Contractor's indemnity obligations and other contractual indemnity obligations assumed by the Contractor), Personal Injury, and Broad Form Property Damage (including coverage for Explosion, Collapse, and Underground Hazards). The following insurance will be carried:

   Employer's Liability Insurance
   $ 2,000,000.00 Each Occurrence
   $ 2,000,000.00 Disease Each Employee
   $ 2,000,000.00 Disease – Policy

   Commercial General Liability insurance
   $ 2,000,000.00 Each Occurrence Limit
   $ 3,000,000.00 General Aggregate
   $ 3,000,000.00 Products/Completed Operations Aggregate
   $ 3,000,000.00 Personal and Advertising Injury
   $ 2,000,000.00 Limited Job Site Pollution Occurrence Sub-Limit

   Comprehensive Automobile Liability Insurance including coverage for all owned, hired and non-owned vehicles
   $ 2,000,000.00 Each Occurrence Combined Single Limit
   $ 3,000,000.00 Aggregate Bodily Injury & Property Damage
   or
   $ 2,000,000.00 Each Person Bodily Injury
   $ 2,000,000.00 Each Occurrence Bodily Injury
   $ 2,000,000.00 Each Occurrence Property Damage
   $ 2,000,000.00 Each Occurrence Pollution Occurrence Sub-Limit

b. "All risk" Builder's Risk Insurance (including earthquake and flood) covering the real and personal property of others in the care, custody, and control of the contractor, if applicable. Coverage shall include theft and damage to building interiors, exterior, in transit and offsite storage. The minimum amount of coverage to be carried shall be equal to the full amount of the contract.

The policy shall be endorsed to have the General Aggregate apply to this Project Only.

The insurance policies may provide coverage which contains deductibles or self-insured retentions. Such deductible and/or self insured retentions shall not be applicable with respect to the coverage provided to the City under such policies. The

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Contractor shall be solely responsible for deductible and/or self insured retention and the City, at its option, may require the Contractor to secure the payment of such deductible or self-insured retentions by a surety bond or an irrevocable and unconditional letter of credit.

Certificates of Insurance: Prior to commencing Services under this Contract, Contractor shall furnish the City with Certificates of Insurance, or formal endorsements as required by the Contract, issued by Contractor's insurer(s), as evidence that policies providing the required coverage, conditions and limits required by this Contract are in full force and effect. Certificates of Insurance should read "Insurance certificate pertaining to Bolton Reservoir Replacement, COWL Project No. PW-14-06. The City of West Linn, its officers, directors and employees shall be added as additional insured with respects to this contract. Insured coverage is primary" in the description portion of the certificate.

If a policy does expire during the life of the contract, a renewal certificate must be sent to the City ten (10) days prior to the expiration date. Insurance required herein shall not expire, be canceled, or materially changed without thirty (30) days prior written notice to the City. The procuring of such required insurance shall not be construed to limit contractor's liability hereunder. Notwithstanding said insurance, Contractor shall be obligated for the total amount of any damage, injury, or loss caused by negligence or neglect connected with this Contract.

13. **PERFORMANCE BOND:** The contractor shall be required to furnish non-revocable security binding the contractor to provide faithful performance of the contract in the amount of 100% of the total contract price payable to the City of West Linn.

    Performance security shall be in the form of a performance bond, certified check or cashier's check. This security must be in the possession of the City within the time specified or ten (10) days after notice of award if no period is specified. If the contractor fails to execute the security document as required, the contractor may be found in default and the contract terminated by the City. In case of default the City reserves all rights.

    All performance bonds shall be executed on the Performance Bond form included in the Bid Document, duly executed by the Bidder as Principal and having as Surety thereon a Surety company approved by the owner and holding a Certificate of Authority to transact surety business in the State of Oregon, by the Oregon Department of Insurance. Individual sureties are unacceptable. All Insurers and Sureties shall have at the time of submission of the proposal an A.M. Best's Key Rating Guide of "A-" or better as currently listed in the most recent Best Key Guide, published by the A.M. Best Company, payable without condition to the Owner.

14. **PAYMENT BOND:** The contractor shall be required to furnish non-revocable security for the protection of all persons supplying labor and material to the contractor or any subcontractor for the performance of any work related to the contract. Payment security shall be in the amount of 100% of the total contract price and be payable to the City of West Linn. Payment security shall be in the form of a payment bond, certified check or cashier's check.

    All payment bonds shall be executed on the Payment Bond form included in the Bid Document, duly executed by the Bidder as Principal and having as Surety thereon a Surety company approved by the owner and holding a Certificate of Authority to transact surety business in the State of Oregon, by the Oregon Department of Insurance. Individual sureties are unacceptable. All Insurers and Sureties shall have at the time of submission of the proposal and A.M. Best's Key Rating Guide of "A-" or better as currently listed in the most recent Best Key Guide, published by the A.M. Best Company, payable without condition to the Owner.

15. **NOTICE TO PROCEED**: Within 45 days of the issuance of the Notice of Award the City may issue a written Notice to Proceed. The Notice to Proceed shall stipulate the actual contract start date, the contract duration and the contract completion date. The time required for the Contractor to obtain permits, licenses and easements shall be included in the contract duration and shall not be justification for a delay claim by the Contractor. The time required for the Contractor to prepare, transmit and obtain approval of applicable submittals shall be included in the contract duration and shall not be justification for a delay claim by the Contractor.

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No work shall be started until after all required permits, licenses, and easements have been obtained.

No work shall be started until all applicable submittals have been submitted and returned approved by the City's Representative.

16. **PROTECTION OF FINISHED OR PARTIALLY FINISHED WORK**: The Contractor shall properly guard and protect all finished or partially finished work, and shall be responsible for the same until the entire contract is completed and accepted by the City Engineer. The Contractor shall turn over the entire work in full accordance with these Specifications before final settlement shall be made.

17. **CHANGE ORDERS**: The City may at any time, and without notice, issue a written Change Order requiring additional work within the general scope of this Contract, or any amendment thereto, or directing the omission of or variation in work. If such Change Order results in a material change in the amount or character of the work, an equitable adjustment in the Contract price and other provisions of this Contract as may be affected may be made. Any claim by Contractor for an adjustment under this section shall be asserted in writing within thirty (30) days from the date of receipt by Contractor of the notification of change or the claim will not be allowed. Whether made pursuant to this section or by mutual agreement, no change shall be binding upon City until a Change Order is executed by the Authorized Representative of City, which expressly states that it constitutes a Change Order to this Contract. The issuance of information, advice, approvals, or instructions by City's Representative or other City personnel shall not constitute an authorized change pursuant to this section. Nothing contained in this section shall excuse the Contractor from proceeding with the prosecution of the work in accordance with the Contract, as changed.

18. **STOCKPILE OF MATERIALS**: The Contractor may, if approved by the City Engineer, place or stockpile materials in the public right-of-way provided they **do not** prevent access to adjacent properties or prevent compliance with traffic regulations. Traffic shall not be required to travel over stockpiled materials, and proper dust control shall be maintained.

19. **EXCESS MATERIALS**: When excavations are made, resultant loose earth shall be utilized for filling by compacting in place or disposed of off the site. Excess or unsuitable material, broken asphaltic concrete and broken portland cement concrete excavated from the right-of-way shall be removed from the project and disposed of by the Contractor.

    Waste material shall not be placed on private property without express permission of the property owner.

    The Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of the work, he shall remove all equipment, tools and surplus materials, and shall completely clean the premises, removing and disposing of all debris and rubbish, and cleaning all stains, spots, marks, dirt, smears, etc. When work premises are turned over to the City, they shall be thoroughly clean and ready for immediate use.

    Clean-up shall include removal of all excess pointing mortar materials within pipes and removal of oversized rocks and boulders left after finish grading. The Contractor shall provide for the legal disposal of all waste products debris, etc., and shall make necessary arrangements for such disposal.

20. **ENVIRONMENTAL POLLUTION**: As provided by ORS 279C.525, all applicable provisions of federal, state or local statutes, ordinances and regulations dealing with the prevention of environmental pollution and the preservation of natural resources that affect the work under this contract are by reference incorporated herein to the same force and affect as if set forth herein in full. If the Contractor must undertake additional work due to the enactment of new or the amendment of existing statutes, ordinances or regulations occurring after the submission of the successful bid, the City shall issue a Change Order setting forth the additional work that must be undertaken. The Change Order shall not invalidate the Contract and there shall be, in addition to a reasonable extension, if necessary, of the contract time, a reasonable adjustment in the contract price,

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if necessary, to compensate the Contractor for all costs and expenses incurred, including overhead and profits, as a result of the delay or additional work.

21. **SALVAGE, COMPOSTING OR MULCHING**: If this is a contract for demolition work, the Contractor shall salvage or recycle construction and demolition debris, if feasible and cost-effective. If this is a contract for lawn and landscape maintenance, Contractor shall compost or mulch yard waste material at an approved site, if feasible and cost-effective.

22. **LOSSES AND DAMAGES**: All loss or damage arising out of the nature of the work to be done or from the action of the elements or from any unforeseen circumstances in the prosecution of the same, or from any unusual obstructions or difficulties which may be encountered in and/or during the prosecution of the work, or from any casualty whatsoever of every description, shall be sustained and borne by the Contractor at his own cost and expense.

23. **CHARACTER AND STATUS OF WORKMEN**: Only skilled foremen and workmen shall be employed on work requiring special qualifications. When required by the City, the Contractor shall discharge any person who is, in the opinion of the City Engineer, disorderly, dangerous, insubordinate, incompetent, or otherwise objectionable. The Contractor shall keep the City harmless from damages or claims for compensation that may occur in the enforcement of this section.

24. **WORK METHODS:** The methods, equipment and appliances used on the work shall be such as will produce a satisfactory quality of work, and shall be adequate to complete the contract within the time limit specified.

    Except as is otherwise specified, the Contractor's procedure and methods of construction may, in general, be of his own choosing, provided they follow best general practice and are calculated to secure results which will satisfy the requirements of the specifications and the supervision of the work.

    The work covered by this Contract shall be carefully laid out in advance and performed in a manner to minimize interference with normal operation and utilization of the roads. The Contractor shall exercise caution during the course of this construction work to avoid damage to all known existing or possible unknown existing underground utilities. He shall conduct his construction operations in such a manner as to avoid injury to his personnel and to avoid damage to all utilities. Any damage done will be repaired without delay and at the expense of the Contractor.

25. **INSPECTION:** All material and/or services are subject to inspection and acceptance by the City. Materials and/or services failing to conform to the specifications of this Contract will be held at Contractor's risk and may be returned to the Contractor. If so returned, all costs are the responsibility of the Contractor. The City may elect to do any or all of the following per written determination:

    a. Waive the non-conformance.

    b. Stop the work immediately.

    c. Bring material into compliance.

26. **TRAFFIC REGULATIONS**: All traffic affected by this construction shall be regulated in accordance with the *Oregon Temporary Traffic Control Handbook,* latest edition, as prepared by the Oregon Department of Transportation and any questions shall be referred to the City of West Linn City Engineer for interpretation.

    At the time of the pre-construction conference, the Contractor shall designate an employee who is well qualified and experienced in construction traffic control and safety to be responsible for implementing, monitoring and altering traffic control measure, as necessary. At the same time the City will designate a representative who will be responsible to see that all traffic control and any alterations are implemented and monitored to the extent that traffic is carried through the work area in an effective manner and that motorists, pedestrians, bicyclists and workers are protected from hazard and accidents.

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a. All traffic control devices required for this project shall be the responsibility of the Contractor. The Contractor shall place advance warnings signs in accordance with the Traffic Control Handbook.

b. The Contractor shall provide, erect and maintain all necessary flashing arrow boards, barricades, suitable and sufficient warning lights, signals and signs, and shall take all necessary precautions for the protection of the work and safety of the public. The Contractor shall provide, erect and maintain acceptable and adequate detour signs at all closures and along detour routes.

c. All barricades and obstructions shall be illuminated at night, and all safety lights shall be kept burning from sunset until sunrise. All barricades and signs used by the Contractor shall conform to the standard design, generally accepted for such purposes, and payment for all such services and materials shall be considered as included in the other pay items of the Contract unless specifically listed and identified.

d. The Contractor shall insure that all existing traffic signs are erect, clean and in full view of the intended traffic at all times. Street name signs at major street intersections shall be maintained erect at all times. If these signs should interfere with construction, the Contractor shall notify the Inspector at least forty eight (48) hours in advance for City personnel to temporarily relocate said signs. The City will re-set all traffic and street name signs to permanent locations when notified by the Contractor that construction is complete unless otherwise stated in the specifications.

e. When construction activities or traffic hazards at the construction site require the use of flagmen, it shall be the Contractor's responsibility to provide adequate personnel including flagmen to direct traffic safely.

f. Equipment used and/or directed by the Contractor shall travel with traffic at all times. Supply trucks shall travel with traffic except when being spotted. Provide a flagman to assist with this operation.

g. During construction, it may be necessary to alter traffic control. Alterations shall be in accordance with the Traffic Control Handbook.

h. **NO STREET WITHIN THIS PROJECT MAY BE CLOSED TO THROUGH TRAFFIC OR TO LOCAL EMERGENCY TRAFFIC WITHOUT THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER PER DIRECTION OF THE CITY MANAGER OF THE CITY OF WEST LINN.** Written approval may be given if sufficient time exists to allow for notification of the public at least two (2) days in advance of such closing. Partial closure of streets within the project shall be done in strict conformity with written directions to be obtained from the City Engineer.

i. The Contractor shall address how local access to adjacent properties will be handled in accordance with the specification herein.

j. Where crossings of existing pavements occur, no open trenches shall be permitted overnight, but plating may be permitted if conditions allow as determined by the City Engineer or his authorized representative. If plates cannot be used, crossings shall be appropriately back-filled to provide a safe smooth travelling surface.

27. **OUTDOOR CONSTRUCTION RESTRICTIONS:** Outdoor construction is restricted to the times listed below in the following table:

	Weekdays (Mon.-Fri.)	Weekends (Sat.-Sun.), Holidays
All Outdoor Construction Work	7:00 a.m. to 7:00 p.m.	9:00 a.m. to 5:00 p.m.

Holidays include: New Year's Day, Martin Luther King Jr. Birthday, Washington's Birthday/President's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day, and Christmas Day.

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28. **FIRST TIER SUBCONTRACTOR DISCLOSURE:** If a Bid for the Project is greater than $100,000, within two working hours of the date and time the Bids are due, the Bidder must submit a written disclosure for all First Tier Subcontractors furnishing labor or labor and materials whose subcontracts are equal to or greater in value than 5% of the total Project Bid or $15,000, whichever is greater, or $350,000 regardless of the percentage of the total project bid in accordance with ORS 279C.370. The Bidder must disclose the following information about their first-tier subcontracts either in its Bid submission or within two (2) working hours after the date and time of the deadline when bids are due:

    a. The subcontractor's name, address, Construction Contractor's Board Number (as applicable), and

    b. The dollar value of the subcontract, and

    c. The category of work that the subcontractor will be performing.

    If the bidder will not be using any subcontractors that are subject to the above disclosure requirements, the bidder is required to indicate "NONE" on the accompanying form. Failure to submit this form by the disclosure deadline will result in a non-responsive bid. A non-responsive bid will not be considered for award. It is the Bidder's responsibility to determine all the documents are must be submitted to the City.

29. **USE OF EQUALS:** When the specifications for materials, articles, products, and equipment state "or equal", Contractor may bid upon, and use materials, articles, products, and equipment which will perform equally the duties imposed by the general design. The Engineer will have the final approval of all materials, articles, products, and equipment proposed to be used as an "equal." It shall not be purchased or installed without prior written approval from the City or its representative.

30. **HAZARDOUS MATERIALS**: The Contractor shall supply the City with a list of any and all hazardous substances used in performance of this Contract. That list shall identify the location of storage and use of all such hazardous substances and identify the amounts stored and used at each location. Contractor shall provide City with material safety data sheets for all hazardous substances brought onto City property, created on City property or delivered to City pursuant to this Contract. For the purpose of this section, "hazardous substance" means hazardous substance as defined by ORS 453.307(5). Contractor shall complete the State Fire Marshall's hazardous substance survey as required by ORS 453.317 and shall assist City to complete any such survey that it may be required to complete because of substances used in the performance of this Contract.

31. **HAZARDOUS WASTE**: If, as a result of performance of this Contract, Contractor generates any hazardous wastes, Contractor shall be responsible for disposal of any such hazardous wastes in compliance with all applicable federal and state requirements. Contractors shall provide City with documentation, including all required manifests, demonstrating proper transportation and disposal of any such hazardous wastes. Contractor shall defend, indemnify, and hold harmless City for any disposal or storage of hazardous wastes generated pursuant to this Contract and any releases or discharges of hazardous materials.

32. **TEMPORARY SANITARY FACILITIES**: The Contractor shall provide facilities for the use of workmen employed on the work site in accordance with the requirements of ORS 654.150, (Sanitary facilities at construction projects; standards, exemptions) and the rules adopted pursuant thereto. Whether or not ORS 654.150 is applicable to the project is the sole responsibility of the Contractor. Contractor shall be responsible for all costs that may be incurred in complying with or in securing exemption or partial exemption from the requirements as incidental to this contract.

33. **ELECTRIC POWER, WATER AND TELEPHONE**: Unless otherwise specified, the Contractor shall make his own arrangements for electric power, water and telephone. Subject to the convenience of the utility, he may be permitted to connect to existing facilities where available, but he shall meter and bear the cost of such power or water, and installation and disconnect of such power, water and telephone services.

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34. **UTILITIES AND ELECTRICAL POWER LINES**: The electric utility company may maintain energized aerial electrical power lines in the immediate vicinity of this project. Do not consider these lines to be insulated. Construction personnel working in proximity to these lines are exposed to an extreme hazard from electrical shock. Contractors, their employees and all other construction personnel working on this project must be warned of the danger and instructed to take adequate protective measure, including maintaining a minimum ten (10) feet clearance between the lines and all construction equipment and personnel. (see: OSHA Std. 1926.550 (a) 15).

    Electrical utility companies may maintain energized underground electrical power lines in the immediate vicinity of this project. These power lines represent an extreme hazard of electrical shock to any construction personnel or equipment coming in contact with them. Contractors, their employees, and all other personnel working near any underground power lines must be warned to take adequate protective measure. (see: OSHA Std. 1926-651 (A)).

    Oregon law requires all parties planning excavations in public rights-of-way to contact utilities for locations of their underground facilities in accordance with the rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0010 through OAR 952-001-0090. You may obtain copies of the rules by calling the center at (503) 232-1987.

35. **COOPERATIVE PURCHASING**: Any publicly funded city, county, district, agency or similar entity shall have the authority to purchase specified goods/services directly from the contractor under the terms and conditions of this contract as indicated below:

    a. The bidder agrees to extend identical pricing to local public agencies for the same terms. Quantities listed in this document reflect the City of West Linn's estimated usage only.

    b. Each contracting agency will execute a separate contract with the successful bidder for its requirements.

    c. Any bidder, by written notification at the time of the bid due date and time, may decline to extend the prices and terms of this bid to any, and/or all other public agencies.

    d. Additional costs may be incurred by the successful bidder in contracting with another public agency. All demonstrable costs (shipping, etc.) may be passed on to that public agency.

    Contractor shall provide information regarding total usage of contract upon request of the City of West Linn.

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Purpose: The City of West Linn intends to establish a contract for the **Bolton Reservoir Replacement project**. For the Technical Special Provisions of this contract see Appendices B and C.

1. **Prospective Bidders Conference:** Prospective bidders are required to attend a conference to be held at the City of West Linn City Hall:

   ADDRESS: 22500 Salamo Road
   West Linn, Oregon 97068
   Bolton Conference Room

   DATE/TIME: AS INDICATED ON INVITATION FOR BID

   The purpose of this conference will be to clarify the contents of this Invitation For Bid in order to prevent any misunderstanding of the City's position. Any doubt as to the requirements of this Invitation For Bid or any apparent omission or discrepancy should be presented to the City at this conference. The City will then determine the appropriate action necessary, if any, and issue a written addendum to the Invitation For Bid. Oral statements or instructions shall not constitute an amendment to the Invitation For Bid.

2. **Bid Acceptance Period:** In order to allow for an adequate evaluation, the City requires a Bid in response to this Solicitation to be valid and irrevocable for sixty (60) days after the opening time and date.

3. **Time of Completion:** The Contractor shall commence work for this project on or before the fifth (5) day following the project start date indicated on the "Notice to Proceed" issued by the City of West Linn and shall fully complete all work under the project within the "Time of Completion" stated on the "Notice of Invitation to Bid and Contract." The Contractor shall, at all times, during the continuance of the Contract, prosecute the work with such force and equipment as is sufficient to complete all work within the time specified.

   The Contractor shall schedule and complete all work in accordance with sequencing and milestones identified in the Technical Special Provision Section 01015 WORK SEQUENCE AND CONSTRAINTS, included in Appendix B of the Bid Documents.

4. **Plans and Specifications to Successful Bidder:** The successful Bidder may obtain five (5) sets of Plans and Specifications for this project from the City at no cost.

5. **City of West Linn Permit:** As a City project, the Contractor is not required to obtain a City Public Works Construction permit. Other permits are described in Appendix B, Section 01100 Special Provisions.

6. **Key Personnel:** It is essential that the Contractor provide adequate experienced personnel, capable of and devoted to the successful accomplishment of work to be performed under this contract. The Contractor must agree to assign specific individuals to the key positions.

   b. The Contractor agrees that, once assigned to work under this contract, key personnel shall not be removed or replaced without written notice to the City.

   c. If key personnel are not available for work under this contract for a continuous period exceeding 30 calendar days, or are expected to devote substantially less effort to the work than initially anticipated, the Contractor shall

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immediately notify the City, and shall, subject to the concurrence of the City, replace such personnel with personnel of substantially equal ability and qualifications.

7. **Technical Special Provisions**: The *COWL Specifications and 2015 ODOT Standard Specifications* are the adopted REFERENCE STANDARDS for all Schedules of work for this project and shall apply except as modified by the Technical Special Provisions identified below.

   Appendix B Technical Special Provisions: Applies to all Schedules A, B, C, and D
   Appendix C Technical Special Provisions: Applies only to Schedules A, B and C
   Appendix D Technical Special Provisions: Applies only to Schedule D

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Appendix A

FORMS

FORMS REQUIRED FOR SUBMITTAL PRIOR TO BID

WATER MAIN CONTRACTOR
STATEMENT OF QUALIFICATIONS FORM
FOR
BOLTON RESERVOIR REPLACEMENT PROJECT
FOR
CITY OF WEST LINN, OREGON

The City of West Linn requires a statement to be completed and submitted by contractors bidding on the Bolton Reservoir Replacement Project regarding their financial ability, equipment, and experience in relation to the proposed water main construction work. The WATER MAIN CONTRACTOR must be qualified by the ENGINEER prior to bidding. Only water main contractors who have received qualification prior to bidding may be named in the Proposal.

Refer to Section 01100, Technical Special Provisions in Appendix C for a list of pre-qualified water main contractors.

This Statement of Qualifications Form shall be completed and submitted by 5:00 PM on September 23, 2015 to:

Submitted to: MURRAY, SMITH & ASSOCIATES, INC.

Address: 121 SW Salmon, Suite 900, Portland, Oregon 97204

Attention: Justin H. Ford, P.E.

To qualify for this project, the prospective WATER MAIN CONTRACTOR must complete the following information:

WATER MAIN CONTRACTOR INFORMATION

Submitted By: _____ A Corporation / A Partnership / An Individual
(WATER MAIN CONTRACTOR)

Type of Work: _____

Principal Office: _____

Contractor's Bank and Local Contact: _____

EXPERIENCE QUESTIONNAIRE

1. How many years has your organization been in business as a contractor under your present business name? _____

2. Have you ever failed to complete any work awarded to you? _____

   If so, where and why? _____

3. List below the contracts which you, or your company, or corporation were party, during the previous 10 years which contracts where involved in litigation of any type:

4. Name the Surety Company, and the name and address of the local agent you expect to use in the event this Contract is awarded to you:

5. Name the field superintendent(s) who will be in direct charge of the water main construction if awarded this Contract and state the relevant, successful experience. A qualified field superintendent will be required to be on the project site in responsible charge, full-time, during all water main construction activities. The proposed superintendent(s) shall be currently employed by the water main contractor and shall have been the water main contractor superintendent on no less than two (2) water/transmission main installations during the last ten years. The water main superintendent(s) shall have been in the direct employment of the water main contractor for both of the water/transmission mains listed. Indicate the owner of projects referenced. Provide the name(s) of at least two (2) water/transmission main jobs successfully completed by all of the superintendents listed by the water main contractor, which shall include a project description, the name and address of the owner, and the approximate completion date of each project.

Superintendent Name(s)		
Project Completed: Owner Project Name Year Completed		
Project Completed: Owner Project Name Year Completed		

6. The names, addresses and telephone numbers of the owners and project engineers, and completion dates and location of at least five (5) projects located within Oregon, Washington or California which have been successfully completed by the water main contractor during the last seven (7) years. In order to meet the experience requirements, at least three (3) of the projects shall be similar in design to the specified construction (i.e., water/transmission main installations greater than or equal to 4,000 linear feet, water/transmission main installations of pipe greater than or equal to 18 inches in diameter, off-site hauling of material through population centers, etc.). Project examples must demonstrate successful completion of the installation and discuss methods for limiting risk given the constraints set forth in the project plans and specifications. Project examples should demonstrate the ability to follow a precise work sequence of construction and successful overall project coordination in order to minimize the water main installation time. (Provide an attachment if additional space is required.)

Project Name, Owner & Water/Transmission Main Length and Diameter	Year Completed	Name & Address of Owner Contact Person and Phone Number	Name & Address of Engineer Contact Person and Phone Number

7. Demonstration of the Contractor's accessibility to a track-mounted hydraulic excavator of the 52,800 to 72,500 pound class equipped with a single shank ripper or a bucket fitted with rock teeth shall also be submitted with the Statement of Qualifications Form. Any excavation machinery that will not provide the substantial equivalent of the above requirements will be rejected. List the major items of equipment which you own or which will be available for use on the proposed work:

_____

_____

_____

_____

_____

The information submitted in this form will be regarded as confidential to the extent of the law.

The undersigned hereby declares that the foregoing statements are true and that the foregoing financial statement is a true and accurate statement of the financial condition of said firm.

Dated at _____ this_____ day of _____, 2015

By_____

Title_____

Date_____

EARTHWORK CONTRACTOR
STATEMENT OF QUALIFICATIONS FORM
FOR
BOLTON RESERVOIR REPLACEMENT PROJECT
FOR
CITY OF WEST LINN, OREGON

The City of West Linn requires a statement to be completed and submitted by contractors bidding on the Bolton Reservoir Replacement Project regarding their financial ability, equipment, and experience in relation to the proposed earthwork associated with reservoir construction. The EARTHWORK CONTRACTOR must be qualified by the ENGINEER prior to bidding. Only earthwork contractors who have received qualification prior to bidding may be named in the Proposal.

Refer to Section 01100, Technical Special Provisions in Appendix C for a list of pre-qualified earthwork contractors.

This Statement of Qualifications Form shall be completed and submitted by 5:00 PM on September 23, 2015 to:

Submitted to: MURRAY, SMITH & ASSOCIATES, INC.

Address: 121 SW Salmon, Suite 900, Portland, Oregon 97204

Attention: Justin H. Ford, P.E.

To qualify for this project, the prospective EARTHWORK CONTRACTOR must complete the following information:

EARTHWORK CONTRACTOR INFORMATION

Submitted By: _____ A Corporation / A Partnership / An Individual
(EARTHWORK CONTRACTOR)

Type of Work: _____

Principal Office: _____

Contractor's Bank and Local Contact: _____

EXPERIENCE QUESTIONNAIRE

1. How many years has your organization been in business as a contractor under your present business name? _____

2. Have you ever failed to complete any work awarded to you? _____

   If so, where and why? _____

3. List below the contracts which you, or your company, or corporation were party, during the previous 10 years which contracts where involved in litigation of any type:

4. Name the Surety Company, and the name and address of the local agent you expect to use in the event this Contract is awarded to you:

5. Name the field superintendent(s) who will be in direct charge of the reservoir earthwork if awarded this Contract and state the relevant, successful experience. A qualified field superintendent will be required to be on the project site in responsible charge, full-time, during all reservoir earthwork activities. The proposed superintendent(s) shall be currently employed by the earthwork contractor and shall have been the earthwork contractor superintendent on no less than two (2) reservoir earthwork projects during the last ten years. The earthwork superintendent(s) shall have been in the direct employment of the earthwork contractor for both of the projects listed. Indicate the owner of projects referenced. Provide the name(s) of at least two (2) earthwork jobs successfully completed by all of the superintendents listed by the earthwork contractor, which shall include a project description, the name and address of the owner, and the approximate completion date of each project.

Superintendent Name(s)		
Project Completed: Owner Project Name Year Completed		
Project Completed: Owner Project Name Year Completed		

6. The names, addresses and telephone numbers of the owners and project engineers, and completion dates and location of at least three (3) projects similar in scope to this project located within Oregon, Washington or California which have been successfully completed by the earthwork contractor during the last seven (7) years. In order to meet the experience requirements for this project, provide at least three (3) projects in which one or more of the work elements listed below were completed. Different projects may be submitted for each required work element listed below but at least three (3) projects are required for each work element. Multiple work element requirements may be satisfied with a single project.
   - Excavations in excess of 5,000 cubic yards (CY)
   - Base preparation and construction of foundation drainage system and liner installation for a new reservoir at least 1.0 million gallons (MG) in size
   - Off-site hauling of material through population centers

   Project examples must demonstrate successful completion of the excavations and construction of reservoir foundation drainage system and discuss methods for limiting risk given the constraints set forth in the project plans and specifications. Project examples should demonstrate the ability to follow a precise work sequence of construction and successful overall project coordination in order to minimize time required for earthwork activities. (Provide an attachment if additional space is required.)

Project Name, Owner & Related Specified Experinece	Year Completed	Name & Address of Owner Contact Person and Phone Number	Name & Address of Engineer Contact Person and Phone Number
Excavations in excess of 5,000 CY 1. 2. 3.			
Base preparation & foundation drainage system for a new reservoir over 1.0 MG 1. 2 3.			
Off-site hauling through population centers 1. 2. 3.			

7. Demonstration of the Contractor's accessibility to a track-mounted hydraulic excavator of the 52,800 to 72,500 pound class equipped with a single shank ripper or a bucket fitted with rock teeth shall also be submitted with the Statement of Qualifications Form. Any excavation machinery that will not provide the substantial equivalent of the above requirements will be rejected. List the major items of equipment which you own or which will be available for use on the proposed work:

_____

_____

_____

_____

_____

The information submitted in this form will be regarded as confidential to the extent of the law.

The undersigned hereby declares that the foregoing statements are true and that the foregoing financial statement is a true and accurate statement of the financial condition of said firm.

Dated at _____ this_____ day of _____, 2015

By_____

Title_____

Date_____

AGGREGATE PIER CONTRACTOR
STATEMENT OF QUALIFICATIONS FORM
FOR
BOLTON RESERVOIR REPLACEMENT PROJECT
FOR
CITY OF WEST LINN, OREGON

The City of West Linn requires a statement to be completed and submitted by contractors bidding on the Bolton Reservoir Replacement Project regarding their financial ability, equipment, and experience in relation to the proposed aggregate pier installation associated with the reservoir construction. The AGGREGATE PIER CONTRACTOR must be qualified by the ENGINEER prior to bidding. Only aggregate pier contractors who have received qualification prior to bidding may be named in the Proposal.

Refer to Section 01100, Technical Special Provisions in Appendix C for a list of pre-qualified aggregate pier contractors.

This Statement of Qualifications Form shall be completed and submitted by 5:00 PM on September 23, 2015 to:

Submitted to: MURRAY, SMITH & ASSOCIATES, INC.

Address: 121 SW Salmon, Suite 900, Portland, Oregon 97204

Attention: Justin H. Ford, P.E.

To qualify for this project, the prospective AGGREGATE PIER CONTRACTOR must complete the following information:

AGGREGATE PIER CONTRACTOR INFORMATION

Submitted By: _____ A Corporation / A Partnership / An Individual
(AGGREGATE PIER CONTRACTOR)

Type of Work: _____

Principal Office: _____

Contractor's Bank and Local Contact: _____

EXPERIENCE QUESTIONNAIRE

1. How many years has your organization been in business as a contractor under your present business name? _____

2. Have you ever failed to complete any work awarded to you? _____

   If so, where and why? _____

   _____

   _____

3. List below the contracts which you, or your company, or corporation were party, during the previous 10 years which contracts where involved in litigation of any type:

   _____

   _____

   _____

   _____

   _____

4. Name the Surety Company, and the name and address of the local agent you expect to use in the event this Contract is awarded to you:

   _____

   _____

   _____

   _____

5. Name the field superintendent(s) who will be in direct charge of the aggregate pier construction if awarded this Contract and state the relevant, successful experience. A qualified field superintendent will be required to be on the project site in responsible charge, full-time, during all aggregate pier construction activities. The proposed superintendent(s) shall be currently employed by the aggregate pier contractor and shall have been the aggregate pier superintendent on no less than two (2) aggregate pier construction projects during the last ten years. The aggregate pier construction superintendent(s) shall have been in the direct employment of the aggregate pier contractor for both of the projects listed. Indicate the owner of projects referenced. Provide the name(s) of at least two (2) aggregate pier construction jobs successfully completed by all of the superintendents listed by the aggregate pier contractor, which shall include a project description, the name and address of the owner, and the approximate completion date of each project.

Superintendent Name(s)		
Project Completed: Owner Project Name Year Completed		
Project Completed: Owner Project Name Year Completed		

6. The names, addresses and telephone numbers of the owners and project engineers, and completion dates and location of at least five (5) projects located within Oregon, Washington or California which have been successfully completed by the aggregate pier contractor during the last seven (7) years. In order to meet the experience requirements, at least three (3) of the projects shall be similar in design to the specified construction (i.e., aggregate pier construction covering an approximate 41,200 square foot area, to an approximate depth of 20 feet below ground surface and in the presence of groundwater, etc.). Project examples must demonstrate successful completion of the installation and discuss methods for limiting risk given the constraints set forth in the project plans and specifications. Project examples should demonstrate the ability to follow a precise work sequence of construction and successful overall project coordination in order to minimize the aggregate pier construction time. (Provide an attachment if additional space is required.)

Project Name, Owner & Aggregate Pier Length and Diameter	Year Completed	Name & Address of Owner Contact Person and Phone Number	Name & Address of Engineer Contact Person and Phone Number

The information submitted in this form will be regarded as confidential to the extent of the law.

The undersigned hereby declares that the foregoing statements are true and that the foregoing financial statement is a true and accurate statement of the financial condition of said firm.

Dated at _____ this_____ day of _____, 2015

By_____

Title_____

Date_____

RESERVOIR CONTRACTOR
STATEMENT OF QUALIFICATIONS FORM
FOR
BOLTON RESERVOIR REPLACEMENT PROJECT
FOR
CITY OF WEST LINN, OREGON

The City of West Linn requires a statement to be completed and submitted by contractors bidding on the Bolton Reservoir Replacement Project regarding their financial ability, equipment, and experience in relation to the proposed reservoir construction work. The RESERVOIR CONTRACTOR must be qualified by the ENGINEER prior to bidding. Only reservoir contractors who have received qualification prior to bidding may be named in the Proposal.

Refer to Section 01100, Technical Special Provisions in Appendix C for a list of pre-qualified reservoir contractors.

This Statement of Qualifications Form shall be completed and submitted by 5:00 PM on September 23, 2015 to:

Submitted to: MURRAY, SMITH & ASSOCIATES, INC.

Address: 121 SW Salmon, Suite 900, Portland, Oregon 97204

Attention: Justin H. Ford, P.E.

To qualify for this project the prospective RESERVOIR CONTRACTOR must complete the following information:

RESERVOIR CONTRACTOR INFORMATION

Submitted By: _____ (RESERVOIR CONTRACTOR)
A Corporation
A Partnership
An Individual

Type of Work: _____

Principal Office: _____

Contractor's Bank and Local Contact: _____

EXPERIENCE QUESTIONNAIRE

1. How many years has your organization been in business as a contractor under your present business name? _____

2. Have you ever failed to complete any work awarded to you? _____

   If so, where and why? _____

   _____

   _____

3. List below the contracts which you, or your company, or corporation were party, during the previous 10 years which contracts where involved in litigation of any type:

   _____

   _____

   _____

   _____

4. Name the Surety Company, and the name and address of the local agent you expect to use in the event this Contract is awarded to you. Please note that the Reservoir Contractor's Surety Company shall be prepared to provide a three (3) year maintenance bond for the reservoir. The Reservoir Contractor's surety is to be A.M. Best A or higher.

   _____

   _____

   _____

   _____

5. Name the field superintendent(s) who will be in direct charge of the reservoir construction if awarded this Contract and state the relevant, successful experience. A qualified field superintendent will be required to be on the project site in responsible charge, full-time, during all reservoir concrete construction activities. The proposed superintendent(s) shall be currently employed by the reservoir contractor and shall have been the reservoir contractor superintendent on no less than two (2) strandwrapped prestressed concrete reservoirs during the last ten years. The reservoir superintendent(s) shall have been in the direct employment of the reservoir contractor for both of the reservoirs listed. Indicate the owner of projects referenced. Provide the name(s) of at least two (2) reservoir jobs successfully completed by all of the superintendents listed by the reservoir contractor, which shall include a reservoir description, the name and address of the owner, and the approximate completion date of each reservoir.

Superintendent Name(s)		
Project Completed: Owner Project Name Year Completed		
Project Completed: Owner Project Name Year Completed		

6. List the names, addresses and telephone numbers of the owners and project engineers, and completion dates and location of at least five (5) reservoirs located within the United States which have been successfully constructed by the reservoir contractor during the last ten (10) years. In order to meet the experience requirements, the five (5) reservoirs shall be similar in design to the specified reservoir (i.e., freed wall base, poured-in-place corewall, externally machine strandwrapped, etc.) and at least 1.0 million gallons in volume. In addition, at least one (1) of the five (5) reservoirs shall be similar in design to the specified reservoir and at least 4.0 million gallons in volume. Experience with reservoirs having fixed wall bases, mild-steel reinforced reservoir corewalls, shotcrete reservoir corewalls, precast reservoir corewalls or reservoir corewalls incorporating internal stressing systems or external machine single wire wrapping (in lieu of strandwrapping) shall not be considered in meeting the required experience requirements. (Provide an attachment if additional space is required.)

Project Name, Owner & Reservoir Size	Year Completed	Name & Address of Owner Contact Person and Phone Number	Name & Address of Engineer Contact Person and Phone Number

The information submitted in this form will be regarded as confidential to the extent of the law.

The undersigned hereby declares that the foregoing statements are true and that the foregoing financial statement is a true and accurate statement of the financial condition of said firm.

Dated at _____ this_____ day of _____, 2015

By_____

Title_____

Date_____

RESERVOIR PRESSTRESSOR
STATEMENT OF QUALIFICATIONS FORM
FOR
BOLTON RESERVOIR REPLACEMENT PROJECT
FOR
CITY OF WEST LINN, OREGON

The City of West Linn requires a statement to be completed and submitted by contractors bidding on the Bolton Reservoir Replacement Project regarding their financial ability, equipment, and experience in relation to the proposed reservoir prestressing work. The RESERVOIR PRESTRESSOR must be qualified by the ENGINEER prior to bidding. Only reservoir prestressors who have received qualification prior to bidding may be named in the Proposal.

Refer to Section 01100, Technical Special Provisions in Appendix C for a list of pre-qualified RESERVOIR PRESTRESSORS.

This Statement of Qualifications Form shall be completed and submitted by 5:00 PM on September 23, 2015 to:

Submitted to: MURRAY, SMITH & ASSOCIATES, INC.

Address: 121 SW Salmon, Suite 900, Portland, Oregon 97204

Attention: Justin H. Ford, P.E.

To qualify for this project the prospective RESERVOIR PRESTRESSOR must complete the following information:

RESERVOIR PRESTRESSOR INFORMATION

Submitted By: _____ (RESERVOIR PRESTRESSOR)
A Corporation
A Partnership
An Individual

Type of Work: _____

Principal Office: _____

Contractor's Bank and Local Contact: _____

EXPERIENCE QUESTIONNAIRE

1. How many years has your organization been in business as a contractor under your present business name? _____

2. Have you ever failed to complete any work awarded to you? _____

   If so, where and why? _____

3. List below the contracts which you, or your company, or corporation were party, during the previous 10 years which contracts where involved in litigation of any type:

4. Provide a written statement indicating that the reservoir prestressor has a minimum of two operable strandwrapping and automated shotcrete machines meeting the specifications of the project. Provide as an attachment to this form.

5. Name the Surety Company, and the name and address of the local agent you expect to use in the event this Contract is awarded to you:

5. Name the field superintendent(s) who will be in direct charge if awarded this Contract and state the relevant, successful experience. A qualified field superintendent will be required to be on the project site in responsible charge, full-time, during all reservoir prestressing construction activities. The proposed superintendent(s) shall be currently employed by the reservoir prestressor and shall have been the reservoir prestressor superintendent on no less than two (2) strandwrapped prestressed concrete reservoirs during the last ten years. The reservoir superintendent(s) shall have been in the direct employment of the reservoir prestressor for both of the reservoirs listed. Indicate the owner of projects referenced. Provide the name(s) of at least two (2) reservoir jobs successfully completed by all of the superintendents listed by the reservoir prestressor, which shall include a reservoir description, the name and address of the owner, and the approximate completion date of each reservoir. The listed reservoir prestressing superintendent and/or operator shall be a certified shotcrete nozzleman in accordance with ACI 506.

Superintendent Name(s)		
Project Completed: Owner Project Name Year Completed		
Project Completed: Owner Project Name Year Completed		

6. List the names, addresses and telephone numbers of the owners and project engineers, and completion dates and location of at least five (5) reservoirs located within the United States which has been successfully prestressed by the reservoir prestressor during the last ten (10) years. In order to meet the experience requirements, the five (5) reservoirs shall be similar in design to the specified reservoir (i.e., freed wall base, poured-in-place corewall, vertical tendons, externally machine strandwrapped, etc.) and at least 1.0 million gallons in volume. In addition, at least one (1) of the five (5) reservoirs shall be similar in design to the specified reservoir and at least 4.0 million gallons in volume. Experience with reservoirs having fixed wall bases, mild-steel reinforced reservoir corewalls, shotcrete reservoir corewalls, precast reservoir corewalls or reservoir corewalls incorporating internal stressing systems or external machine single wire wrapping (in lieu of strandwrapping) shall not be considered in meeting the required experience requirements. (Provide an attachment if additional space is required.)

Project Name, Owner & Reservoir Size	Year Completed	Name & Address of Owner Contact Person and Phone Number	Name & Address of Engineer Contact Person and Phone Number

The information submitted in this form will be regarded as confidential to the extent of the law.

The undersigned hereby declares that the foregoing statements are true and that the foregoing financial statement is a true and accurate statement of the financial condition of said firm.

Dated at _____ this_____ day of _____, 2015

By_____

Title_____

Date_____

FORMS REQUIRED FOR SUBMITTAL WITH BID

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

SCHEDULE A - RESERVOIR SITE						
Item	**Spec Reference**	**Description of material and/or services**	**Quantity**	**Unit**	**Unit Price**	**Total Amount**
A-1		Mobilization, bonds, insurance, and permitting	1	LS	$	$
A-2		All work required to construct 4.0 MG prestressed concrete reservoir, complete, other than as provided for under separate unit prices. General work categories are described in the price breakdown below, with the sum of items a-bb being equal to the total lump sum for Item A-2:				
		a. Shop drawings and approvals	1	LS	$	$
		b. Construction survey and staking	1	LS	$	$
		c. Tree protection, removal, clearing, and grubbing	1	LS	$	$
		d. Erosion control plan and maintenance	1	LS	$	$
		e. Demolition of existing reservoir and building structures	1	LS	$	$
		f. Subsurface soil improvements (rammed aggregate piers)	1	LS	$	$
		g. Reservoir construction, including access hatch, vent, reservoir foundation, miscellaneous interior piping, interior ladder with fall prevention system, reservoir hydrodynamic mixing system and other accessories as noted and shown in the Drawings	1	LS	$	$
		h. Earthwork to include mass excavation, hauling, stockpiling, backfilling, general surface restoration, gravel road, drainage ditches, and final grading	1	LS	$	$
		i. Construction shoring	1	LS	$	$
		j. Electrical, instrumentation and control, telemetry, and system integration	1	LS	$	$
		k. Reservoir testing, disinfection, and startup	1	LS	$	$
		l. Dewatering	1	LS	$	$
		m. Valve vault	1	LS	$	$

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A-2 (cont'd)		n. Reservoir dechlorination manhole	1	LS	$	$
		o. Reservoir monitoring manhole	1	LS	$	$
		p. Stormwater outfall	1	LS	$	$
		q. Water detention facility (pond)	1	LS	$	$
		r. Stormwater swale	1	LS	$	$
		s. Stormwater facilities start-up and testing	1	LS	$	$
		t. Landscaping to include soil, preparation, grass seeding, plantings, and jute matting	1	LS	$	$
		u. Temporary irrigation, and planting maintenance and guarantee	1	LS	$	$
		v. Chain-link fencing and gate	1	LS	$	$
		w. Decorative fencing and gate	1	LS	$	$
		x. Foundation drainage trench	1	LS	$	$
		y. Project plaques	1	LS	$	$
		z. Removal of asphalt and concrete surfacing from lots at 6123 & 6175 Skyline Drive	1	LS	$	$
		aa. Traffic control	1	LS	$	$
		bb. Site clean-up and demobilization	1	LS	$	$
A-3		Overexcavation and select backfill material for unsuitable foundation conditions	100	CY	$	$
A-4		Furnish and install 24-inch diameter Class 55 ductile iron pipe with Class B (compacted native material) trench backfill, restrained:	280	LF	$	$
A-5		Furnish and install Class 52 ductile iron pipe with Class B (compacted native material) trench backfill, restrained:				
		a. 12-inch diameter, Restrained	390	LF	$	$
		b. 18-inch diameter, Restrained	112	LF	$	$
A-6		Furnish and install ductile iron pipe fittings	12,054	LBS	$	$
A-7		Furnish and install buried valves:				
		a. 12-inch diameter BFV, MJ	3	EA	$	$
		b. 24-inch diameter BFV, MJ	5	EA	$	$

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A-8		Furnish and install flexible expansion joints:				
		a. 12-inch diameter, FLGxMJ	1	EA	$	$
		b. 24-inch diameter, FLGxMJ	3	EA	$	$
A-9		Testing, flushing and disinfection of water mains	1	LS	$	$
A-10		Connections to existing water system piping:				
		a. Connect to 24-inch diameter pump station suction line	1	LS	$	$
		b. Connect to 6-inch diameter water main	1	LS	$	$
A-11		Existing water main abandonment	1	LS	$	$
A-12		Furnish and install ASTM D3034 PVC drain piping:				
		a. 4-inch diameter	125	LF	$	$
A-13		Furnish and install HDPE drain piping:				
		a. 4-inch diameter	190	LF	$	$
		b. 6-inch diameter	285	LF	$	$
A-14		Furnish and install RCP storm drain piping:				
		a. 12-inch diameter	630	LF	$	$
		b. 18-inch diameter	15	LF	$	$
A-15		Furnish and install 48-inch diameter manhole	3	EA	$	$
A-16		Furnish and install catch basins/field inlets	4	EA	$	$
A-17		Paved access road, 4-inch HMAC, Level 2, over 12-inch aggregate with geotextile	1,691	SY	$	$
A-18		Furnish and install cathodic protection systems	1	LS	$	$
A-19		Furnish and install bollards	33	EA	$	$

SUBTOTAL FOR SCHEDULE A: $_____

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SCHEDULE B - PUMP STATION

Item	Spec Reference	Description of material and/or services	Quantity	Unit	Unit Price	Total Amount
B-1		All work required to construct the addition of a metal roof onto an existing pump station, and pump improvements to include installation of an owner-procured water booster pump and associated electrical and piping improvements.	1	LS	--	$
B-2		Allowance for established lump sum price to provide one Floway 100 hp vertical turbine pump, Model 11JKM - 7 stage, per Specification Section 11101.	1	LS	--	$ 73,192
					SUBTOTAL FOR SCHEDULE B:	**$**_____

SCHEDULE C - WATER MAIN REPLACEMENT

Item	Spec Reference	Description of material and/or services	Quantity	Unit	Unit Price	Total Amount
C-1		Mobilization, bonds, insurance, and permitting	1	LS	$	$
C-2		Furnish and install Class 55 ductile iron piping with Class D trench backfill regardless of depth:				
		a. 24-inch diameter, Restrained	424	LF	$	$
C-3		Furnish and install Class 52 ductile iron piping with Class D trench backfill:				
		a. 24-inch diameter, Restrained	2,668	LF	$	$
		b. 18-inch diameter, Restrained	60	LF	$	$
		c. 8-inch diameter, Restrained	1,214	LF	$	$
		d. 6-inch diameter, Restrained	110	LF	$	$
		e. 4-inch diameter, Restrained	558	LF	$	$
C-4		Furnish and install ductile iron pipe fittings	43,000	LBS	$	$

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C-5		Furnish and install buried valves:				
		a. 24-inch diameter BFV, FLGxMJ	3	EA	$	$
		b. 18-inch diameter BFV, FLGxMJ	3	EA	$	$
		c. 8-inch diameter GV, FLGxMJ	9	EA	$	$
		d. 6-inch diameter GV, FLGxMJ	1	EA	$	$
		e. 4-inch diameter GV, FLG	1	EA	$	$
C-6		Replace water service connections:				
		a. 1" service	17	EA	$	$
		b. 2" service	1	EA	$	$
C-7		Replace water meter boxes	18	EA	$	$
C-8		Furnish and install fire hydrant assemblies	7	EA	$	$
C-9		Remove and abandon existing fire hydrants	6	EA	$	$
C-10		Furnish and install filling station	1	EA	$	$
C-11		Testing, flushing, and disinfection of water mains	1	LS	$	$
C-12		Connections to existing water system piping:				
		a. 18-inch DI to existing steel (temporary)	1	EA	$	$
		b. 18-inch DI to existing steel (permanent)	1	EA	$	$
		c. 16-inch DI to existing DI	1	EA	$	$
		d. 8-inch DI to existing CI or DI	2	EA	$	$
		e. 6-inch DI to existing DI	2	EA	$	$
		f. Temporary service connection to existing 2-inch PVC	1	EA	$	$
C-13		Saw-cutting existing asphalt concrete (AC) pavement and concrete surfacing:				
		a. First 4-inches depth	16,512	LF	$	$
		b. Additional saw-cutting per 1-inch of depth	66,048	LF	$	$
C-14		Hot mix asphaltic concrete (HMAC) trench patch along entire pipeline length in existing paved areas	670	TON	$	$
C-15		Grind and install 2-inch thick full-width HMAC inlay of Skyline Circle	110	TON	$	$

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C-16		Traffic control	1	LS	$	$
C-17		Furnish and install 2-inch diameter blow-off assemblies	2	EA	$	$
C-18		Furnish and install 2-inch diameter air-release assemblies	1	EA	$	$
C-19		Furnish and install 18-inch diameter insulated transition couplings	2	EA	$	$
C-20		Furnish and install 18-inch diameter wet tap	1	EA	$	$
C-21		General clean-up, erosion control, and surface restoration of landscaped areas and non-paved surfaces	1	LS	$	$
C-22		Existing water main abandonment	1	LS	$	$
C-23		Additional cost for rock excavation	115	CY	$	$
C-24		Overexcavation and select backfill material for unsuitable foundation conditions	115	CY	$	$
C-25		Furnish and install cathodic protection systems	1	LS	$	$
C-26		Furnish and install package pressure regulating valve vault	1	LS	$	$
					SUBTOTAL FOR SCHEDULE C:	**$**_____

SCHEDULE D - SKYLINE DRIVE STREET AND STORMWATER IMPROVEMENTS						
Item	Spec Reference	Description of material and/or services	Quantity	Unit	Unit Price	Total Amount
TEMPORARY FEATURES AND APPURTENANCES						
D-1	00210	MOBILIZATION	1	LS	$	$
D-2	00225	TEMPORARY WORK ZONE TRAFFIC CONTROL, COMPLETE	1	LS	$	$
D-3	00280	EROSION CONTROL, COMPLETE	1	LS	$	$
D-4	00290	POLLUTION CONTROL PLAN	1	LS	$	$
ROADWORK						
D-5	00305	CONSTRUCTION SURVEY WORK	1	LS	$	$

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D-6	00310	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	1	LS	$	$
D-7	00320	CLEARING AND GRUBBING	1	LS	$	$
D-8	00330	GENERAL EXCAVATION	2,500	CUYD	$	$
D-9	00331	12 INCH SUBGRADE STABILIZATION	350	SQYD	$	$
D-10	00390	CULVERT EMBANKMENT PROTECTION	1	EA	$	$
D-11	00390	RIPRAP BASINS	1	EA	$	$
DRAINAGE AND SEWERS						
D-12	00405	ROCK EXCAVATION	170	CUYD	$	$
D-13	00415	MAINLINE VIDEO INSPECTION	1,371	FOOT	$	$
D-14	00445	12 INCH STORM SEWER PIPE, 5 FT DEPTH	465	FOOT	$	$
D-15	00445	12 INCH STORM SEWER PIPE, 10 FT DEPTH	906	FOOT	$	$
D-16	00445	SLOPED END SECTIONS, 12 INCH	1	EA	$	$
D-17	00445	CONCRETE CLOSURE COLLARS	1	EA	$	$
D-18	00470	CONCRETE STORM SEWER MANHOLES	5	EA	$	$
D-19	00470	CONCRETE INLETS, TYPE G-2	10	EA	$	$
D-20	00470	CONCRETE INLETS, TYPE CG-3	2	EA	$	$
D-21	00470	CONCRETE INLETS, TYPE D	4	EA	$	$
D-22	00490	ADJUSTING BOXES	35	EA	$	$
D-23	00490	FILLING ABANDONED STRUCTURES	2	EA	$	$
D-24	00490	ADD OR REPLACE MANHOLE ADJUSTMENT RINGS	4	EA	$	$
D-25	00490	MANHOLES OVER EXISTING SEWERS	2	EA	$	$
D-26	00495	TRENCH RESURFACING	676	SQYD	$	$
BRIDGES						
D-27	00596	RETAINING WALL, PREFABRICATED MODULAR GRAVITY, COMPLETE	1	LS	$	$

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BASES						
D-28	00610	RECONDITIONING EXISTING ROADWAY	1	LS	$	$
D-29	00620	COLD PLANE PAVEMENT REMOVAL, 0-2 INCHES DEEP	830	SQYD	$	$
D-30	00620	COLD PLANE PAVEMENT REMOVAL, 2 INCHES DEEP	3,680	SQYD	$	$
D-31	00620	COLD PLANE PAVEMENT REMOVAL, 6 INCHES DEEP	240	SQYD	$	$
D-32	00641	AGGREGATE BASE	2,240	TON	$	$
D-33	00641	AGGREGATE SHOULDERS	40	TON	$	$
WEARING SURFACES						
D-34	00744	LEVEL 3, 1/2" DENSE ACP MIXTURE, PG64-22	1,730	TON	$	$
D-35	00744	LEVEL 3, 3/4" DENSE ACP MIXTURE, PG64-22	560	TON	$	$
D-36	00748	3 INCH ASPHALT CONCRETE PAVEMENT REPAIR	680	SQYD		
D-37	00749	ASPHALT BERMS	1,680	FOOT	$	$
D-38	00749	ASPHALT APPROACHES	13	EA	$	$
D-39	00749	ASPHALT PEDESTRIAN LANDINGS	1	EA		
D-40	00759	CONCRETE CURBS, STANDARD CURB	3,428	FOOT	$	$
D-41	00759	CONCRETE CURBS, CURB AND GUTTER	25	FOOT	$	$
D-42	00759	CONCRETE CURBS, LOW PROFILE MOUNTABLE CURB	175	FOOT	$	$
D-43	00759	CONCRETE WALKS	17,130	SQFT	$	$
D-44	00759	6 INCH CONCRETE SURFACING	195	SQFT	$	$
PERMANENT TRAFFIC SAFETY AND GUIDANCE DEVICES						
D-45	00851	PAVEMENT LINE REMOVAL	1,400	FOOT	$	$
D-46	00851	PAVEMENT BAR REMOVAL	30	SQFT	$	$
D-47	00851	PAVEMENT LEGEND REMOVAL	2	EA	$	$
D-48	00865	THERMOPLASTIC, EXTRUDED, SURFACE, PROFILED	8,300	FOOT	$	$
D-49	00865	THERMOPLASTIC, EXTRUDED, SURFACE, NON-PROFILED	11,800	FOOT	$	$
D-50	00867	PAVEMENT LEGEND, TYPE B-HS: BICYCLE LANE STENCIL	10	EA	$	$

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D-51	00867	PAVEMENT LEGEND, TYPE B-HS: SHARED LANE MARKING	1	EA	$	$
D-52	00867	PAVEMENT BAR, TYPE B-HS	790	EA	$	$
D-53	00867	PAVEMENT LEGEND, TYPE B-HS: ARROWS	2	EA	$	$
D-54	00867	PAVEMENT LEGEND, TYPE B-HS: "STOP"	1	EA	$	$
D-55	00867	PAVEMENT LEGEND, TYPE B-HS: "AHEAD"	1	EA	$	$
D-56	00867	PAVEMENT LEGEND, TYPE B-HS: "SCHOOL"	1	EA	$	$
D-57	00867	PAVEMENT LEGEND, TYPE B-HS: "XING"	1	EA	$	$
PERMANENT TRAFFIC CONTROL AND ILLUMINATION SYSTEMS						
D-58	00940	REMOVE EXISTING SIGNS	1	LS	$	$
RIGHT OF WAY DEVELOPMENT AND CONTROL						
D-59	01030	LANDSCAPE RESTORATION, COMPLETE	1	LS	$	$
D-60	01050	CL-4 CHAIN-LINK FENCE WITH BLACK VINYL CLAD FABRIC	265	FOOT	$	$
D-61	01070	SINGLE MAILBOX SUPPORTS	2	EA	$	$
D-62	01070	MAILBOX CONCRETE COLLARS	2	EA	$	$
					SUBTOTAL FOR SCHEDULE D:	**$**_____

City of West Linn	**BID PROPOSAL FORM** Solicitation Number: PW-14-06	**Public Works Department** 22500 Salamo Road West Linn, Oregon 97068 Telephone: (503) 722-5500 Fax: (503) 656-4106

BID PROPOSAL SUMMARY

1) SCHEDULE A - SUBTOTAL **$**_____

2) SCHEDULE B - SUBTOTAL **$**_____

3) SCHEDULE C - SUBTOTAL **$**_____

4) SCHEDULE D - SUBTOTAL **$**_____

GRAND TOTAL BID AMOUNT **$**_____
(SUM OF SCHEDULES A, B, C, & D) (Use numbers)

GRAND TOTAL BID AMOUNT: (SUM OF SCHEDULES A, B, C, & D)

_____

(Use words)

Public Works Department
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Telephone: (503) 722-5500
Fax: (503) 656-4106

Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

BIDDER acknowledges that estimated quantities are not guaranteed and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid Items will be based on actual quantities provided, determined as provided in the Contract Documents.

BIDDER must submit a bid on all schedules for bid to be accepted. Award will be based on grand total bid amount. Individual bid schedules will not be awarded to separate bidders. OWNER reserves the right to remove any bid items and schedules from the work after bid is awarded.

BIDDER intends to provide the services of the following (enter the names of the proposed pre-qualified Water Main Contractor, Earthwork Contractor, Reservoir Contractor, Reservoir Prestressor, and Rammed Aggregate Pier Contractor):

Water Main Contractor _____
(Do not leave blank. If BIDDER is an approved Water Main Contractor, enter BIDDER's name)

Earthwork Contractor _____
(Do not leave blank. If BIDDER is an approved Earthwork Contractor, enter BIDDER's name)

Aggregate Pier Contractor _____
(Do not leave blank. If BIDDER is an approved Aggregate Pier Contractor, enter BIDDER's name)

Reservoir Contractor _____
(Do not leave blank. If BIDDER is an approved Reservoir Contractor, enter BIDDER's name)

Reservoir Prestressor _____
(Do not leave blank. If BIDDER is an approved Reservoir Prestressor, enter BIDDER's name)

BID BOND

Solicitation Number: PW-14-06

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

KNOW ALL PERSONS BY THESE PRESENTS:

That we, _____, as "Principal,"
(Name of Principal)

and _____, an _____ Corporation,
(Name of Surety)
authorized to transact Surety business in Oregon, as "Surety," hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns to pay unto the City of West Linn ("Obligee") the sum of ($_____) _____ dollars.

WHEREAS, the condition of the obligation of this bond is that Principal has submitted its proposal or bid to an agency of the Obligee in response to Obligee's procurement document for the project identified in the Solicitation Number indicated above which proposal or bid is made a part of this bond by reference, and Principal is required to furnish bid security in an amount equal to ten (10%) percent of the total amount of the bid pursuant to the procurement document and ORS 279C.365(4) for competitive bidding or 279C.400(5) for competitive proposals.

NOW, THEREFORE, if the proposal or bid submitted by Principal is accepted, and if a contract pursuant to the proposal or bid is awarded to Principal, and if Principal enters into and executes such contract within the time specified in the procurement document and executes and delivers to Obligee its good and sufficient performance and payment bonds required by Obligee, as well as any required proof of insurance, within the time fixed by Obligee, then this obligation shall be void; otherwise, it shall remain in full force and effect.

IN WITNESS WHEREOF, we have caused this instrument to be executed and sealed by our duly authorized legal representatives this _____day of _____, 20__.

PRINCIPAL: _____

By_____
Signature

_____
Official Capacity

Attest: _____
Corporation Secretary

SURETY: _____

BY ATTORNEY-IN-FACT:

_____
Name

_____
Signature

_____
Address

_____
City State Zip

_____ _____
Phone Fax

City of West Linn	**NONCOLLUSION AFFIDAVIT** Solicitation Number: PW-14-06	**Public Works Department** 22500 Salamo Road West Linn, Oregon 97068 Telephone: (503) 722-5500 Fax: (503) 656-4106

NONCOLLUSION AFFIDAVIT

I, (Type/Print Name)_____, state that I am **(Position Title)** _____of **(Name of Firm)_____** and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and, officers. I am the person responsible in my firm for the price(s) and the amount of this bid.

I state that:

1. The price(s) and the amount of this bid have been arrived at independently and without consultation, communication or agreement with any other contractor, bidder or potential bidder.

2. Neither the price(s) nor the amount of this bid, and neither the approximate price(s) nor approximate amount of this bid, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before bid opening.

3. No attempt has been made or will be made to induce any firm or person to refrain from bidding on this contract, or to submit a bid higher than this bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.

4. The bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.

5. **(Name of Firm)_____,** its affiliates, subsidiaries, officers, directors, and employees are not currently under investigation by any governmental agency and have not in the last four (4) years been convicted or found liable for any act prohibited by state or federal law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract, except as follows:

I state that **(Name of Firm)_____** understands and acknowledges that the above representations are material and important, and will be relied on by **THE CITY OF WEST LINN, OREGON** in awarding the contract(s) for which this bid is submitted. I understand and my firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from **THE CITY OF WEST LINN, OREGON** of the true facts relating to the submission of bids for this contract.

_____
(Signature) (Signatory's Name)

_____
(Signatory's Title)

STATE OF _____)
)§
COUNTY OF _____)

SWORN TO AND SUBSCRIBED BEFORE ME THIS _____DAY OF _____**, 20____**

_____
Notary Public

My Commission Expires _____

City of West Linn	**EXPERIENCE RECORD** Solicitation Number: PW-14-06	**Public Works Department** 22500 Salamo Road West Linn, Oregon 97068 Telephone: (503) 722-5500 Fax: (503) 656-4106

THREE YEAR EXPERIENCE RECORD

Recent projects first

#1 (Project Name, Location, Contract Cost)

_____

Project description: _____

_____

_____

Project completion date: (contract) _____ (actual) _____

Contact name: _____

Telephone: _____

#2 (Project Name, Location, Contract Cost)

_____

Project description: _____

_____

_____

Project completion date: (contract) _____ (actual) _____

Contact name: _____

Telephone: _____

#3 (Project Name, Location, Contract Cost)

_____

Project description: _____

_____

_____

Project completion date: (contract) _____ (actual) _____

Contact name: _____

Telephone: _____

#4 (Project Name, Location, Contract Cost)

_____

Project description: _____

_____

_____

Project completion date: (contract) _____ (actual) _____

Contact name: _____

Telephone: _____

#5 (Project Name, Location, Contract Cost)

_____

Project description: _____

_____

_____

Project completion date: (contract) _____ (actual) _____

Contact name: _____

Telephone: _____

Attach additional sheets if needed.

FIRST-TIER SUBCONTRACTOR DISCLOSURE

PROJECT NAME: _____

BID #: _____

BID CLOSING: Date: _____Time:_____

This form must be submitted at the location specified in the Invitation to Bid on the advertised bid closing date and within two working hours after the advertised bid closing time.

List below the name of each subcontractor that will be furnishing labor or will be furnishing labor and materials and that is required to be disclosed, the category of work that the subcontractor will be performing and the dollar value of the subcontract. Enter "NONE" if there are no subcontractors that need to be disclosed. (ATTACH ADDITIONAL SHEETS IF NEEDED.)

NAME	DOLLAR VALUE	CATEGORY OF WORK
(1) _____	$ _____	_____
(2) _____	$ _____	_____
(3) _____	$ _____	_____
(4) _____	$ _____	_____
(5) _____	$ _____	_____
(6) _____	$ _____	_____
(7) _____	$ _____	_____
(8) _____	$ _____	_____
(9) _____	$ _____	_____

Failure to submit this form by the disclosure deadline will result in a non-responsive bid. A non-responsive bid will not be considered for award.

Form submitted by (bidder name):_____

Contact name: _____ Phone no.: ( )

ORS 279C.370 First-tier subcontractor disclosure. (1)(a) Within two working hours after the date and time of the deadline when bids are due to a contracting agency for a public improvement contract, a bidder shall submit to the contracting agency a disclosure of the first-tier subcontractors that:

(A) Will be furnishing labor or will be furnishing labor and materials in connection with the public improvement contract; and

(B) Will have a contract value that is equal to or greater than five percent of the total project bid or $15,000, whichever is greater, or $350,000 regardless of the percentage of the total project bid.

(b) For each contract to which this subsection applies, the contracting agency shall designate a deadline for submission of bids that has a date on a Tuesday, Wednesday or Thursday and a time between 2 p.m. and 5 p.m., except that this paragraph does not apply to public contracts for maintenance or construction of highways, bridges or other transportation facilities.

(c) This subsection applies only to public improvement contracts **("projects")** with a value, estimated by the contracting agency, of more than **$100,000**.

(d) This subsection does not apply to public improvement contracts that have been exempted from competitive bidding requirements under ORS 279C.335 (2).

(2) The disclosure of first-tier subcontractors under subsection (1) of this section must include the name of each subcontractor, the category of work that each subcontractor will perform and the dollar value of each subcontract. The information shall be disclosed in substantially the following [above] form:

(3) A contracting agency shall accept the subcontractor disclosure. The contracting agency shall consider the bid of any contractor that does not submit a subcontractor disclosure to the contracting agency to be a non-responsive bid and may not award the contract to the contractor. A contracting agency is not required to determine the accuracy or the completeness of the subcontractor disclosure.

(4) After the bids are opened, the subcontractor disclosures must be made available for public inspection.

(5) A contractor may substitute a first-tier subcontractor under the provisions of ORS 279C.585.

(6) A subcontractor may file a complaint under ORS 279C.590 based on the disclosure requirements of subsection (1) of this section.

WH-179 (08-10-10)

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

FORMS NOT REQUIRED AT TIME OF BID

PERFORMANCE BOND

Solicitation Number: PW-14-06

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

KNOW ALL MEN BY THESE PRESENTS, that we, _____
(Official Name & Form of Organization)

Whose address is: _____
(Street Address) *(City)* *(State)* *(Zip)*

as Principal, and, _____
(Name of Surety) *(Print - Agent / Contact Name)* *(Phone Number)*

_____
(Street Address of Surety) *(City)* *(State)* *(Zip)*

a corporation duly authorized to conduct a general surety business in the State of Oregon, as Surety, are jointly and severally held and bound unto the City of West Linn, Oregon, a municipality of the State of Oregon, hereinafter called Obligee, in the sum of _____ and _____/100 DOLLARS ($_____),*(The Contract Price, Both in Words & Figures)* lawful money of the United State of America, for the payment of which we, as Principal, and as Surety, jointly and severally bind ourselves, our successors and assigns firmly by these presents,

TERMS AND CONDITIONS

On the _____ *(Day)* of _____*(Month)*, _____*(Year)*, _____
(Name of Contractor)

Principal, entered into a contract with the City of West Linn, Oregon, Obligee, to construct certain public improvements and to provide material, labor and equipment for the construction of those improvements. The public improvements and work to be performed by Principal are more fully described in the contract documents between Principal and Obligee. Those contract documents are incorporated herein by reference.

In the event that Principal fails to complete the work as required under the contract, Surety shall either complete the work or pay Obligee the costs of completion of the work. Work is only complete when it meets the standards required by the Contract and applicable City standards. Surety's obligation shall remain in effect until the work is accepted by Obligee, but shall terminate on acceptance by Obligee. The total amount of the Surety's liability to Obligee under this bond shall in no event exceed the amount stated above.

Surety agrees that no change, extension of time, alternation, or addition to the terms of the contract, or to the work to be performed thereunder or the specifications accompanying the same shall in anywise affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the contract or to the work or the specifications.

IN WITNESS WHEREOF, the parties hereto have caused this Bond to be executed in _____, Oregon, this ____ *(Day)* of _____*(Month)*, _____*(Year)*.

_____
Contractor

_____
Principal Signature

Witnesses:

_____
Principal Printed Name

_____ _____
Surety

(A true copy of the Power of Attorney must be attached to the original of this bond)

Countersigned:

_____
Surety Attorney of Fact

_____
Resident Agent

PAYMENT BOND

Solicitation Number: PW-14-06

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

KNOW ALL MEN BY THESE PRESENTS, that we, _____
(Official Name & Form of Organization)

Whose address is: _____
(Street Address) *(City)* *(State)* *(Zip)*

as Principal, and, _____
(Name of Surety) *(Print - Agent / Contact Name)* *(Phone Number)*

_____
(Street Address of Surety) *(City)* *(State)* *(Zip)*

a corporation duly authorized to conduct a general surety business in the State of Oregon, as Surety, are jointly and severally held and bound unto the City of West Linn, Oregon, a municipality of the State of Oregon, hereinafter called Obligee, in the sum of _____ and ___/100 DOLLARS ($_____),*(The Contract Price, Both in Words & Figures)* lawful money of the United State of America, for the payment of which we, as Principal, and as Surety, jointly and severally bind ourselves, our successors and assigns firmly by these presents,

TERMS AND CONDITIONS

On the _____ *(Day)* of _____*(Month)*, _____*(Year)*, _____
(Name of Contractor)

Principal, entered into a contract with the City of West Linn, Oregon, Obligee, for the construction of certain public improvements. As part of the contract, Principal is required to furnish materials, labor, and equipment to construct the improvements. The contract documents between Principal and Obligee are incorporated herein by this reference.

In the event that Principal fails to make payments when due to suppliers of labor, equipment or materials, Surety shall pay the suppliers the amounts they are due. In the event that Obligee pays any amounts to suppliers that Principal was required to pay, Surety shall reimburse Obligee for those payments. In the event that Principal permits any lien or claim to be filed or prosecution against the City on account of any labor or material furnished, Surety shall take such steps as are necessary to clear the lien, claim or prosecution. In the event that Principal fails to (1) promptly pay all contributions or amounts due the State Unemployment Compensation Trust Fund incurred to the performance of the contract, (2) promptly, as due, make payments to the person, co-partnership, association, or corporation entitled thereto of the money and sums mentioned in Section 279C.600 of the Oregon Revised Statutes, or (3) promptly pay to the Oregon State Tax Commission all sums required to be deducted and retained from wages of employees of the Principal and his sub-Contractors, pursuant to the Section 316.711, Oregon Revised Statues, Surety shall make the required payments. Surety's obligations under this bond shall terminate when all payments required of Principal described in this paragraph are made in full.

The total amount of the Surety's liability under this bond both to the Obligee and to the persons furnishing labor or materials, provisions and goods to any person or persons, shall in no event exceed the amount stated above.

Surety agrees that no change, extension of time, alternation, or addition to the terms of the contract, or to the work to be performed there under or the specifications accompanying the same shall in anywise affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the contract or to the work or the specifications.

IN WITNESS WHEREOF, the parties hereto have caused this Bond to be executed in _____, Oregon, this ____ *(Day)* of _____*(Month)*, _____*(Year)*.

_____
Contractor

_____
Principal Signature

Witnesses:

_____ _____
Principal Printed Name

_____ _____
Surety

(A true copy of the Power of Attorney must be attached to the original of this bond)

Countersigned: _____
Surety Attorney of Fact

_____
Resident Agent

City of West Linn	**AFFIDAVIT** Solicitation Number: PW-14-06	**Public Works Department** 22500 Salamo Road West Linn, Oregon 97068 Telephone: (503) 722-5500 Fax: (503) 656-4106

CONTRACTOR'S AFFIDAVIT
SETTLEMENT OF CLAIMS

DATE:_____

PROJECT: Bolton Reservoir Replacement

TO: City of West Linn

Persons:

This is to certify that all lawful claims for materials, rental of equipment, and labor used in connection with the construction of the above, whether by subcontractor or claimant in person, have been duly discharged.

The undersigned, for the consideration of $_____, as set forth in the final pay estimate, as full and complete payment under the terms of the contract, hereby waives and relinquishes any and all further claims or right of lien under, in connection with, or as a result of this project. The undersigned further agrees to indemnify and hold harmless _____against any and all liens, claims of liens, suits, actions, damages, charges and expenses whatsoever, which _____ may suffer arising out of the failure of the undersigned to pay for all labor performance and materials furnished for the performance of said project.

Signed at _____, this _____ day of _____, 20_____

_____
(CONTRACTOR)

BY:_____

STATE OF _____)
)§
COUNTY OF _____)

The foregoing instrument was subscribed and sworn to before me this _____ day of _____, 20___

_____
Notary Pubic

My Commission Expires:_____

CONTRACT FEE SECTION
PREVAILING WAGE RATE UNIT
BUREAU OF LABOR AND INDUSTRIES
800 N.E. OREGON ST., #1045
PORTLAND, OR 97232-2180
PHONE: (971) 673-0852
FAX: (971) 673-0769

For Office Use Only:
Project DB #:_____

PUBLIC WORKS FEE INFORMATION FORM

For use by public agencies that have contracted with a contractor on a public works project regulated by ORS 279C.800 to 279C.870, in compliance with ORS 279C.825. Also for use by public agencies that are a party to a public works project pursuant to ORS 279C.800(6)(a)(B), (C) (D) or (E).

PUBLIC AGENCIES: Please complete and mail this form to BOLI at the above address, along with the public works fee of one-tenth of one percent of the contract price (contract amount x .001), payable to BOLI. **The minimum fee is $250.00; the maximum fee is $7,500.00.** Without the following completed information, the bureau may be unable to properly credit you for payment received.

PUBLIC AGENCY: _____ **AGENCY #:**_____

AGENCY MAILING ADDRESS: _____

CITY, STATE, ZIP:_____

AGENCY CONTACT PERSON: _____ **PHONE: (____)**_____

PROJECT MANAGER NAME:_____ **PHONE: (____)**_____

PROJECT NAME: _____

CONTRACT NAME (if part of larger project):_____

PROJECT LOCATION: _____

PROJECT NO: _____ **DATE CONTRACT FIRST ADVERTISED:** _____

DATE CONTRACT AWARDED: _____ **CONTRACTOR CCB#:** _____

CONTRACTOR BUSINESS NAME (DBA): _____

CONTRACTOR ADDRESS: _____

CITY, STATE ZIP _____

CONTRACT AMOUNT: $_____ **FEE AMOUNT DUE/PAID: $**_____
If less than $50K, is it part of a larger project? ☐yes ☐no **Contract amount x .001 = fee due**

(Please duplicate this form for future use.)

BUREAU OF LABOR AND INDUSTRIES
NOTICE OF PUBLIC WORKS

(For use by public agencies in complying with ORS 279C.835)

For Office Use Only:

Project DB #:_____

NOTE: ORS 279C.835 requires that public contracting agencies include with this form a copy of the disclosure of first-tier subcontractors submitted pursuant to ORS 279C.370.

PUBLIC AGENCY INFORMATION

Agency Name: _____

Agency Division:_____ Agency # (if known):_____

Address:_____

City, State, Zip:_____

Email Address: _____

Agency Representative: _____ Phone: _____

SECTION A: To be completed when a public agency awards a contract to a contractor for a public works project, including CM/GC projects. (See reverse for public works projects in which no public agency awards a contract to a contractor.)

CONTRACT INFORMATION:

Project Name: _____

Contract Name (if part of larger project): _____

Project #: _____ Contract #:_____

Project Manager Name:_____ Phone: _____ Fax:_____

Project Location (Street(s), City): _____ Project County: _____

Contract Amount: $_____ If under $50,000, is this contract part of a larger project? YES ☐ NO ☐

If yes, total project amount: $_____

Will project use federal funds that require compliance with the Davis-Bacon Act? YES ☐ NO ☐

Date Contract Specifications First Advertised for Bid (if not advertised, date of RFP or first contact with contractor): _____

OR If CM/GC Contract, Date Contract Became a Public Works Contract (see OAR 839-025-0020(6)): _____

Date Contract Awarded: _____ Date Work Expected to Begin: _____ Date Work Expected to be Complete: _____

PRIME CONTRACTOR INFORMATION:

Name: _____

Address: _____

City, State Zip:_____ Phone:_____

Construction Contractors Board Registration #: _____

Name of Bonding Company: _____

Address: _____

Agent Name: _____ Phone:_____

Payment Bond #: _____

☐ Copy of first-tier subcontractors attached (**see NOTE above**).

Signature of agency representative completing form: _____

Printed Name: _____ Phone: _____ Date:_____

Email Address:_____

THIS FORM WILL BE RETURNED TO THE PUBLIC AGENCY FOR CORRECTION AND RESUBMITTAL IF INCOMPLETE.

Complete this page for public works projects in which NO PUBLIC AGENCY AWARDS A CONTRACT TO A CONTRACTOR. Complete the CONTRACT INFORMATION *AND* SECTION B, C, D or E, whichever applies to the project.

CONTRACT INFORMATION:

Name of Project Owner: _____ Phone: _____

Project Name: _____ Project #: _____

Project Location (Street(s), City): _____ Project County: _____

Total Project Cost: $_____ Amount of Public Funds Provided for the project: $_____

Name(s) of Public Agency(ies) Providing Public Funds: _____

Will project use federal funds that require compliance with the Davis-Bacon Act? YES ☐ NO ☐

Date Work Expected to Begin: _____ Date Work Expected to be Complete: _____

SECTION B: **To be completed when a project is a public works pursuant to ORS 279C.800(6)(a)(B)** (a project for the construction, reconstruction, major renovation or painting of a privately owned road, highway, building, structure or improvement of any type **that uses funds of a private entity and $750,000 or more of funds of a public agency**).

Date the public agency or agencies committed to the provision of funds for the project: _____

SECTION C: **To be completed when a project is a public works pursuant to ORS 279C.800(6)(a)(C)** (a project for the construction of a privately owned road, highway, building, structure or improvement of any type **that uses funds of a private entity and in which 25 percent or more of the square footage of the completed project will be occupied or used by a public agency**).

Total square footage of privately owned road, highway, building, structure or improvement: _____

Percent of total square footage of the completed project that will be occupied or used by a public agency: _____

Date the public agency or agencies entered into an agreement to occupy or use the completed project: _____

SECTION D: **To be completed when a project is a public works pursuant to ORS 279C.800(6)(a)(D)** (a project that includes the construction or installation of a **device, structure or mechanism that uses solar radiation** on public property, regardless of project cost or whether the project uses funds of a public agency).

Date the public agency entered into an agreement for the project: _____

SECTION E: **To be completed when a project is a public works pursuant to ORS 279C.800(6)(a)(E)** (a project for the construction, reconstruction, major renovation or painting of a road, highway, building, structure, or improvement of any type that occurs, with or without using funds of a public agency, **on real property that the Oregon University System or an institution in the Oregon University System owns**).

Date the public agency entered into an agreement for the project: _____

Signature of agency representative completing form: _____

Printed Name: _____ Phone: _____ Date: _____

Email Address: _____

THIS FORM WILL BE RETURNED TO THE PUBLIC AGENCY FOR CORRECTION AND RESUBMITTAL IF INCOMPLETE.

RETURN THIS COMPLETED FORM TO:

Prevailing Wage Rate Unit • Bureau of Labor and Industries • 800 NE Oregon Street, #1045 • Portland, OR 97232-2180

Telephone (971) 673-0852 • FAX (971) 673-0769 • pwremail@boli.state.or.us

CONTRACT FEE SECTION
PREVAILING WAGE RATE UNIT
BUREAU OF LABOR AND INDUSTRIES
800 N.E. OREGON ST., #1045
PORTLAND, OR 97232-2180
PHONE: (971) 673-0852
FAX: (971) 673-0769

For Office Use Only:

Project DB #:_____

PUBLIC WORKS FEE ADJUSTMENT FORM

THIS FORM TO BE USED FOR RECONCILIATION OF FEES UPON COMPLETION OF PUBLIC WORKS PROJECTS

(As required by ORS 279C.825 and OAR 839-025-0210)

PUBLIC AGENCIES: Complete and mail this form to BOLI at the above address after completion of the public work project and not less than 30 days after the final progress payment is made to the contractor. Public agencies are required to determine the final contract price, including all change orders or other adjustments to the original contract price, and to calculate the adjusted prevailing wage rate fee based on the revised contract price. Documentation must be included to support the final contract price. Documentation of the final contract price may consist of change orders or other contract documents substantiating the amount of the contract. The prevailing wage rate fee of one-tenth of one percent (.001) shall be applied to the final contract price, with credit taken for fees already submitted. The public agency must submit any additional fee payable to BOLI, or submit any request for refund, with this adjustment form. **THE MINIMUM FEE IS $250.00; THE MAXIMUM FEE IS $7,500.00. NO ADDITIONAL FEE IS REQUIRED TO BE PAID, AND REFUNDS WILL NOT BE MADE, IF THE BALANCE DUE OR THE REFUND DUE IS LESS THAN $100.00.**

PUBLIC AGENCY: _____ **AGENCY #:** _____

AGENCY CONTACT PERSON: _____ **PHONE :(___)** _____

MAILING ADDRESS: _____

PROJECT NAME: _____

CONTRACT NAME (if part of larger project): _____

PROJECT NUMBER: _____ **PROJECT LOCATION:** _____

CONTRACTOR/BUSINESS NAME (DBA): _____

CONTRACTOR CCB#: _____ **DATE AWARDED:** _____

FINAL CONTRACT/PROJECT AMOUNT: _____ **FINAL FEE DUE:** _____
(Include all change orders and adjustments to the contract price) **(Final Contract amount X .001)**

ORIGINAL CONTRACT AMOUNT: _____ **INITIAL FEE PAID:** _____
(Original Contract amount X .001)

TOTAL ADJUSTMENT: _____ **BALANCE DUE*:** _____
or
REFUND DUE*: _____
***Final contract fee less initial fee paid**

Sample Calculation:			
Final Contract Amount:	$ 400,000.00	Final Fee Due:	$ 400.00
Original Contract Amount:	- 300,000.00	Initial Fee Paid:	- 300.00
Total Adjustment:	$ 100,000.00	Additional Amount Due:	$ 100.00

(Please duplicate this form for future use)

BUREAU OF LABOR AND INDUSTRIES, PREVAILING WAGE RATE UNIT

INSTRUCTIONS FOR COMPLETING THE PREVAILING WAGE RATE PAYROLL/CERTIFIED STATEMENT FORM (WH-38)

The Payroll/Certified Statement form (WH-38) may be used by contractors for reporting their payroll as required by ORS 279C.845 on public works projects subject to the Prevailing Wage Rate (PWR) Law. Although this form has not been officially approved by the U.S. Department of Labor (US DOL), it is designed to meet the requirements of the federal Davis-Bacon Act. For projects associated with the U.S. Department of Housing and Urban Development (HUD), contact the public agency (owner) associated with the project for assistance with payroll reporting.

Contractors are not required to use the WH-38 form in reporting their payroll; however, the contractor must provide all of the information contained in the form, including the certified statement on page two. The certified statement must be signed by the contractor, certifying the accuracy of the information reported on the payroll, including representations pertaining to the provision of fringe benefits to employees by third parties, and must be submitted with each weekly payroll report. Detailed instructions concerning the preparation of the form follow:

Complete the top third of the form. Be sure to enter the date the contract was first advertised for bid. If you are not sure of this date, contact the public agency (owner) associated with the project. The "Payroll No." is a US DOL requirement and represents the number of weeks the contractor performed work on the project.

Column 1 – NAME AND ADDRESS: The employee's full name must be shown on each payroll submitted. The employee's address must also be shown on the first payroll submitted. The address need not be shown on subsequent payrolls submitted unless the address changes. The US DOL requires an employee identification number for each individual employee, on each payroll submitted. This number may be, but does not have to be, the last four digits of the employee's social security number.

Column 2 – CLASSIFICATION: For assistance in determining the correct classification, use the Bureau of Labor and Industries' publication "Definitions of Covered Occupations for Public Works Contracts in Oregon." On the WH-38, list the classification that is most descriptive of the work actually performed by the employee. Give the group number for those classifications that include such information. Indicate which workers are apprentices, if any, and give their current percentage, classification, and group number when applicable. If an employee works in more than one classification, use the highest rate for all hours worked, or use separate line entries to show hours worked and hourly rates for each classification.

Column 3 – DAY AND DATE: Enter the day of the week (M, T, W, Th, F, S, and Sn) in the top row of boxes, and the corresponding date below.

HOURS WORKED EACH DAY: Enter the total number of straight time hours worked in the row marked "ST." Generally, hours worked over 8 in a day or work performed on Saturdays, Sundays, and legal holidays should be entered as overtime ("OT") hours worked. Contractors who have adopted and followed a written work schedule of four consecutive ten-hour days (Monday through Thursday or Tuesday through Friday) may enter hours worked over 10 in a day as overtime hours. For more information on overtime requirements, see the Contractor Responsibilities section of the Bureau of Labor and Industries' publication "Prevailing Wage Rate Laws" handbook.

Column 4 – TOTAL HOURS: Enter separately the total number of straight time and overtime hours worked by the employee (in each classification, if applicable) on the PWR project during the week. The total number of straight time hours worked should be entered in the lower box ("ST"); the total number of overtime hours worked should be entered in the top box ("OT").

Column 5 – HOURLY BASE RATE: Enter the hourly base rate (plus zone pay, if any) and the hourly overtime rate (plus zone pay, if any) paid to the employee in the appropriate straight time and overtime boxes. (Payment of not less than one and one half times the base rate of pay, including zone pay but not

including fringe benefits, is required to be paid for overtime hours pursuant to ORS 279C.540). Generally, use the appropriate prevailing wage rates in effect at the time the contract was first advertised for bid by the public agency. If this date is not known, or if the project was not advertised for bid, contact the public agency (owner) associated with the project for assistance with applicable rates.

Column 6 – HOURLY FRINGE BENEFIT AMOUNT PAID AS WAGES TO THE EMPLOYEE: Enter hourly fringe benefit amounts paid directly to the employee as wages. (For overtime hours worked, it is not necessary to pay time and one half for the fringe benefit portion of the prevailing wage rate.)

Column 7 – GROSS AMOUNT EARNED: Enter the gross amount earned for work on the PWR project during the week. If part of the employee's wages for the pay period were earned on projects other than the project described on the WH-38, or if the employee is paid less often than on a weekly basis, enter in column 7 first the gross amount earned on the PWR project for the week, then the total gross amount earned for the pay period. For example: $567.84 / $1,267.27.

Column 8 – ITEMIZED DEDUCTIONS, FICA, FED, STATE, ETC.: Enter deductions withheld from wages for the pay period. All deductions must be in accordance with the provisions of ORS 652.610 (and as defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. Stat. 967, 76 Stat. 357; 40 U.S.C 276c) on projects subject to Davis-Bacon Act). For projects subject to the Davis-Bacon Act, itemize the deductions.

Column 9 – NET WAGES PAID: Enter the total amount of net wages actually paid to the employee for the pay period. This figure can be calculated by subtracting the total deductions reported in Column 8 from the gross amount of wages for the pay period reported in the bottom portion of Column 7.

Column 10 – HOURLY FRINGE BENEFITS PAID TO BENEFITS PARTY, PLAN, FUND OR PROGRAM: Enter the hourly amount of fringe benefits paid to each individually approved party, plan, fund, or program, for each employee. List these amounts separately on the lines provided. Any contractor who is making payments to approved parties, plans, funds or programs in amounts less than the required hourly fringe benefit is obligated to pay the difference directly to the employee as wages in lieu of fringe benefits, and to show that amount in Column 6 of this form. For information on how to calculate hourly fringe benefit credits, see Appendix A in the Bureau of Labor and Industries' publication "Prevailing Wage Rate Laws" handbook.

Column 11 – NAME OF BENEFIT PARTY, PLAN, FUND OR PROGRAM: Enter the name of the party, plan, fund, or program that corresponds to the amount paid as an hourly fringe benefit in Column 10.

CALCULATION CHECK

In order to determine whether the wages and fringe benefits paid are sufficient to meet prevailing wage rate requirements, the following check may be performed:

1. For each classification listed in column 2, compute the sum of:
   a) the hourly base rate of pay shown in Column 5,
   b) the hourly fringe benefit amount paid as wages to employee shown in Column 6, and
   c) the hourly fringe benefits paid to benefit party, plan, fund or program shown in Column 10.

2. This sum must equal or exceed the total of the hourly base rate (including zone pay) and the hourly fringe benefit rate for that classification as listed in the appropriate issue of the Bureau of Labor and Industries publications Prevailing Wage Rates for Public Works Contracts in Oregon.

IF YOU HAVE QUESTIONS REGARDING COMPLETION OF THIS FORM, CONTACT THE PREVAILING WAGE RATE UNIT OF THE BUREAU OF LABOR AND INDUSTRIES AT (971) 673-0838.

NOTE: PAYROLL/CERTIFIED STATEMENTS ARE ONLY REQUIRED TO BE SUBMITTED TO THE PUBLIC AGENCY ASSOCIATED WITH THE PROJECT.

CERTIFIED PAYROLL AND OTHER FORMS ARE AVAILABLE ON OUR WEBSITE:
WWW.OREGON.GOV/BOLI

BUREAU OF LABOR AND INDUSTRIES
WAGE AND HOUR DIVISION

PAYROLL/CERTIFIED STATEMENT FORM WH-38
FOR USE IN COMPLYING WITH ORS 279C.845*

PRIME CONTRACTOR ☐ SUBCONTRACTOR ☐ PAYROLL NO.

Business Name (DBA): Phone: ( ) CCB Registration Number:

Project Name: Project Number: Type of Work:

Street Address: Project Location:

Mailing Address: Project County:

Date Pay Period Began: Date Pay Period Ended:

THIS SECTION FOR PRIME CONTRACTORS ONLY

Public Contracting Agency Name:
Phone: ( )
Date Contract Specifications First Advertised for Bid:
Contract Amount:

THIS SECTION FOR SUBCONTRACTORS ONLY

Subcontract Amount:
Prime Contractor Business Name (DBA):
Prime Contractor Phone: ( )
Prime Contractor's CCB Registration Number:
Date You Began Work on the Project:

(1)	(2)		(3) DAY AND DATE	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
NAME , ADDRESS AND EMPLOYEE'S IDENTIFICATION NUMBER	CLASSIFICATION (INCLUDE GROUP # AND APPRENTICESHIP STEP IF APPLICABLE)		HOURS WORKED EACH DAY	TOTAL HOURS	HOURLY BASE RATE	HOURLY FRINGE BENEFIT AMOUNTS PAID AS WAGES TO EMPLOYEE	GROSS AMOUNT EARNED (see directions)	ITEMIZED DEDUCTIONS FICA, FED, STATE, ETC.	NET WAGES PAID	HOURLY FRINGE BENEFITS PAID TO BENEFIT PARTY, PLAN, FUND, OR PROGRAM	NAME OF BENEFIT PARTY, PLAN, FUND, OR PROGRAM
		OT									
		ST									
		OT									
		ST									
		OT									
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		OT									
		ST									
		OT									
		ST									

*Although this form has not been officially approved by the U.S. Department of Labor, it is designed to meet the requirements of both the state PWR law and the federal Davis-Bacon Act.

THIS FORM CONTINUED ON REVERSE

CERTIFIED STATEMENT

Date: _____

I, _____, _____
(NAME OF SIGNATORY PARTY) (TITLE)
do hereby state:
(1) That I pay or supervise the payment of the persons employed by:

_____
(CONTRACTOR, SUBCONTRACTOR OR SURETY)
on the _____; that during the payroll period
(BUILDING OR WORK)
commencing on the _____ day of _____, _____, and ending the _____ day
(MONTH) (YEAR)
of _____, _____, all persons employed on said project have been paid the
(MONTH) (YEAR)
full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said _____
(CONTRACTOR, SUBCONTRACTOR OR SURETY)
from the full weekly wages earned by any person, and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as specified in ORS 652.610, and as defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. 276c), and described below:

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for workers contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each worker conform with work performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a state apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a state, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

I HAVE READ THIS CERTIFIED STATEMENT, KNOW THE CONTENTS THEREOF AND IT IS TRUE TO MY KNOWLEDGE:

_____
(NAME AND TITLE)

_____
(SIGNATURE AND DATE)

In addition to completing sections (1) - (3), if your project is subject to the federal Davis-Bacon Act requirements, complete the following section as well:

(4) That:
(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS OR PROGRAMS

☐ - In addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ - Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in Section 4(c) below.

(c) EXCEPTIONS:

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.

FILE THIS FORM WITH THE PUBLIC AGENCY ASSOCIATED WITH THE PROJECT
NOTE TO CONTRACTORS: YOU MUST ATTACH COPIES OF THIS FORM TO EACH OF YOUR PAYROLL SUBMISSIONS ON THIS PROJECT.
INSTRUCTIONS AND ADDITIONAL FORMS ARE AVAILABLE ON OUR WEBSITE: WWW.OREGON.GOV/BOLI.

Appendix B

TECHNICAL SPECIAL PROVISIONS FOR ALL WORK (ALL SCHEDULES)

CITY OF WEST LINN, OREGON
PROJECT NUMBER: PW-14-06
BOLTON RESERVOIR REPLACEMENT

APPENDIX B

TECHNICAL SPECIAL PROVISIONS FOR ALL WORK (SCHEDULES A, B, C & D)

Seal w/signature	I certify the Technical Special Provisions Section(s) listed below are applicable to the design for the subject project for overall project requirements, construction sequencing and measurement and payment. Technical Special Provisions were prepared by me or under my supervision. Technical Special Provisions Sections 01015, 01100, 01200
	
Date Signed: 9/4/15	

CITY OF WEST LINN, OREGON
PROJECT NUMBER: PW-14-06
BOLTON RESERVOIR REPLACEMENT

Seal w/signature	I certify the Technical Special Provisions Section(s) listed below are applicable to the design for the subject project for landscaping improvements to a new prestressed concrete reservoir site and along the Skyline Drive roadway improvements. Technical Special Provisions were prepared by me or under my supervision. Technical Special Provisions Sections 02921, 02930
 Date Signed: 9/4/15	

APPENDIX B – TECHNICAL SPECIAL PROVISIONS FOR ALL WORK (SCHEDULES A, B, C & D)

TABLE OF CONTENTS

SECTION 01015

WORK SEQUENCE AND CONSTRAINTS

PART 1 GENERAL

This Section describes general constraints to the Work and identifies proposed project phasing, and coordination requirements.

1.1 Scope of Work

The work contemplated consists of furnishing all labor, materials and equipment necessary for the construction of the Bolton Reservoir Replacement generally described in four schedules as follows:

Schedule A – Reservoir Site: The Work includes a new 4.0 million gallon (MG) partially buried circular prestressed concrete reservoir and associated appurtenances, site work including demolition of the existing 2.5 MG concrete Bolton Reservoir and other building demolitions, earthwork and site grading, foundation improvements, water main and stormwater improvements, valve vault, access road, fencing and landscaping, and associated electrical, instrumentation, controls and telemetry systems integration work.

Schedule B – Pump Station: The Work includes improvements to the existing Bolton Pump Station, consisting of a new pitched wood framed roof with metal roofing, relocating an existing 200 HP vertical turbine pump into an existing vacant pump barrel, installing two new pump control valves, a new surge valve, a new 100 HP vertical turbine pump into an existing pump barrel, with a new VFD, piping, and associated mechanical and electrical work.

Schedule C – Water Main Replacement: The Work includes approximately 3,100 linear feet of 24-inch diameter potable water supply main, including valves, fittings, appurtenances, pressure reducing valve vault, connections to existing distribution system, pavement and surface restoration.

Schedule D – Skyline Drive Street and Stormwater improvements: The Work includes approximately 3,800 linear feet of roadway improvements consisting of roadway widening and grading, curb and sidewalk, drainage improvements, retaining walls, asphalt paving, pavement striping and landscaping.

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 Construction Sequencing, Contract Times and Milestones

Construction sequencing is critical to successful project completion within seasonal, system operation, and project scheduling constraints. The CONTRACTOR shall develop, maintain, and be solely responsible for sequencing all aspects of the project, complete in accordance with all project, work, and operational parameters. The CONTRACTOR's construction sequencing plan shall consider all aspects of the work, schedule, weather, water system operation, and public and private access, including the need to: 1. Ensure the OWNER's water system is not impacted outside identified allowable periods; 2. Ensure compliance with all permit conditions and restrictions; 3. Ensure safety of the public, personnel, and the project; 4. Conduct all operations in a manner that minimizes impact to the public, the OWNER, and the adjacent projects or development.

Sequence of Construction Requirements:

A. The CONTRACTOR shall be solely responsible for planning all work, materials, labor, and all operations necessary to complete the project on schedule.

B. The CONTRACTOR shall plan and accomplish the work in accordance with a project schedule and sequencing plan reviewed and approved by the ENGINEER. As a minimum, the CONTRACTOR's project schedule and sequencing plan shall identify and incorporate all of the work phases and specifically demonstrate conformance with all project parameters and limitations identified in the Contract Documents and project permits.

C. The CONTRACTOR's project schedule and sequencing plan shall identify each work phase and properties thereof. The CONTRACTOR shall conduct all operations in accordance with the CONTRACTOR's project schedule and sequencing plan (approved by the ENGINEER), the Contract Documents, and project permits.

D. This project is divided into four separate Schedules of construction, each having distinct schedule milestones. For each Schedule of this project, the

CONTRACTOR shall achieve all work required to complete the Milestone events listed within the dates as set forth below.

	Milestone Events	Time of Completion
	Schedule A – Reservoir Site	
A.1	Tree Removal – Complete prior to bird nesting season, in compliance with Migratory Bird Treaty Act	Completion by January 31, 2016
A.2	Relocate SCADA equipment from old pump station building to Bolton Pump Station (must precede A.5, demolition of old pump station building)	Completion by February 1, 2016
A.3	On-Site reservoir by-pass piping (must precede A.5) a. New reservoir inlet/outlet piping connection to existing pump station suction b. Abandonment of 14-inch main c. Cap existing 6" main in NW site corner	Completion by April 1, 2016
A.4	Temporary simultaneous shutdown period for reservoir and pump station (reservoir and pump station cannot be taken off-line simultaneously after May 1, 2016)	Allowed November 1, 2015 to May 1, 2016
A.5	Permanent reservoir shutdown for demolition – (*Earlier permanent shutdown may be possible upon confirmation that pump improvements will be completed by April 15, 2016.)	Allowed May 1, 2016* to May 15, 2017
A.6	Reservoir Substantial Completion – Reservoir tested and operational	Completion by May 15, 2017
A.7	Reservoir Final Completion - all Schedule A work complete, begin warranty period upon final acceptance	Completion by November 1, 2017
	Schedule B – Pump Station	
B.1	Stage 1: Relocate 200 HP Pump No. 1, install Pumps No. 2 and No. 3 discharge, and install surge valve (shutdown required, must precede B.2).	Completion by January 20, 2016
B.2	Stage 2: Install and start-up new 100 HP pump into Pump No. 1 (shutdown required). Pump tested and operational. (must precede A.5)	Completion by April 15, 2016
B.3	Pump Station Final Completion – all Schedule B work complete, begin warranty period upon final acceptance	Completion by August 1, 2016

	Milestone Events	Time of Completion
	Schedule C – Water Main Replacement	
C.1	24" Main Stage 1: STA A2+16 to STA A6+73, Skyline Circle to temporary inter-tie with existing 18" water main on Skyline Drive, tested and operational. (must precede A.3.b, and A.5)	Completion by March 1, 2016
C.2	Skyline Drive 8" & 4" Main and PRV vault, STA C1+00 to STA A3+34 4.5' RT and STA A13+00 2.3' LT (must precede A.3.b)	Completion by March 1, 2016
C.3	24" Main Stage 2: STA A6+73 to A33+36 , Skyline Drive to Broadway Street, tested and operational (must precede D.5), all Schedule C work complete, begin warranty period upon final acceptance	Completion by August 1, 2016
C.4	Closure of Skyline Drive from Clark Street (STA S20+00) to the West Linn High School driveway (STA S41+40) will be allowed between June 13, 2016 and August 12, 2016.	Allowed June 13, 2016 to August 12, 2016
	Schedule D – Skyline Drive Street and Stormwater improvements	
D.1	Tree Removal – Complete prior to bird nesting season, in compliance with Migratory Bird Treaty Act	Completion by January 31, 2016
D.2	Construct roadway improvements from Firwood Drive to Clark Street.	Completion by June 13, 2016
D.3	Construct roadway improvements from Clark Street to "A" Street.	Completion by August 12, 2016
D.4	Closure of Skyline Drive from Clark Street (STA S20+00) to the West Linn High School driveway (STA S41+40) will be allowed between June 13, 2016 and August 12, 2016.	Allowed June 13, 2016 to August 12, 2016
D.5	Schedule D Substantial Completion – all work Schedule D work complete except final landscaping	Completion by August 12, 2016
D.6	Schedule D Final Completion – all Schedule D work complete, begin warranty period upon final acceptance	Completion by November 1, 2016

Special construction sequencing requirements are required for construction of certain elements of the work. These work sequences are described in Part 3 Execution, of this Section.

E. Coordinate construction schedule and operation with OWNER.

F. Coordinate proposed work with OWNER and ENGINEER before implementing any system, reservoir and pump station shutdowns. Under no circumstances cease work at the end of a normal working day if such actions may inadvertently cause a cessation of any facility operating process; in which case, remain on site until necessary repairs are complete.

G. Do not close lines, open valves, or take other action that would affect the operation of existing systems, except as specifically required by the Contract Documents and after approval of OWNER and ENGINEER.

H. CONTRACTOR shall not operate any of the existing equipment without written permission from the OWNER naming the specific piece of equipment and dates the CONTRACTOR may use the equipment. The CONTRACTOR is liable for any loss or damage caused to property or equipment or any personal injury resulting from or related to this usage.

I. CONTRACTOR shall have all equipment and parts necessary to finish the work and be prepared to reinstall temporary or existing removed piping and equipment on short notice if for any reason service needs to be restored.

J. The OWNER may determine the order of preference and the time and season at which any portion or portions of the work shall be commenced and carried on in order to ensure proper completion of the contract or proper operation of the facility.

1.3 Submittals

A. Submit a Work Sequencing Plan detailing the complete sequence of construction for all activities contained herein.

B. Identify the following in the Work Sequencing Plan:

1. Major work activities to occur.

2. General schedule when work will occur. Submit separately a detailed schedule as specified in Section 01300, Submittals. Incorporate materials in detailed schedule and work sequencing plan.

3. Proposed modifications to normal facility operations for each major work activity.

4. Number and duration of process shutdowns required.

5. Facility, equipment, or utility to be shutdown.

6. What equipment will be present, including temporary equipment during shutdowns.

7. What assistance will be required of OWNER's operating personnel during shutdowns.

8. Contingency backup plan identifying what action will be taken if activities during a shutdown cannot be completed within the allotted times, or if there is a failure of the CONTRACTOR's temporary equipment.

9. Name of individual in charge of CONTRACTOR's activity during shutdown.

1.4 Interruption of Utility Service.

A. Indicate required shutdowns of existing utilities or interruptions of existing operations on Progress Schedule. Interruptions to utility service will be allowed to the extent that customer service will not be adversely compromised.

B. Submit requests for interruptions to utility service not less than ten (10) business days in advance of the date scheduled for the interruption.

C. Following receipt of the request, ENGINEER will notify the CONTRACTOR if the requested date will be permitted. Evaluation of the request will be based upon the availability of the utility owners personnel to assist and monitor utilities during the shutdown period and impact to customer service.

D. Minimize the period of interruption by thorough advance planning. Procure required materials, equipment and labor and have on hand all equipment to be installed during the shutdown.

E. Do not begin interruption until written authorization is received from ENGINEER.

1.5 Temporary Shutdowns

A. Provide 14-day minimum advance Notice to Request for Approval of a Temporary Shutdown of the Bolton Pump Station or Bolton Reservoir.

B. Each Notice of Request for Approval of a Temporary Shutdown submitted to the OWNER shall include the following:

1. Dates, times, and duration of proposed shutdown.

2. Work activities to be performed during the shutdown.

3. Assistance required of OWNER's personnel before, during, and after shutdown.

4. CONTRACTOR's personnel to be on site during shutdown.

5. Contingency plan if work during shutdown is not completed during allotted time or critical equipment fails.

B. Upon receipt of such request, the OWNER will decide what action needs to be taken and if the requested shutdown is acceptable considering the system operation needs at that time. The request from the CONTRACTOR will be returned to him with the OWNER's decision noted. If the OWNER deems that the requested shutdown is unacceptable, the OWNER will state such reasons, and the CONTRACTOR shall reschedule the shutdown as required.

C. It is hereby agreed between the CONTRACTOR and OWNER that disapproval by the OWNER of the CONTRACTOR's shutdown request does not entitle the CONTRACTOR to any time extension unless the CONTRACTOR can demonstrate to the satisfaction of the OWNER, through an updated CPM schedule, that the overall project completion date will not be met as a result of this disapproval.

D. The OWNER may postpone a planned and approved shutdown at any time for pumping capacity, or safety reasons.

PART 2 PRODUCTS

A. Not Used.

PART 3 EXECUTION

3.1 General Requirements for Execution of Work

A. Maintain overall coordination of execution of Work.

B. Obtain all necessary permits for the work not otherwise obtained by the Owner.

C. Obtain schedules from subcontractors and suppliers and assume responsibility for correctness.

D. Incorporate schedules from all parties into Progress Schedule to plan for and comply with sequencing constraints.

E. Pre-locate by exploratory excavation existing utilities to minimize service interruption and demands on OWNER's personnel.

3.2 Work Sequences

Proposed work sequences are outlined below for each of the work elements with allowable shutdown periods during key construction sequences. It is noted that the proposed order of sequence for each element of Work presented below is one recommended method where many steps can be completed simultaneously. CONTRACTOR may submit alternate sequences and methods that comply with the intent of the criteria for ENGINEER review.

3.3 Schedule A: Proposed Bolton Reservoir Construction Sequence and Schedule C: Proposed Water Supply Main Construction Sequence

A. Tree removal work shall be completed by no later than January 31, 2016, prior to bird nesting season, in compliance with Migratory Bird Treaty Act.

B. Relocate SCADA equipment from old pump station building to Bolton Pump Station. This must occur prior to demolition of old pump station building.

C. Prior to permanent reservoir shutdown for demolition:

1. Construct new on-site water main necessary for Bolton Pump Station operation during reservoir construction, and off-site water main Schedule C Milestones C.1 and C.2, and transfer water supply to residences on Skyline Circle and Skyline Drive from the 14-inch diameter steel main on-site to new mains.

a. Replace 18-inch diameter steel water main with 24-inch diameter ductile iron piping and valving necessary to connect the existing pump station with the 18-inch diameter steel main at approximately Station A6+73.

b. Install 8-inch diameter distribution main from approximately Station C1+00 to Station C6+77.

c. Install 4-and 8-inch diameter distribution main from approximately Station A3+34 to A6+28.

d. Provide temporary connection at approximately Station A6+28 to the existing 2-inch diameter main.

e. Replace water services and meter boxes along Skyline Circle.

f. Abandon 4-inch diameter piping along Skyline Circle.

g. Install new water service connections for residences along Skyline Circle as outlined above.

2. Isolate site piping for piping removal:

a. Cap 6-inch diameter water main at approximately Station E1+00.

b. Cap 14-inch diameter water main at approximate roadway station S14+10.

3. All work along Skyline Circle, the utility easement from the reservoir site property line to water system connections in Skyline Drive, and water piping supply to Bolton Pump Station shall be completed by March 15, 2016.

D. Take existing reservoir offline and abandon on-site facilities. City staff will drain existing reservoir prior to taking reservoir offline.

1. Disconnect power to on-site light poles and reservoir cover sump pumps and instrumentation,

2. Demolish old pump station and storage building,

3. Demolish existing reservoir and yard piping

E. Perform reservoir foundation improvements:

1. Mass excavation and temporary construction shoring,

2. Aggregate Pier improvements,

3. Install drainage improvements from new outfall facilities at approximately Station F1+00 to terminal manhole installation at approximately F3+39,

4. Install French drain in aggregate pier improvement area and connect to terminate drainage manhole.

F. Reservoir Substantial Completion – Reservoir tested and operational by May 15, 2017.

G. Reservoir Final Completion - all Schedule A work complete by November 1, 2017.

3.4 Schedule B: Proposed Bolton Pump Station Construction Sequence

A. The Bolton Pump Station is a critical facility in supplying drinking water to City of West Linn's customers. As such, CONTRACTOR shall conduct all work in a manner that will protect water quality and minimize shutdowns.

B. Shutdown of Bolton Pump Station shall only be allowed during the period of November 1 to April 15 unless otherwise approved by OWNER.

C. Verify existing piping and equipment, and determine new pipe, fittings, equipment and materials required to complete all work.

D. Before any pump removal and replacement work can begin, new pumps, motors, valves, piping, motor drives, and all other materials and equipment required for pump relocation, pump installation and start-up shall be on site and ready for installation during pump relocation and new pump work.

E. Coordinate disinfection and pressure testing of modified and new discharge piping with City.

F. Stage 1: Relocate 200 HP Pump No. 1, install Pumps No. 2 and No. 3 discharge, and install surge valve (shutdown required). Stage 1 work shall be completed by no later than January 20, 2016.

1. Coordinate construction and shut down schedule and operation with City. The steps below can be done in any order but they shall be done as concurrently as possible to minimize duration of pump station shutdown. Maximum of five (5) work days allowed for Stage 1 shutdown period.

2. After pump station shutdown, disassemble 200 HP Pump No. 1 discharge piping, remove 200 HP pump and install into Pump No. 3 pump barrel.

3. With 200 HP pump removed, measure to verify all dimensions within Pump No. 1 pump barrel and depth to suction header to confirm lengths and dimensions for new 100 HP pump assembly. Blind flange Pump No. 1 pump barrel.

4. Install new discharge piping and valving for relocated 200 HP Pump in Pump No.3 location.

5. Disassemble Pump No. 2 discharge piping and modify as shown on the plans.

6. Complete surge valve modification in valve vault as shown on the Plans.

7. Put pump station back on line

8. Complete power connections to relocated 200 HP Pump No. 3, control connection to pump control valve, perform start-up of Pump No. 3.

G. Stage 2: Install and start-up new 100 HP pump into Pump No. 1 (shutdown required).

1. Coordinate construction and shut down schedule and operation with City. Pump No. 1 installation shall not occur until Pump No. 2 and No. 3 are back on line and functional. New pumps, motors, and discharge piping shall be on site a ready for installation prior to shut down. Maximum of three (3) work days allowed for Stage 2 shutdown period.

2. Install new 100 HP pump in Pump No. 1 pump barrel and install discharge piping and valving.

3. Put pump station back on line after Pump No. 1 is installed along with discharge piping.

4. Install new VFD and connect power to 100 HP pump.

5. Perform start-up of Pump No. 1.

3.5 Schedule D: Proposed Skyline Drive Street and Stormwater Improvements

A. Tree removal work shall be completed by no later than January 31, 2016, prior to bird nesting season, in compliance with Migratory Bird Treaty Act.

B. Construct roadway improvements from Firwood Drive to Clark Street.

C. Construct roadway improvements from Clark Street to “A” Street.

D. Closure of Skyline Drive from Clark Street (STA S20+00) to the West Linn High School driveway (STA S41+40) will be allowed between June 13, 2016 and August 12, 2016, with a hard closure at STA S41+40 and local access provided at STA S20+00.

E. Schedule D Substantial Completion – All Schedule D work shall be completed by August 12, 2016, with the exception of final landscaping.

F. Schedule D Final Completion – all Schedule D work complete by November 1, 2016

END OF SECTION

SECTION 01100

SPECIAL PROVISIONS

PART 1 GENERAL

These Special Provisions supplement the City of West Linn Public Works Standards. The City of West Linn Public Works Standards shall apply except as modified herein. These Special Provisions and additional Technical Special Provisions may contain occasional requirements not pertinent to the project. However, these Special Provisions and additional Technical Special Provisions shall apply in all particulars insofar as they are applicable to this project.

1.1 Definitions and Applicable Standard Specifications and Plans

Wherever used in these Special Provisions or other Technical Special Provisions the following terms have the meanings indicated which are applicable to both the singular and plural thereof.

OWNER:
Refers to City of West Linn, a municipal corporation of the State of Oregon, with whom CONTRACTOR has entered into the Contract and for whom the work is to be performed. OWNER is also hereinafter referred to as CITY.

CITY:
Refers to City of West Linn, a municipal corporation of the State of Oregon, with whom CONTRACTOR has entered into the Contract and for whom the work is to be performed. CITY is also hereinafter referred to as OWNER.

CONTRACTOR:
Refers to person, firm or corporation with whom the OWNER has entered into the construction and installation Contract.

ENGINEER:
Refers to Murray, Smith & Associates, Inc. 121 SW Salmon, Suite 900, Portland, Oregon 97204, (503) 225-9010, by whom the Project has been designed.

City of West Linn Public Works Design Standards shall apply except as may be modified by these Special Provisions and Technical Special Provisions. In the case of discrepancy, unless noted otherwise herein, the more restrictive provisions shall apply.

1.2 Scope of Work

The work contemplated consists of furnishing all labor, materials and equipment necessary for the construction of the Bolton Reservoir Replacement generally described as follows:

Schedule A – Reservoir Site: The Work includes a new 4.0 million gallon (MG) partially buried circular prestressed concrete reservoir and associated appurtenances, site work including demolition of the existing 2.5 MG concrete Bolton Reservoir and other building demolitions, earthwork and site grading, foundation improvements, water main and stormwater improvements, valve vault, access road, fencing and landscaping, and associated electrical, instrumentation, controls and telemetry systems integration work.

Schedule B – Pump Station: The Work includes improvements to the existing Bolton Pump Station, consisting of a new pitched wood framed roof with metal roofing, relocating an existing 200 HP vertical turbine pump into an existing vacant pump barrel, installing two new pump control valves, a new surge valve, a new 100 HP vertical turbine pump into an existing pump barrel, with a new VFD, piping, and associated mechanical and electrical work.

Schedule C – Water Main Replacement: The Work includes approximately 3,100 linear feet of 24-inch diameter potable water supply main, including valves, fittings, appurtenances, pressure reducing valve vault, connections to existing distribution system, pavement and surface restoration.

Schedule D – Skyline Drive Street and Stormwater improvements: The Work includes approximately 3,800 linear feet of roadway improvements consisting of roadway widening and grading, curb and sidewalk, drainage improvements, retaining walls, asphalt paving, pavement striping and landscaping.

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.

1.3 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. If there is a conflict within the Contract Documents, it will be resolved by the following order of precedence:

A. Permits for outside agencies required by law
B. OWNER-CONTRACTOR Agreement
C. Addenda to Contract Documents
D. CONTRACTOR's Proposal
E. Contract Drawings
F. Technical Special Provisions
G. Standard Terms and Conditions
H. General Terms and Conditions
I. Special Terms and Conditions
J. City of West Linn, Oregon, Design & Construction Standards

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 described above. 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.

The contract drawings are designated by general title, sheet number and sheet title. When reference is made to the drawings, the "Sheet Number" of the drawing will be used. Each drawing bears the ENGINEER's File No. 14-1586 and the general title:

CITY OF WEST LINN, OREGON
BOLTON RESERVOIR REPLACEMENT

The specific titles of each sheet are contained on Sheet G-1.

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 Bureau of Labor and Industries
G. City of West Linn
H. Clackamas County

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

1.5 Time of Completion/Liquidated Damages

The CONTRACTOR shall complete all work shown and specified within the time limits stated in the Notice of Invitation for Bid and Contract. The written Notice to Proceed will be sent to the CONTRACTOR after the CONTRACTOR submits the signed Contract, Bonds, insurance certificates, and affidavit to the OWNER and those documents have been approved as to form and executed by the OWNER. The CONTRACTOR's attention is directed to the General Terms and Conditions, Item 8, in respect to liquidated damages.

1.6 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.

1.7 Access to Work

Access to the work shall be provided as may be required by the OWNER or its representatives, and all authorized representatives of the state and federal governments and any other agencies having jurisdiction over any phase of the work, for inspection of the progress of the work, the methods of construction or any other required purposes.

1.8 Permits and Licenses

To expedite the project permitting schedule, the OWNER has obtained or may proceed with acquiring certain permits prior to the construction contract award. The OWNER will apply for and pay all plan check fees and other fees necessary to obtain permits issued by the City of West Linn. The CONTRACTOR shall be responsible for compliance with all permit provisions and shall accommodate all special

inspections required thereof, all at no additional expense to the OWNER beyond prices as bid. A copy of all permits shall be kept on the work site for use of the ENGINEER.

Permits previously obtained by the City of West Linn for this project:

- Land Use Permits – Conditional Use and Class I & II Design Review

Permits to be obtained by the City of West Linn for this project:

- Tree Removal Permits issued by the City of West Linn
- Erosion and Sediment Control Permit issued by the City of West Linn
- Building Permits issued by the City of West Linn
- Mechanical Permit issued by the City of West Linn
- Plumbing Permit issued by the City of West Linn

Permits to be obtained by the Contractor for this project:

- Electrical Permit issued by Clackamas County

1.9 Conditional Use Permit and Class I & II Design Review Permit

The OWNER has obtained a Conditional Use Permit and a Class II Design Review Permit for the construction of the project. All terms of the Conditional Use Permit and a Class II Design Review Permit related to construction shall apply and by reference shall be included as part of this contract. The project is located in residential areas. The CONTRACTOR is obligated to become familiar with the terms of the Conditional Use Permit and Class II Design Review Permit prior to bidding and to assess any implications with respect to construction cost/pricing/bidding. CONTRACTOR failure to become familiar with the Conditional Use Permit and Class II Design Review Permit provisions will not relieve the CONTRACTOR from permit obligations and will not constitute justification for added compensation for any requirements thereof which may not have been included in the CONTRACTOR's bid. A copy of the Conditional Use Permit and Class II Design Review Permit is bound herewith as Supplementary Information. Included copy is provided for bidder information only and may not include all various attachments and exhibits.

1.10 Erosion and Sedimentation Control

The OWNER will obtain a National Pollutant Discharge Elimination System (NPDES) 1200-C Permit for this project. The CONTRACTOR shall be responsible for compliance with all 1200-C permit provisions. The OWNER will transfer the Permit from the OWNER to the CONTRACTOR. Work shall not commence until the 1200-C Permit has been transferred from the OWNER to the CONTRACTOR. CONTRACTOR shall at all times maintain a copy of the 1200-C permit and its provisions on project site.

Erosion control measures shall be maintained throughout the project site until approved permanent cover such as a healthy stand of grass, other permanent vegetation, or other ground covering is established. When approved permanent ground cover is established, all temporary erosion control measures shall be removed from the construction site. Erosion control measures shall be installed as approved, per the erosion control drawing(s) in the above referenced document. Erosion control measures including stabilized construction entrances and sediment barriers must be established in conjunction with site clearing and grading.

During construction, and until permanent vegetation or other ground covering is established, the erosion control facilities shall be upgraded as needed for unexpected storm events or site conditions and with the purpose of retaining sediment and sediment-laden water on the construction site.

1.11 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.

1.12 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. Water for construction purposes will be furnished by the OWNER at no cost. 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.

1.13 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.

1.14 Construction Within Private Easements

When portions of the work contemplated are within easements held by the OWNER on private property, the CONTRACTOR shall ascertain for itself to what extent the width, status and special conditions attached to easements may have on its operations and all costs resulting therefrom shall be included and absorbed in the unit prices of the CONTRACTOR's bid. CONTRACTOR shall coordinate with private property owners and businesses if required. Landscaping, surface restoration and fence restoration shall be completed within 24 hours following piping and conduit installation and other construction work. Temporary fencing shall be provided continuously until such private fencing is properly restored.

Certain portions of this project require working in close proximity to existing structures and property within private easements. It is the CONTRACTOR'S responsibility to conduct its operations and limit the size of equipment used in such a manner so as to prevent damage to existing property from excessive vibration or from other direct or indirect CONTRACTOR operations. The cost associated with repairing or replacing property that is damaged by the CONTRACTOR's operations shall be the responsibility of the CONTRACTOR, in accordance with the General Conditions.

1.15 Private Roads and Driveways

Bridges at entrances to business properties where vehicular traffic is necessary shall be provided and maintained. Bridges shall be adequate in width and strength for the service required. 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.

1.16 Traffic Control and Protection

The CONTRACTOR shall maintain traffic control and protection in the work areas twenty-four (24) hours per day. Traffic control shall conform to the standards set forth in the "Oregon Manual on Uniform Traffic Control Devices" issued by the Oregon Department of Transportation.

Except for approved and planned street closure on Skyline Drive as outlined in Schedule D, the CONTRACTOR shall conduct its operations so as to keep one lane of traffic open for public and private access at all times on City, County and Public streets, roads and highways. If required by the State, the CONTRACTOR shall conduct its operations so as to keep both directions of traffic open on State Highways. Permits obtained for the project may have more stringent requirements than noted in this section.

Prior to beginning construction, the CONTRACTOR shall submit a detailed street closure and traffic control plan to the ENGINEER for approval. As construction proceeds, the CONTRACTOR shall notify the ENGINEER as to the status of street closures and detours.

Detours as required by the ENGINEER shall be surfaced with asphalt concrete and maintained in good condition. Detours for pedestrians shall not exceed one block in length, and foot bridges over the trenches shall be provided with adequate handrails.

All work shall be carried on with due regard for safety to the public. Open trenches shall be provided with barricades of a type that can be seen at a reasonable distance, and at night they shall be distinctly indicated by adequately placed lights.

1.17 Materials and Compaction Testing

The CONTRACTOR shall provide the services of a licensed, independent agency to perform materials and compaction testing for this project. The agency must be approved by the ENGINEER. Materials and compaction tests will be required to show that specified densities of compacted backfill and asphaltic concrete surfacing are being achieved by the CONTRACTOR's compaction methods. The CONTRACTOR shall provide the ENGINEER with copies of recent Proctor tests for the backfill and paving material in addition to copies of compaction tests performed in the field.

After the ENGINEER is satisfied that the CONTRACTOR's method of compaction consistently meets specified compaction requirements, the testing frequency may be reduced. The ENGINEER may direct testing at a higher frequency upon failure to

obtain specified densities or if the CONTRACTOR changes compaction equipment or methods of compaction. All test locations shall be determined by the ENGINEER.

1.18 Dechlorination and Disposal of Chlorinated Water

Any discharge of chlorinated water shall either be through an approved connection to a public sanitary sewer system or shall include dechlorination to limits acceptable by the Oregon State Department of Environmental Quality (DEQ) and the City of West Linn for discharge into an existing storm or surface drainage system. No chlorinated water shall be discharged into a storm or surface drainage system prior to being treated by approved dechlorination treatment.

1.19 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 and adjacent public rights-of-way subject to permission of the public owner of that right-of-way. 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.

1.20 Existing Water System Shutdown

If the project involves the need to shut down an existing water system, the CONTRACTOR shall coordinate the work to insure a minimum of shutdown time. The CONTRACTOR shall submit a written shutdown schedule to the ENGINEER for approval. The CONTRACTOR shall provide 72-hour notice preceding each shutdown. See Section 02664, Water Service Connections, for additional requirements.

1.21 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 to be crossed, by potholing ahead of the pipe installation, of sufficient distance to avoid conflicts through pipe joint deflection if possible. 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.

1.22 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.

1.23 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.

1.24 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.

1.25 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.

1.26 Public Safety and Convenience

General Rule: The CONTRACTOR shall ensure the safety of the public during its performance of the Work and shall minimize any public inconvenience in addition to any other requirement imposed by law. These duties include, but are not limited to, the matters listed below.

Access: The CONTRACTOR shall not unreasonably restrict access to public facilities, commercial property, fire hydrants, residential property, and other areas where the public can be expected to be present, such as sidewalks and streets without first obtaining approval of the OWNER. Driveways shall be closed only with the approval of the OWNER or after obtaining specific permission from the property owner or owners. In addition, the CONTRACTOR shall not obstruct or interfere with travel over any public street or sidewalk without approval of the OWNER.

Public Transit: The CONTRACTOR shall not interfere with the normal operation of any public transit vehicles unless otherwise authorized.

Work Site: The CONTRACTOR shall keep the Project site safe in compliance with applicable law. Safety includes, but is not limited to: 1) providing an approved type of secured and adequate barricades or fences that are easily visible from a reasonable distance around open excavations; 2) closing up or covering with steel plates all open excavations at the end of each Working Day in all street areas and in all other areas when it is reasonably required for public safety; 3) marking all open work and obstructions by lights at night; 4) installing and maintaining all necessary signs, lights, flares, barricades, railings, runways, stairs, bridges, and facilities; 5) observing any and all safety instructions received from the OWNER; and 6) following all laws and regulations concerning worker and public safety. In the event that the law requires greater safety obligations than that imposed by the OWNER, the CONTRACTOR shall comply with the law.

Emergency: Emergency vehicles, including but not limited to police, fire, and disaster units shall be provided access to the work site at all times.

Cleanliness: The CONTRACTOR shall, on a continuing basis, keep the surfaces of all public and private roadways, sidewalks, and other pathways free of dirt, mud, cold plane grindings, and other matters that the CONTRACTOR may place upon the road. The cost of performing such work shall be included in the CONTRACTOR's Bid and no additional payment will be made for performing this task.

Parking: The CONTRACTOR shall make any necessary contacts with all applicable governmental bodies to arrange for the removal of parked automobiles, vehicles and other obstructions if they would interfere with the performance of the CONTRACTOR'S work.

Accidents: The CONTRACTOR'S Project Manager or superintendent shall be in charge of accident prevention. CONTRACTOR shall take all actions necessary to prevent damage, injury and loss to persons and property as a result of accidents.

The OWNER has no responsibility for Work site safety. Work site safety is the responsibility of the CONTRACTOR. The CONTRACTOR is required to have a competent person on site at all times during construction activities.

The CONTRACTOR shall provide signs on work zone fencing that provide information regarding access to businesses and stating that such businesses are open and in operation. The CONTRACTOR shall furnish and install the signs and provide sign attachments for the various business names.

1.27 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.

1.28 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.

1.29 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.

1.30 Vehicle Parking

The vehicles of the CONTRACTOR's and subcontractors' employees shall be parked in accordance with local parking ordinances.

1.31 Protection of Quality of Water

The work to be performed may involve connections to an existing potable water system. If such work is included in the project, the CONTRACTOR shall take such precautions as are necessary or as may be required to prevent the contamination of the water. Such contamination may include but shall not be limited to deleterious chemicals such as fuel, cleaning agents, paint, demolition and construction debris, sandblasting residue, etc. In the event contamination does occur, the CONTRACTOR shall, at its own expense, perform such work as may be necessary to repair any

damage or to clean the affected areas of the water mains to a condition satisfactory to the ENGINEER.

1.32 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.

1.33 "Or Equal" Clause

In order to establish a basis of quality, certain processes, types of machinery and equipment or kinds of material may be specified on the drawings or herein by designating a manufacturer's name and referring to its brand or product designation. It is not the intent of these specifications to exclude other processes, equipment or materials of a type and quality equal to those designated. When a manufacturer's name, brand or item designation is given, it shall be understood that the words "or equal" follow such name or designation, whether in fact they do so or not. If the CONTRACTOR desires to furnish items of equipment by manufacturers other than those specified, he shall secure the approval of the ENGINEER prior to placing a purchase order.

No extras will be allowed the CONTRACTOR for any changes required to adopt the substitute equipment. Therefore, the CONTRACTOR's proposal for an alternate shall include all costs for any modifications to the drawings, such as structural and foundation changes, additional piping or changes in piping, electrical changes or any other modifications which may be necessary or required for approval and adoption of the proposed alternate equipment. Approval of alternate equipment by the ENGINEER before or after bidding does not guarantee or imply that the alternate equipment will fit the design without modifications.

1.34 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.

1.35 Dust Prevention

All unpaved streets, roads, detours, haul roads or other areas where dust may be generated shall receive an approved dust-preventive treatment or be routinely watered to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.

1.36 Interferences, Obstructions and Sewer Crossings

At certain places, power, light and telephone poles may interfere with excavation and the operation of the CONTRACTOR's equipment. Necessary arrangements shall be made with utility companies for moving or maintaining such poles. The utility company affected by any such interferences shall be notified thereof so that the necessary moving or proper care of poles and appurtenances may have appropriate attention.

All costs resulting from any other interferences and obstructions, or the replacement of such, whether or not herein specifically mentioned, shall be included and absorbed in the unit prices of the CONTRACTOR's bid.

1.37 Noise Limitations

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

1.38 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.

1.39 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.

1.40 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.

1.41 Prevailing Wage Rates for Public Works Contracts in Oregon

The CONTRACTOR shall abide by ORS 279C.800 through 279C.870 which relate to the prevailing wage rates for the building and construction trades in the State of Oregon. These prevailing wage rates are shown in the Bureau of Labor and Industries document which is included elsewhere in these contract documents.

1.42 Oregon Products

CONTRACTOR's attention is directed to the provisions of Oregon Law, ORS 279A.120 regarding the preference for products that have been manufactured or produced in Oregon. CONTRACTOR shall use Oregon-produced or manufactured materials with respect to common building materials such as cement, sand, crushed rock, gravel, plaster, etc., and Oregon-manufactured products in all cases where price, fitness, availability and quality are otherwise equal.

1.43 Use of Explosives

The use of explosives shall not be allowed on this project. Alternative methods of excavation shall be utilized.

1.44 Contaminated Material

A. General

It is possible that the CONTRACTOR may encounter contaminated material (soil and/or water) during excavation activities. This specification identifies requirements for handling and disposing contaminated media.

B. Definitions

1. "Contaminated material" is defined as soil, water, free product, Underground Storage Tanks (UST), buried abandoned utility lines containing residual or free product, solid waste, treated wood waste, chemical containers, or other solid, liquid, or gas substances with contamination levels above background levels.

2. "Hazardous substances" shall mean those substances or materials defined in the Oregon Revised Statutes (ORS) 465.200, as amended.

3. "Release" shall have the meaning as defined in ORS 465.200, as amended.

4. "Environmental laws" shall mean any applicable statute, law, ordinance, order, consent decree, judgment, permit, license, code, covenant, deed, common law, treaty, convention or other requirement pertaining to protection of the environment, health or safety, natural resources, conservation, wildlife, waste management or disposal, hazardous substances or pollution, including but not limited to regulation of releases to air, land, water, and groundwater.

C. Execution

1. Discovery of Contaminated Material

   In the event that the CONTRACTOR, during the course of construction or during any other activities authorized under this contract, should encounter suspected contaminated material or any other materials suspected of posing a threat to human health and the environment, the CONTRACTOR shall notify the ENGINEER immediately and manage according to requirements identified below.

2. Discovery of Contaminated Soil

   CONTRACTOR shall note evidence of contamination (odor, visual staining of soil, free liquid product seeping from soil, sheen on groundwater etc.) and note location of evidence on a sketch of the excavation and provide to the ENGINEER.

CONTRACTOR shall report the discovery to the ENGINEER immediately. CONTRACTOR shall stop all excavation activities, and secure the site to prevent entry by the public. The excavation shall not be backfilled. Protect all open excavations with berms, plates and fencing. CONTRACTOR may continue with work in other non-contaminated areas.

CONTRACTOR shall assist ENGINEER in collecting sample(s) of suspected contaminated media for testing and characterization. CONTRACTOR shall allow 21 days, at no cost to OWNER, for testing, results and instructions as to how to proceed with contaminated materials.

The CONTRACTOR shall obtain a copy of an approved soil disposal/acceptance permit (Disposal/Treatment Facility requires transporter to have a copy of the permit.)

CONTRACTOR will transport and dispose of contaminated material at an approved disposal/treatment facility.

CONTRACTOR shall provide the ENGINEER with a copy of the contaminated soil disposal receipt.

3. Handling of Contaminated Soil

After approval from the ENGINEER, excavate the soil in a manner that prevents commingling of contaminated and non-contaminated soil. ENGINEER will make determination (based on soil saturation) if contaminated soil can be directly transported to a treatment or disposal facility, or if soil needs to be stockpiled to reduce water content. ENGINEER will determine when stockpiled soil can be transported off-site.

CONTRACTOR will be responsible for stockpiling contaminated soil in containers or on impervious surface to prevent the spread of contamination. Any water runoff from the contaminated soil stockpile area(s) must be contained by CONTRACTOR and handled as contaminated water.

Minimize movement of excavation equipment over or through contaminated soil to prevent movement of contaminated soil into areas where no contaminated soil exists.

Stockpiles will be created on an approved site and shall be surrounded by a fence to limit access. The stockpiles must be covered and bermed during periods of rainfall to prevent run-on and run-off. The stockpiles

shall be covered with a minimum 10 mil high density polyethylene (HDPE) plastic during periods of strong winds, nightfall, over the weekends, or during extended work stoppages. If dust is observed coming from the stockpiles, the stockpiles shall be either covered or the dust controlled with water.

Maintain excavation equipment in good working order. Prevent spillage of oil, fuel, or hazardous substances from equipment. In particular, promptly repair oil leaks from equipment and clean up any contaminated soil.

4. Transport of Contaminated Materials

CONTRACTOR shall comply with all applicable Federal, State, or local laws, codes, and ordinances that govern or regulate contaminated substance transportation. Contaminated soils placed in stockpiles shall be loaded into trucks in a manner that prevents the spilling or tracking of contaminated soil into areas of the site with uncontaminated soil. Loose material falling onto the exterior of the truck during loading shall be removed before the truck leaves the loading area. Any material collected in the loading area shall either be placed back into the truck or back into the stockpile. If loading areas are unpaved, the surface soil shall be sampled at the conclusion of the loading activities to confirm that contaminated soil is not present. If loading areas are paved, any loose soil shall be cleaned from the pavement at the conclusion of the loading activities.

Specific truck haul routes shall be established before beginning off-site contaminated media transport. On-site truck routes shall be established to minimize or prevent movement of trucks over contaminated soils. Off-site truck routes shall be established to reduce the risk of releases of contaminated soils and impact on local traffic. The CONTRACTOR shall be responsible for ensuring that loaded truck weights are within acceptable limits. All trucks shall be covered before they leave the loading area.

The CONTRACTOR shall ensure that all drivers of vehicles transporting contaminated substances have in their possession during transport all applicable Oregon State and local vehicle insurance requirements, valid driver's license, and vehicle registration and license. The CONTRACTOR shall be responsible for informing all drivers of transport vehicle about:

a. The nature of the material transported.

b. Required routes to and from the off-site thermal treatment or disposal facility.

c. Applicable County street regulations and requirements, and State of Oregon Department of Transportation codes, regulations and requirements.

d. The County's requirement for proper handling and transportation of the substances.

The CONTRACTOR shall not allow contaminated substances to be spilled or tracked off-site at any time during the project. Trucks used for the transportation of contaminated substances off-site shall be water tight, substance compatible, licensed, insured, and permitted pursuant to federal, state, and local statutes, rules, regulations and ordinances.

If contaminated media is discarded prior to removal of contaminated material, the price per cubic yard of soil materials and price per 100 gallons of contaminated water will be negotiated with OWNER.

1.45 Water Main Contractor Qualification Prior to Bidding

The Water Main Contractor must be qualified by the ENGINEER prior to bidding. A Statement of Qualifications Form shall be submitted to the ENGINEER for review and approval by those prospective Water Main Contractors not already listed as prequalified contractors below. Refer to Appendix A, Water Main Contractor Statement of Qualifications Form, for prequalification information.

Contractors qualified for inclusion in the Bid Proposal as the Water Main Contractor are:

To be determined through the prequalification process outlined in Appendix A, Water Main Contractor Statement of Qualifications Form.

1.46 Earthwork Contractor Qualification Prior to Bidding

The Earthwork Contractor must be qualified by the ENGINEER prior to bidding. A Statement of Qualifications Form shall be submitted to the ENGINEER for review and approval by those prospective Earthwork Contractors not already listed as prequalified contractors below. Refer to Appendix A, Earthwork Contractor Statement of Qualifications Form, for prequalification information.

Contractors qualified for inclusion in the Bid Proposal as the Earthwork Contractor are:

To be determined through the prequalification process outlined in Appendix A, Earthwork Contractor Statement of Qualifications Form.

1.47 Aggregate Pier Contractor Qualification Prior to Bidding

The Aggregate Pier Contractor must be qualified by the ENGINEER prior to bidding. A Statement of Qualifications Form shall be submitted to the ENGINEER for review and approval by those prospective Aggregate Pier Contractors not already listed as prequalified contractors below. Refer to Appendix A, Aggregate Pier Contractor Statement of Qualifications Form, for prequalification information.

Contractors qualified for inclusion in the Bid Proposal as the Aggregate Pier Contractor are:

a. Geopier-Northwest, Inc., Bellevue, WA
b. GeoTech Foundation Company - West, Hillsboro, OR
c. Hayward Baker, Inc. – Tukwila, WA

1.48 Reservoir Contractor Qualification Prior to Bidding

The Reservoir Contractor must be qualified by the ENGINEER prior to bidding. A Statement of Qualifications Form shall be submitted to the ENGINEER for review and approval by those prospective Reservoir Contractors not already listed as prequalified contractors below. Refer to Appendix A, Reservoir Contractor Statement of Qualifications Form, for prequalification information.

Contractors qualified for inclusion in the Bid Proposal as the Reservoir Contractor are:

A. Gateway Pacific Contractors, Inc.
B. Marion Construction Company
C. Skaar Construction, Inc.,
D. Ward-Henshaw Construction Co., Inc.

1.49 Reservoir Prestressor Qualification Prior to Bidding

The Reservoir Prestressor must be qualified by the ENGINEER prior to bidding. A Statement of Qualifications Form shall be submitted to the ENGINEER for review and approval by those prospective Reservoir Prestressors not already listed as prequalified contractors below. Refer to Appendix A, Reservoir Prestressor Statement of Qualifications Form, for prequalification information.

Contractors qualified for inclusion in the Bid Proposal as the Reservoir Prestressor are:

A. DN Tanks, (Company or one of its divisions)

1.50 Special Inspections

Special inspections and testing as required by Chapter 17 of the IBC shall be conducted by ENGINEER retained 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.

1.51 Work with Existing Asbestos Water Pipelines

The CONTRACTOR shall comply with all requirements of the State of Oregon, Department of Environmental Quality (DEQ) with respect to the safe handling, removal and disposal of asbestos cement pipe, including all reporting requirements.

END OF SECTION

SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 GENERAL

Measurement and payment will be on a unit price basis in accordance with the prices set forth in the proposal for individual work items. Where work is required but does not appear as a separate item in the proposal, the cost for that work shall be included and absorbed in the unit prices named in the proposal. CONTRACTOR shall make a careful assessment when preparing the bid.

Schedule A – Reservoir Site

A-1. Mobilization, bonds, insurance, and permitting: Payment for mobilization, bonds, insurance, and permitting will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

A. When 5% is earned, either 100% of the amount for mobilization or 5% of the original contract amount, whichever is the least.

B. When all work is completed, amount of mobilization exceeding 5% of the original contract amount.

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

A-2. All work required to construct 4.0 MG prestressed concrete reservoir: Measurement and payment for all work required to construct a 4.0 million gallon (MG) prestressed concrete reservoir, complete, other than as provided for under separate unit prices, will be made on a single lump sum basis. General work categories are described in the price breakdown below, with the sum of items (a) through (t) below being equal to the total lump sum for Bid Item A-2.

A. Shop Drawings and approvals;

B. Construction survey and staking;

C. Tree protection, removal, clearing, and grubbing;

D. Erosion control plan and maintenance;

E. Demolition of existing reservoir and building structures;

F. Subsurface soil improvements (rammed aggregate piers);

G. Reservoir construction, including access hatch, vent, reservoir foundation, miscellaneous interior piping, interior ladder with fall prevention system, reservoir hydrodynamic mixing system, and other accessories as noted and shown in the Drawings

H. Earthwork to include mass excavation, hauling, stockpiling, backfilling, general surface restoration, gravel access road, drainage ditches and final grading;

I. Construction shoring;

J. Electrical, instrumentation and control, telemetry, and system integration

K. Reservoir testing, disinfection, and startup;

L. Dewatering;

M. Valve vault;

N. Reservoir dechlorination manhole;

O. Reservoir monitoring manhole;

P. Stormwater outfall;

Q. Water detention facility (pond);

R. Stormwater swale;

S. Stormwater facilities start-up and testing;

T. Landscaping to include soil, preparation, grass seeding, plantings, and jute matting;

U. Temporary irrigation, and planting maintenance and guarantee;

V. Chain-link fencing and gate, complete;

W. Decorative fencing and gate to include new and Owner supplied fencing, complete;

X. Foundation drainage trench;

Y. Project plaques;

Z. Removal of asphalt and concrete surfaces from lots at 6123 & 6175 Skyline Drive;

AA. Traffic control;

BB. Site clean-up and demobilization.

A-3. Overexcavation and select backfill material for unsuitable foundation conditions: Payment for overexcavation and select backfill material for unsuitable foundation conditions will only be considered as approved by the Engineer in writing. When such pre-approval is obtained, payment will be made on a per cubic yard basis.

A-4. Furnish and install 24-inch diameter Class 55 ductile iron pipe with Class B trench backfill, restrained: Payment for furnishing and installing 24-inch diameter Class 55 ductile iron (DI) pipe with Class B trench backfill, including all work and materials, excavation to depths shown on the Drawings, all required joint restraint systems for pipe, fittings, valves, and appurtenances, standard concrete thrust blocks (including concrete, excavation, and thrust plates), dewatering, Class D bedding and pipe zone backfill and Class B trench backfill will be on a per linear foot basis for the burial depths shown. Measurement will be based on total length of piping constructed with restrained joints as indicated on the plans without deduction for fittings and valves. Bedding and pipe zone material is understood to be imported granular material, compacted in place as shown on the plans. Trench backfill material is understood to be native material, compacted in place as shown. Class B and Class D fill material shall be as specified within Section 02222, Excavating, Backfilling and Compacting for Utilities.

A-5. Furnish and install Class 52 ductile iron pipe with Class B trench backfill, restrained: Payment for furnishing and installing Class 52 ductile iron (DI) pipe with Class B trench backfill, including all work and materials, excavation to depths shown on the Drawings, all required joint restraint systems for pipe, fittings, valves, and appurtenances, standard concrete thrust blocks (including concrete, excavation, and thrust plates), dewatering, Class D bedding and pipe zone backfill and Class B trench backfill will be on a per linear foot basis for the pipe diameters shown. Measurement will be based on total length of piping constructed with restrained joints as indicated on the plans without deduction for fittings and valves. Bedding and pipe zone material is understood to be imported granular material, compacted in place as shown on the plans. Trench backfill material is understood to be native material, compacted in place as shown. Class B and Class D fill material shall be as specified within Section 02222, Excavating, Backfilling and Compacting for Utilities.

A-6. Furnish and install ductile pipe iron fittings: Payment for furnishing and installing ductile iron fittings will be made on a per pound basis. The weight of fittings used for payment will be the nominal weights listed in AWWA Standard C110 for the actual Class and type of fitting specified and shown on the plans. Fitting installation will be

considered a separate pay item from work performed under other pay items. Fitting accessories including glands, bolts, and gaskets shall be considered incidental in the fitting weights for payment.

A-7. Furnish and install buried valves: Payment for furnishing and installing buried valves not included in other pay items, including valve boxes, covers, risers and extensions, if required, complete, will be on a per each valve basis for the size and type shown on the Drawings.

A-8. Furnish and install flexible expansion joints: Payment for furnishing and installing flexible expansion joints shall be on a per each basis for the size and type shown on the Drawings and shall include all trench excavation, pipe zone, bedding and backfill material, and polyethylene material required for installation.

A-9. Testing, flushing, and disinfection of water mains: Payment for testing, flushing, and disinfection of water mains will be on a lump sum basis and shall include furnishing, installing and removing temporary blow-off piping, including miscellaneous piping, valves, fittings, and thrust restraint. The OWNER shall provide off-site laboratory analysis. Payment for any retesting shall be paid by the CONTRACTOR.

A-10. Connections to existing water system piping: Payment for connecting to existing water system piping, including exploratory excavation as may be required to confirm piping locations and type, any additional excavation and backfill, cutting existing piping, and all other miscellaneous tie-in related work not included in other pay items will be on a lump sum basis for the sizes and types as shown in the plans.

A-11. Existing water main abandonment: Payment for removing abandoned piping or abandoning pipe in place, disconnecting and capping new/live mains, capping abandoned pipe ends, removal/demolition of associated valves, valve boxes and vaults, test stations, meters and meter boxes, hydrants, abandoned services and other appurtenances, excavation, pipe hole cutting, backfill, and restoring excavations as may be required will be on a lump sum basis.

A-12. Furnish and install ASTM D3034 PVC drain piping: Payment for furnishing and installing ASTM D3034 polyvinylchloride (PVC) drain piping shall be made at the unit price per linear foot for the various pipe sizes, with Class D bedding, pipe zone, and trench backfill, from ground surface to the pipe invert regardless of depth. Measurement for payment for length shall be the horizontal distance which shall be from center to center of manholes or inlet structures and to the end of pipes. For pipe slopes greater than 25 percent, the measurement for payment shall be the actual slope distance of the pipe. Measurement for depth will be made at intervals of 25 feet along the centerline of the trench on even 25 foot stations and the depth of each measuring point from ground to the pipe invert will be used for computing the depth of trench for a distance of 25 feet ahead of the point of measurement. Class D fill material shall

be as specified within Section 02222, Excavating, Backfilling and Compacting for Utilities.

A-13. Furnish and install HDPE drain piping: Payment for furnishing and installing high-density polyethylene (HDPE) drain piping shall be made at the unit price per linear foot for the various pipe sizes, with Class D bedding, pipe zone and trench backfill, from ground surface to the pipe invert regardless of depth. Measurement for payment for length shall be the horizontal distance which shall be from center to center of manholes or inlet structures and to the end of pipes. For pipe slopes greater than 25 percent, the measurement for payment shall be the actual slope distance of the pipe. Measurement for depth will be made at intervals of 25 feet along the centerline of the trench on even 25 foot stations and the depth of each measuring point from ground to the pipe invert will be used for computing the depth of trench for a distance of 25 feet ahead of the point of measurement. Class D fill material shall be as specified within Section 02222, Excavating, Backfilling and Compacting for Utilities.

A-14. Furnish and install RCP storm drain piping: Payment for furnishing and installing reinforced concrete (RCP) storm drain piping shall be made at the unit price per linear foot for the various pipe sizes, with Class D bedding, pipe zone and trench backfill, from ground surface to the pipe invert regardless of depth. Measurement for payment for length shall be the horizontal distance which shall be from center to center of manholes or inlet structures and to the end of pipes. For pipe slopes greater than 25 percent, the measurement for payment shall be the actual slope distance of the pipe. Measurement for depth will be made at intervals of 25 feet along the centerline of the trench on even 25 foot stations and the depth of each measuring point from ground to the pipe invert will be used for computing the depth of trench for a distance of 25 feet ahead of the point of measurement. Class D fill material shall be as specified within Section 02222, Excavating, Backfilling and Compacting for Utilities.

A-15. Furnish and install 48-inch diameter manhole: Payment for furnishing and installing pre-cast concrete manholes shall be made at the unit price for each 48-inch diameter manhole at the depth as shown on the plans. The unit price shall be full compensation for the manhole in-place including excavation and backfill, cover and frame, grade rings, piping connections, restrained flap valves, and any other work shown on the Drawings, complete.

A-16. Furnish and install catch basins/field inlets: Payment for furnishing and installing catch basins and field inlets, complete, including concrete basin, frame and grate, all excavation, backfill, adjustments for setting to final grade, and other incidental work as shown on the Drawings and described in the specifications, shall be made on a per each basis.

A-17. Paved access road, 4-inch HMAC, Level 3, ½-inch Dense, over 12-inch base aggregate with geotextile: Payment for paved access road shall include roadway excavation, structural fill, base aggregate, hot mix asphaltic concrete (HMAC)

paving, geotextile fabric, and other items to meet the city of West Linn roadway standards and the requirements shown in the plans. Measurement for paved access road shall be made on a per square yard basis.

A-18. Furnish and install cathodic protection systems, complete: Payment for this item includes furnishing and installing cathodic protection systems on the buried waterline piping and appurtenances, complete, as shown on the Drawings, shall be on a lump sum basis. Payment for cathodic protection systems for ductile iron (DI) transmission mains shall include furnishing and installing 16 mil polyethylene wrap, double-wrapped, flush-mounted test stations at all locations identified on the Drawings with test box and lid, terminal block, wires, connections, prepackaged zinc reference electrodes, excavation and backfill; and 30 mil geo-membrane barriers between gas and water main identified on the Drawings.

A-19. Furnish and install bollards: Payment will be made on a per each basis and shall include furnishing all labor and materials.

Schedule B – Pump Station

Measurement and payment for Schedule B will be on a lump sum basis for work associated with the construction of the potable water pump station (Bid Item B-1). Basis and payment for individual bid items will be as follows:

B-1. All work required to construct the addition of a pitched metal roof onto an existing pump station and pumping improvements, including installation of a water booster pump, surge control valve, and associated electrical and piping improvements: Lump sum payment under this item shall cover all labor and materials necessary for making pump station improvements within Schedule B of the Contract Documents.

Anticipated metal roof work items include:

- Removal of existing materials to include guardrail and anchoring;
- Removal of loose material from existing roof;
- Manufactured wood truss framing system;
- Standing seam metal roof, metal gutter and downspout system;
- Dome skylight roof hatches;
- Exhaust louvers;
- Fiber cement lap siding;
- Fiber cement fascia and trim boards;
- Locking roof access door;
- Insulation;
- and incidental work as specified and necessary.

Anticipated pump improvement work items include:

- Removal of existing discharge piping and valves from existing 200 hp Pumps No. 1 and 2;
- Relocating existing 200 hp pump from Pump No. 1 location to Pump No. 3 location;
- Install new 100 hp VFD controlled pump in Pump No. 1 location (pump furnished per Item No. B-2);
- Furnish and install new discharge piping and valves for Pumps No. 1, No. 2 and No. 3;
- Modify existing surge system including furnish and install surge anticipator valve and isolation valving;
- Furnish and install VFD for Pump No. 1 in exiting MCC;
- All electrical and control improvements as shown;
- and incidental work as specified and necessary.

CONTRACTOR shall provide a schedule of values for all the Work under this item which will include quantities and prices of items aggregating the lump sum bid price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such process will include an appropriate amount of overhead and profit applicable to each item of Work. The Schedule of Values will serve as the basis for progress payments and will be incorporated into a form of Application of Payment acceptable to the ENGINEER.

B-2 Allowance for established lump sum price to provide one Floway 100 hp vertical turbine pump, Model 11JKM: Payment for furnishing the Floway 100 hp vertical turbine pump, Model 11JKM, will be on a lump sum basis in the amount included in Schedule B of the Bid Schedule, and shall cover furnishing vertical turbine pumps as specified in the Contract Documents and as shown on the plans. See Appendix C, Section 01210 regarding Allowances requirements.

Schedule C – Water Main Replacement

C-1. Mobilization, bonds, insurance, and permitting: Payment for mobilization, bonds, insurance, and permitting will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

A. When 5% is earned, either 100% of the amount for mobilization or 5% of the original contract amount, whichever is the least.

B. When all work is completed, amount of mobilization exceeding 5% of the original contract amount.

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

C-2. Furnish and install Class 55 ductile iron piping with Class D trench backfill, 24-inch diameter, restrained: Payment for furnishing and installing restrained joint 24-inch diameter Class 55 ductile iron (DI) pipe with Class D trench backfill, including all work and materials, excavation for cover at depths as shown on the plans, all required joint restraint systems for pipe, fittings, valves, and appurtenances, standard concrete thrust blocks (including concrete, excavation, and thrust plates), dewatering, Class D bedding, Class D pipe zone and Class D trench backfill and temporary asphaltic concrete surfacing as required will be on a per linear foot basis. Measurement will be based on total length of piping constructed with restrained joints as indicated on the plans without deduction for fittings and valves. Bedding, pipe zone and trench backfill material is understood to be imported granular material, compacted in place as shown on the plans. Class D fill material shall be as specified within Section 02222, Excavating, Backfilling and Compacting for Utilities.

The pay quantities for pipe, trench excavation and backfill will be on the basis of the horizontal length of pipe laid without deductions for valves or fittings which may be included in the end-to-end measurement of a continuous section of pipe. Where pipe is laid on a continuous slope greater than 10 percent for a distance greater than 100 feet, payment will be made upon the average slope distance between 100-foot stations. When water mains intersect, the measurement of each main shall be to the intersection of the center lines of the connecting fittings.

The unit price shall include any incidental excavation, backfill and additional work required to cutting existing piping, installation of branch-line fittings and/or connection to existing pipelines. Unit price shall also include as incidental the removal of existing fittings and piping as shown on the plans.

C-3. Furnish and install Class 52 ductile iron pipe with Class D trench backfill: Payment for furnishing and installing Class 52 ductile iron (DI) pipe with Class D trench backfill, including all work and materials, excavation to depths as shown on the plans and as listed in the Bid Proposal, all required joint restraint systems for pipe, fittings, valves, and appurtenances, standard concrete thrust blocks (including concrete, excavation, and thrust plates), dewatering, Class D bedding, Class D pipe zone and Class D trench backfill and temporary asphaltic concrete surfacing as required will be on a per linear foot basis for the pipe diameters shown. Measurement will be based on total length of piping constructed with restrained joints as indicated on the plans without deduction for fittings and valves. Bedding, pipe zone and trench backfill material is understood to be imported granular material, compacted in place as shown on the plans. Class D fill material shall be as specified within Section 02222, Excavating, Backfilling and Compacting for Utilities.

The pay quantities for pipe, trench excavation, and backfill will be on the same basis and shall include the same work as specified in Pay Item C-2.

C-4. Furnish and install ductile iron pipe fittings: Payment for furnishing and installing ductile iron fittings will be made on a per pound basis. The weight of fittings used for payment will be the nominal weights listed in AWWA Standard C110 for the actual Class and type of fitting specified and shown on the plans. Fitting installation will be considered a separate pay item from work performed under other pay items. Fitting accessories including glands, bolts, and gaskets shall be considered incidental in the fitting weights for payment.

C-5. Furnish and install buried valves: Payment for furnishing and installing buried valves not included in other pay items, including valve boxes, covers, risers and extensions, if required, complete, will be on a per each valve basis for the size and type shown on the Drawings.

C-6. Replace water service connections: Payment for replacing water services shall be on a per each basis for the sizes shown. The unit price for service lines shall be full compensation for all service line work including excavation, hand excavation, trenchless installation, backfill, pavement and surface restoration, all utility locates on private property, copper tubing, fittings, couplings, service saddles, corporation stops, unions, adapters, angle meter stops, and expansion joint filler material (where required). Where applicable and indicated on the Drawings and in the Bid Proposal, payment shall also include all costs associated with furnishing and installing water service meters (not including service meter boxes) and backflow prevention devices with sectional concrete vault as shown in the Drawings. Costs will also include coordination with the City of West Linn and property owners, installation, and testing. No additional payment will be made for special coordination with private property owners or permits for work on private property. Restoration of concrete curb, gutter, and sidewalk as required will be considered incidental to this pay item.

C-7. Replace water meter boxes: Payment for replacing water meter boxes shall be on a per each basis. The unit price for meter boxes shall be full compensation for all work including excavation, hand excavation, backfill, pavement and surface restoration, all utility locates on private property. Costs will also include coordination with the City of West Linn and property owners. No additional payment will be made for special coordination with private property owners or permits for work on private property. Restoration of concrete curb, gutter, and sidewalk as required will be considered incidental to this pay item.

C-8. Furnish and install fire hydrant assemblies: Payment for furnishing and installing fire hydrant assemblies will be on a per each basis. The unit price for hydrants shall include all costs for shackles, tie rods, pier blocks, gravel, isolation valves, painting and all other items for the complete installation of the hydrant as shown in the Drawings, including the pipe connecting the hydrant to the main. Tees will be paid

for at the unit contract price each under the appropriate bid items. Restoration of concrete curb, gutter, and sidewalk will be considered incidental to this pay item.

C-9. Remove and abandon existing fire hydrants: Payment for removing and abandoning existing fire hydrant assemblies will be on a per each basis. The unit price shall include all costs associated with the complete removal of the existing fire hydrants as shown in the Drawings. Restoration of concrete curb, gutter, and sidewalk will be considered incidental to this pay item.

C-10. Furnish and install filling station: Payment for furnishing and installing filling stations will be on a per each basis. The unit price for filling stations shall include all costs associated with the complete installation of the filling station as shown in the Drawings, including 2-inch copper water service piping and fittings, water meter and meter box, backflow prevention assembly, and single port fire hydrant. Restoration of concrete curb and sidewalk as required will be considered incidental to this pay item.

C-11. Testing, flushing, and disinfection of water mains: Payment for testing, flushing, and disinfection of water mains will be on a lump sum basis and shall include furnishing, installing and removing temporary blow-off piping, including miscellaneous piping, valves, fittings, and thrust restraint. The OWNER shall provide off-site laboratory analysis. Payment for any retesting shall be paid by the CONTRACTOR.

C-12. Connections to existing water system piping: Payment for connecting to existing water system piping, including exploratory excavation as may be required to confirm piping locations and type, any additional excavation and backfill, cutting existing piping, and all other miscellaneous tie-in related work not included in other pay items will be on a lump sum basis for the sizes and types as shown in the plans. Restoration of concrete curb, gutter, and sidewalk as required will be considered incidental to this pay item.

C-13. Saw-cutting existing asphalt concrete (AC) pavement and concrete surfacing: Measurement and payment for saw cutting existing AC pavement and concrete surfacing shall include trench width limits plus 6 inches on each side of trench for tee-cut excavation. Payment for saw cutting existing surfacing for cuts up to 4 inches in depth and for each 1-inch depth beyond the first 4-inch thickness will be on a per linear foot basis.

C-14. Hot mix asphaltic concrete (HMAC) trench patch along entire pipeline length in existing paved areas: Measurement and payment for HMAC trench patch shall be on a per ton basis. Payment for HMAC trench patch shall include furnishing and installing of the asphaltic concrete and aggregate base materials, compaction, process control, acceptance testing and other incidental work required to provide permanent HMAC pavement as shown on the Drawings and specified in Section 02505 of the Technical Specifications. Payment shall be based on truck tickets collected for AC delivery to project site.

C-15. Grind and install 2-inch thick full-width HMAC inlay of Skyline Circle: Measurement and payment for the grinding and installation of the 2-inch thick asphaltic concrete inlay will be on a per ton basis. Payment shall include cold plane pavement removal and replacement as specified in the Oregon Department of Transportation, Standard Specifications for Highway Construction. Payment shall also include the replacement of all traffic markings removed during cold planing and shall comply with City of West Linn requirements. Measurement shall be based on the quantity of AC installed and shall not include excavated areas. Payment shall be based on truck tickets collected for AC delivery to project site.

C-16. Traffic control: Payment for traffic control, maintenance and protection including all coordination, materials, labor and equipment, as required, will be on a lump sum basis, complete.

C-17. Furnish and install 2-inch diameter blow-off assemblies: Payment for furnishing and installing 2-inch diameter blow off assemblies, complete, will be on a per each basis and shall include furnishing and installing materials included in the 2-inch diameter blow-off assembly detail in the Drawings and other appurtenances, excluding ductile iron fittings as paid for by other items. Excavation, sheeting, shoring, and dewatering shall be considered incidental to payment. Restoration of concrete curb, gutter, and sidewalk as required will be considered incidental to this pay item.

C-18. Furnish and install 2-inch diameter air-release assemblies: Payment for furnishing and installing 2-inch diameter air-release assemblies, complete, will be on a per each basis and shall include furnishing and installing materials included in the 2-inch diameter air-release assembly detail in the Drawings and other appurtenances, excluding ductile iron fittings as paid for by other items. Excavation, sheeting, shoring, and dewatering shall be considered incidental to payment. Restoration of concrete curb, gutter, and sidewalk as required will be considered incidental to this pay item.

C-19. Furnish and install 18-inch diameter insulated transition couplings: Payment for furnishing and installing 18-inch diameter insulated transition couplings suitable for transition from ductile iron pipe to existing steel pipe, complete, will be on a per each basis and shall include furnishing and installing the coupling. Excavation, sheeting, shoring, and dewatering shall be considered incidental to payment.

C-20. Furnish and install 18-inch diameter wet tap: Payment for furnishing and installing 18-inch diameter wet tap assemblies shall be on a per each basis for the type shown on the Drawings and shall include all costs for tapping sleeve assembly, driving and tagging of existing water main. Hot tap isolation valve will be paid for at the unit contract price under the appropriate bid item.

C-21. General clean-up, erosion control, and surface restoration of landscaped areas and non-paved surfaces: Payment for all required clean-up, erosion control, and general

surface restoration other than streets, including installation and removal of erosion control best management practices, stripping and stockpiling topsoil, re-grading to original contours, bark mulching planting areas, resurfacing gravel areas, repairing landscaped areas, replacing fences and mailboxes, repairing sidewalks and curbs not specified under other items, and cleanup following construction will be made on a lump sum basis.

C-22. Existing water main abandonment: Payment for removing abandoned piping or abandoning pipe in place, disconnecting and capping new/live mains, capping abandoned pipe ends by either mechanical means, or grout plugs, or both, removal/demolition of associated valves, valve boxes and vaults, test stations, meters and meter boxes, hydrants, abandoned services and other appurtenances, excavation, pipe hole cutting, backfill, and restoring excavations as may be required will be on a lump sum basis. Restoration of concrete curb, gutter, and sidewalk as required will be considered incidental to this pay item.

C-23. Additional cost for rock excavation: Payment for rock excavation will be made at the unit price per cubic yard of rock excavated and rock excavation will be paid for in addition to the linear foot price for pipe, trench excavation, and backfill. The pay limits for pipe trench shall be 12 inches below the pipe invert and the width shall be the nominal pipe diameter plus one foot on each side of the pipe. Pay limits for vault and other structures shall be to the depth necessary to install the structure and to a maximum of 18 inches beyond the outside walls of the vault or structure. No payment will be made for rock excavation beyond these limits.

Rock excavation is defined in Section 02200, Earthwork.

CONTRACTOR's attention is directed to Section 01100, Special Provision, which disallows CONTRACTOR's use of explosives.

C-24. Overexcavation and select backfill material for unsuitable foundation conditions: Payment for overexcavation and select backfill material for unsuitable foundation conditions will only be considered as approved by the Engineer in writing. When such pre-approval is obtained, payment will be made on a per cubic yard basis.

C-25. Furnish and install cathodic protection systems, complete: Payment for this item includes furnishing and installing cathodic protection systems on the buried waterline piping and appurtenances, complete, as shown on the Drawings, shall be on a lump sum basis. Payment for cathodic protection systems for ductile iron (DI) transmission mains shall include furnishing and installing isolation joints of various required pipe sizes, double-wrapped 16 mil polyethylene pipe wrap, flush-mounted test stations at all locations identified on the Drawings with test box and lid, terminal block, wires, connections, excavation and backfill; and 30 mil isolation mat barrier and galvanic ribbon anodes between gas and water main as identified on the Drawings.

C-26. Furnish and install package pressure regulating valve vault, complete: Payment for furnishing and installing the package pressure reducing valve vault, complete per the City of West Linn standards, and as shown on the Drawings, shall be on a lump sum basis.

Schedule D – Skyline Drive Street and Stormwater Improvements

Measurement and Payment for Schedule D work shall be per the 2015 Oregon Standard Specifications for Construction. See Appendix D for more information.

END OF SECTION

SECTION 02921

HYDROMULCH SEEDING

PART 1 GENERAL

1.1 Summary

A. Related Documents: Drawings and general provisions of the Contract, including General and, Supplementary Conditions, apply to the work of this Section.

B. Related Work Described Elsewhere

1. Division 2 Section "Earthwork," for topsoil and preparation requirements for new lawns and grasses.

2. Division 2 Section "Plants" for planting bed border edgings.

1.2 Quality Assurance

A. Qualification of Workmen: Provide at least one person who shall be an experienced full-time supervisor to be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this section.

B. Equipment: Use only mechanical agitation hydroseeder with gear driven pump. Hydroseeder should be of sufficient size and capacity to put down a minimum of one acre of mulch and seed slurry per tank load.

C. Schedules: Install seed mixes during the specified time periods. If special conditions exist that may warrant a variance in the specified plant dates or conditions, a written request shall be submitted to the Engineer stating the special conditions and proposed variance.

D. Notice to Proceed: The Contractor shall not proceed with seeding until the seedbed has been approved by the Engineer.

1.3 Submittals

A. Product Data: For each type of product indicated.

B. Submit within 30 days from Award of Contract the following product samples:

1. Fertilizers: Submit manufacturer's guaranteed analysis.

2. Certification of each seed mixture for lawngrass, identifying source, including name and telephone number of supplier.

3. Submit copy of herbicide applicator's Commercial Applicator's License to Engineer before application of herbicides (includes pesticides). Submit a copy of the application record to the Engineer immediately after each herbicide or pesticide application.

C. Substitutions: All requests for substitutions shall be submitted in writing to the Engineer stating the special conditions and proposed variance.

1.4 Product Handling

A. Protection:

1. All seed shall be delivered to the job site in the original bags with tags certifying purity, germination, common and botanical name for each species, and percent weed seed. All tags shall be removed from the bags by the Engineer. Untagged seed bags shall be rejected.

2. All hydromulch, hydromulch tackifier and fertilizer shall be delivered to the job site in the original unopened packaging.

B. Storage: Seed, hydromulch, hydromulch tackifier and fertilizer shall be kept in dry storage away from contaminants.

PART 2 PRODUCTS

2.1 Seed

A. General: Provide State-certified seed of the latest season’s crop, delivered in original, sealed packages, and labeled in conformance with Department of Agriculture regulations and state seed laws.

1. Free from noxious weed seeds, and recleaned.

2. Grade A seed; 95% minimum purity, 85% minimum germination.

3. Treated with appropriate fungicide;

4. Delivered to the site in sealed containers with dealer's guaranteed analysis for percentage of mixture, purity, germination, weedseed content, and inert material.

B. Wet, moldy, or otherwise damaged seed will be rejected. Field mixing will be acceptable when mixing is performed on site in the presence of the Engineer.

C. Grass Seed Mixtures:

1. Rough Seed:
Protime 710; Hobbs & Hopkins Ltd.; Portland, Oregon (503) 239-7518.
Apply seed at a rate of 2 pounds per 1000 SF.

2. Storm water quality basins and conveyance swales:
Protime 440; Hobbs & Hopkins Ltd.; Portland, Oregon (503) 239-7518.
Apply seed at a rate of 1 pound 1000 SF.

2.2 Fertilizer for Hydroseeding Slurry

A. General:

1. Fertilizer shall be commercially prepared, fully water soluble and shall contain the following percentages by weight:

a. 12% Nitrogen
b. 45% Phosphoric Acid
c. 10% Potash

2. Commercial fertilizer shall be complete, uniform in composition, dry and free-flowing. The fertilizer shall be delivered to the site in the original waterproof containers, each bearing the manufacturer's statement of analysis.

3. Approved Product: Nutriculture Super Start® 12-45-10 PLUS Water Soluble Hydroseed Starter, by Plant Marvel Laboratories, Inc., Tel: (708) 757-7500. To be considered for substitution, any "or equal" product shall have a formulation within 2% +/- for N-P-K of the approved product formulation.

B. Special Protection: If stored at the site, protect fertilizer from the elements at all times.

2.3 Post-Installation and Maintenance Fertilizer

A. Meet requirements of applicable State fertilizer laws. Fertilizers shall be uniform in composition, dry and free flowing. Deliver to the site in original unopened containers each bearing manufacturer's guaranteed analysis.

B. Commercial Fertilizer: Provide slow release, granular fertilizer that is derived from natural organic and inorganic sources. For bidding purposes, assume a composition of 16 Nitrogen (N), 6 Phosphorous (P), 8 Potassium (K), 2 Iron (Fe), applied at a rate of 1 pound of actual Nitrogen per 1000 square feet. Adjust actual composition and rate based on results of soil analyses.

1. Post installation Fertilizer: Woodburn Fertilizer 'Perfection Mix #29' 15-15-15 w/Minors, as available from Woodburn Fertilizer, Woodburn; Oregon; Tel.: 1-503-981-3521, or equal.

2. Maintenance Fertilizer: Woodburn Fertilizer 'Regal Green' 21-4-21 with 50 percent of the nitrogen controlled release from superior Duration™ Type II, as available from Woodburn Fertilizer, Woodburn, Oregon; Tel.: 1-503-981-3521, or equal.

2.4 Mulch

A. Mulch for hydroseeding shall be appropriate to the slopes and grades of the areas to be seeded. For slopes steeper than 3 horizontal to 1 vertical (3:1) a bonded fiber matrix mulch shall be used.

B. Bonded Fiber Matrix: Shall be composed of long strand, thermally refined wood fibers, crimped interlocking man-made fibers and performance enhancing additives. It shall require no curing period and upon application form an intimate bond with the soil surface to create a continuous, porous, absorbent and flexible erosion resistant blanket that allows for rapid germination. Bonded Fiber Matrix to be Flexterra FGM, by Profile Products LLC, Tel: 800-508-8681; www.profileproducts.com; Soil Guard by Fibramulch, Tel: 1.888.298.9911, or approved equal.

1. Apply at a rate of 3500 pounds per acre.

C. Wood Fiber Mulch: Shall be 100% thermally refined shredded wood fiber that when applied in a hydroseed slurry shall form an interlocking ground cover which readily absorbs water and allows infiltration to the underlying soil. Wood Fiber Mulch to be Terra Wood or Terra Wood Plus with premixed tackifier, by Profile Products LLC, Tel: 800-508-8681; www.profileproducts.com; or approved equal.

1. Apply at a rate of 2000 pounds per acre.

D. Blended Fiber Mulch: Shall be composed of 70% thermally refined shredded wood fiber, 27% recycled cellulose fiber, and 3% +/- 1% polymer based tackifiers, with observable blue or green material cover. Blended fiber mulch to be HydroCover Blend with Tack, by Profile Products LLC, Tel: 800-508-8681; www.profileproducts.com; or approved equal.

1. Apply at a rate of 2000 pounds per acre.

2.5 Mulch Tackifier

A. Shall be a guar gum tackifier, a natural, organic polysaccharide, containing no additives, and that when added to water the guar granules swell and become slippery. After application the prepared slurry dries and binds together, helping to provide protection from surface winds or heavy weather variables.

B. Tackifier shall be applied using a water (hydroseeding) slurry which includes seed, mulch and fertilizer.

C. Tackifier may come premixed and blended with the selected fiber mulch.

D. Rate of Application: For slopes up to 4:1 (4 horizontal to 1 vertical): 60 lbs. per acre. On slopes steeper than 2:1, use 90 pounds per acre. Level ground may use 40 lbs. per acre.

E. Approved Product: ConTack Organic Tackifier by Profile Products LLC, Tel: 800-508-8681.

2.6 Water

A. Water shall be available from the site water distribution system. Contractor shall make all arrangements for temporary use and payment for water with the Owner.

2.7 Temporary Barricade Materials

A. At a minimum, the following materials shall be used to delineate limits of hydroseeding:

1. Agricultural metal stakes, minimum 42-inch exposed height.
2. Twine or wire.
3. Plastic flagging tape, 12-inch lengths.

PART 3 EXECUTION

3.1 Weed Abatement

A. Spray out existing weeds, etc. with approved herbicide and remove and dispose of lawfully all dead material, including root systems, prior to soil preparation. After initial kill and removal of existing weeds and grasses, repeat herbicide treatment two (2) more time(s), allowing six (6) weeks germination time between treatments to eliminate virtually all existing weeds and grasses. Time allowance for weed abatement shall be 14 weeks, minimum for triple kill, 8 weeks minimum for double kill.

3.2 Site Preparation

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways

3.3 Soil Preparation

A. Conform to the requirements of Division 2 Section “Earthwork.”

3.4 Surface Conditions

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Specifically, irrigation coverage test shall have been performed and all irrigation trenches backfilled and compacted.

2. Verify that hydroseeding may be completed in accordance with the original design and the referenced standards. Identify conditions not indicated on the Drawings and those which will adversely affect the execution this work. Notify the Engineer of unsatisfactory conditions immediately.

B. The Engineer shall determine areas beyond those indicated on the Drawings which require preparation and hydroseeding due to construction disturbance. This work shall be performed by the Contactor at no additional cost to the Owner.

C. Observe the conditions under which Work is to be performed. Notify the Engineer of conditions unfavorable to the propagation and growth of lawn such as; rubble, construction debris, rock fill, glazed soil, hardened soil or adverse drainage conditions before adding soil amendments or seeding. Do not proceed with the work until these conditions have been corrected in a manner acceptable to the Engineer.

D. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.5 Finish Grading

A. Grade lawn areas to finish grades indicated on the drawings, filling as needed or removing surplus dirt and floating areas to a smooth uniform grade. All lawn areas shall slope to drain.

B. Environmental Requirements: Do not place, spread, or roll fill materials during unfavorable weather conditions. When work is interrupted by adverse weather conditions, do not resume fill operations until moisture content and density of fill are satisfactory.

C. Where no grades are shown, surfaces shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basins, elevations at steps, or building). Roll, scarify, rake and level as necessary to obtain true even surfaces. All finish grades shall meet approval of the Engineer before grass seed is sown.

D. Protection of subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations or other areas prepared for the Project. Protect subgrades, fills and excavation areas from surface waters flowing into the work areas.

3.6 Weed Control

A. Prior to application of seed the seed bed shall be roughed up to a depth of 1/8th inch.

B. Moisten the seedbed to a depth of 1" to promote germination of any seeds contained in the topsoil.

C. After weeds have germinated and are growing vigorously, spray with Roundup in strict conformance with manufacturers specifications. Seeding shall be executed 7 days following Roundup application. Do not disturb the sterilized seedbed in any way prior to seeding.

3.7 Sowing Native Grass and Standard Maintenance Lawn Grasses

A. Preparation: Seed bed preparation shall pertain to the preparation of the surface of the ground to receive the seed.

1. The ground shall be hand or machine raked so as to remove all debris, clods, rocks, and other material larger than 1 inch from the surface. Such debris, clods, rocks, and other material so removed shall be disposed of off the immediate property in a legal manner.

2. Seed bed preparation shall not commence until the moisture conditions make the ground area and soil friable.

3. If there has been a time lapse following the placement of the topsoil to allow it to become settled and compacted on the surface, the area to be planted with seed shall be thoroughly worked to a depth of 3 inches so as to provide a surface of such condition that it will allow application of the seed in compliance with these Specifications.

4. Seed beds should be permitted to settle or should be firmed by rolling before seedings are made.

B. Sowing Seed:

1. Immediately prior to the application of the seed, the soil shall be loose to a depth of at least l inch and free from all material as specified. If soil is too loose or dry for good handling, it should be moistened and rolled lightly.

2. Non-irrigated areas shall be seeded between March 15 and April 15 or between September 15 and October 7.

3. Seed shall be sown at the rates previously listed for seed types. Exercise great care so that a uniform distribution of seed is obtained. Seeding shall be done on a still day.

4. All native seed shall be placed by hydraulic methods.

5. Seed and mulch shall be applied in a single operation. A biodegradable coloring agent shall be added to the seed slurry as a visual aid during the seeding process.

6. The application of the seed slurry shall be made with the equipment having a built-in agitation system and operating capacity sufficient to agitate, suspend and homogeneously mix a slurry containing water, seed, and mulch. The slurry shall be sprayed over the soil in a uniform coat. Apply fertilizer prior to or with seeding application at the rate of 4 lbs. per 1000 square feet or as recommended by an analysis of the topsoil/seed bed material.

7. Hydromulch shall be applied in a single application with seed and fertilizer. If the Engineer so authorizes in writing, hydromulch may follow seeding, but shall be applied as soon as practical, with consideration for minimal soil erosion through washing. All seeded areas shall be mulched before work is terminated on any day.

C. Supplemental Mulching:

1. Mulch all hydroseeded areas. Topsoil or seed which washes out for reasons attributable to the Contractor's activities or failure to take proper precautions, shall be replaced at the Contractor's expense.

2. All structures shall be protected from hydraulic application of mulch material. Any material deposited on pavements, or structures shall be removed by the Contractor, to the satisfaction of the Owners' Representative, at no cost to the Owner.

3. Mulch shall not be applied in the presence of free surface water, but may be applied on damp ground.

4. Mulch shall be mixed with water at a rate of one pound mulch (dry weight) to two gallons of machine water capacity.

5. Mulch shall be applied uniformly as per manufacturer's recommendations at a minimum rate of 2000 pounds per acre.

D. Tackifier: Mulch tackifiers shall be mixed with water at a rate specified by the manufacturer and shall be applied at a minimum rate of 40 pounds per acre.

3.8 Protection

A. Protect all seeded areas by erecting temporary fences, barriers, signs, etc. as necessary to prevent all traffic. Barriers shall remain in place for at least six (6) weeks unless other arrangements are made with the Engineer.

B. Provide adequate measures to protect workers and passers-by the site. Execute all work in an orderly and careful manner with due consideration for any and all surrounding areas, plantings, or structures which are to remain. Protect all adjacent property and improvements from work damage, and replace any portions damaged. For the purposes of this paragraph, the term damage shall include overspray of hydromulch onto plantings already in place, pavements, walks, or the exterior surfaces of buildings and structures.

C. Any structures or facilities damaged due to Work of this Section shall be restored equal or better to their original condition at Contractor's expense and to the satisfaction of the Engineer at no additional cost to the Owner.

3.9 Maintenance

A. General: Maintain all native grass areas until final completion of the job but in no case less than 8 weeks.

B. Duration: Maintenance of the seeded grass shall commence after preliminary observation and approval of the seed bed by the Engineer, and continue for a period of 60 calendar days minimum after written Notice of Substantial Completion of the Project and until Final Acceptance, whichever is later.

C. Establishment: If grass is not established before the dormant period, maintain for a period of 60 calendar days minimum after the dormant period and until Final Acceptance. The dormant period is November 15th to March 1st.

D. Watering: If seeding was performed in an unirrigated area, provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep grass uniformly moist to a depth of 4 inches.

3.10 Satisfactory Grass

A. Grass installations shall meet the following criteria as determined by the Engineer:

1. Satisfactory Grass: At end of maintenance period, a healthy, uniform, dense stand of grass has been established, free of weeds and surface irregularities, humps and depressions, with coverage exceeding 95 percent over any 10 sq. ft. and bare spots not exceeding 2 by 2 inches.

B. Areas of work which do not meet the criteria for Satisfactory Grass shall be replaced using the specified materials to re-establish grass. Maintenance shall continue until grasses are satisfactory.

3.11 Cleanup and Protection

A. Promptly remove soil and debris, created by lawn work, from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from foot and vehicular traffic and to protect against trespassing and damage. Maintain fencing and barricades throughout initial maintenance period and remove after lawn is established.

C. Remove nondegradable erosion-control measures after grass establishment period.

3.12 Replacement

A. Any area that fails to produce a satisfactory stand of grass within two growing seasons shall be reseeded by the Contractor at no additional expense to the Owner. Stand adequacy shall be judged by the Owners' Representative, and his

opinion shall be final. As a basis for judgment, after two growing seasons, any bare area more than 2 inches square will be considered inadequate.

B. Replacements required because of vandalism or other causes beyond the control of the Contractor are not part of the Contract. The contractor shall be responsible for identifying and documenting vandalism and alerting the Engineer.

C. Replacement: In the event of rejection of the seed, immediately make all replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.13 Extension of Maintenance Period

A. Continue the maintenance period at no additional cost to the Owner until all previously noted deficiencies have been corrected, at which time the final inspection shall be made.

END OF SECTION

SECTION 02930

EXTERIOR PLANTS

PART 1 GENERAL

1.1 Summary

A. Section Includes:

1. Trees.
2. Shrubs.
3. Ground Cover.
4. Plants.
5. Herbicide.
6. Planting Fertilizers.
7. Erosion Control Matting.
8. Mulches.
9. Tree Stabilization.
10. Planting Accessories.

B. Related Sections:

1. Division 01 Section “Existing Tree Protection” for protection of existing trees and plantings and root pruning of existing trees.

2. Division 02 Section “Earthwork” for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.

3. Division 2 Section "Site Preparation" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.

4. Division 2 Section “Hydromulch Seeding" for lawn planting.

1.2 References

A. Standards: Comply with botanical names, sizes, and conditions provided in:

1. Botanical Names: American Joint Committee on Horticultural Nomenclature, "Standardized Plant Names."

2. Sizes and Conditions: ANSI Z60.1 "American Standards for Nursery Stock", (latest edition).

3. Perennials: "Perennial Plant Association Standards."

4. Native Species: Hitchcock, C.L. and A. Cronquist, "Flora of the Pacific Northwest," 1973.

1.3 Quality Assurance

A. Contractor: Provide one person who shall: Be present at all times during execution of work in this section; be familiar with the materials and best methods for installation; direct work performed under this section.

B. Government Inspection: All plants and planting material shall meet or exceed the specifications of Federal, State, and County laws requiring inspection for plant disease and control.

C. Secure plant material and maintain in a climate similar to that of the project site for a minimum period of one year.

D. All plant material to be grown from cuttings or seed. Collected plants are not acceptable.

1.4 Submittals

A. Within 30 days after Contract award, submit:

1. A list of local/regional suppliers for each plant species to be installed. List to include plant quantities, sizes and root conditions. Certify in writing, confirmed orders for plants by submitting a Bill of Sale for each plant to be installed. Each plant species shall be supplied by one grower only unless otherwise approved by Engineer.

a. Requests for substitutions of plants not available in size, quantity or type specified must be made within 30 days after Contract award. Submit written evidence that a specified plant cannot be obtained and has been unobtainable since Contract award.

2. Plant Material Inspection Certificates for all plant material shipped from out of state.

3. 1/2 cubic foot sample of bark mulch for approval prior to delivery.

4. Product Data: For the following:

a. Mulch.
b. Anti-desiccant.
c. Post-emergent herbicide.
d. Fertilizer tablets.
e. Erosion control matting.

f. Tree stabilization products.
g. Browsing protectors.
h. Tree wrap.
i. Mycorrhizal inoculum.

5. Submit copy of herbicide applicator's Commercial Applicator's License to Engineer before application of herbicides (includes pesticides). Submit a copy of the application record to the Engineer immediately after each herbicide or pesticide application.

B. Shrub and Tree Samples: Typical samples, three each of all varieties and sizes (5 gallon and under for shrubs, 15 gallon and under for trees) of all plant materials shall be submitted for inspection approval at the site a minimum of fifteen (15) days prior to planting operations. Approved samples shall remain on site and shall be maintained by the Contractor as standards of comparison for plant materials to be furnished. Approved samples shall be incorporated into the work.

C. Upon completion of the Work, submit:

1. Written notification to Engineer requesting review for Substantial Completion.

2. Written notification to Engineer of Punch List Completion.

D. With application for final payment, submit:

1. Duplicate copies of delivery invoices, labels, or other acceptable proof of quantities of materials used.

2. Copies of delivery invoices, labels, or other proof of quantities of plant materials and fertilizers.

1.5 Site Observation

A. Site observations herein specified shall be made by the Engineer. The Contractor shall provide a minimum of three (3) days notice before Observation is required.

1. Pre-Construction Meeting: Explain Owner Representative’s role to Contractor, review construction sequence.

2. Upon the completion of grading prior to planting.

3. When trees and shrubs are spotted in place for planting, but before planting holes are excavated.

4. Verification of finish grades.

5. Pre-final observation after planting and all other indicated or specified work has been completed—Substantial Completion--acceptance and written approval shall establish beginning of the Maintenance Period.

6. Final Observation—Final Acceptance—at the completion of the ninety (90) day Maintenance Period. Successful completion of this observation shall establish the beginning date for the one (1) year guarantee of all trees.

B. Construction Observation visits shall be made in proper sequence with the installation of work. No sites visits shall occur until all soil submittals have been made and approved. The Landscape Contractor shall be responsible for reimbursement of time and travel expenses at current billing rates, incurred by the Architect due to out of sequence site visits.

C. Contractor shall be on site at the time of each observation. Contractor shall speak English.

D. No site visits shall occur until all items in previous Observation Reports have been completed or remedied unless the Owner has waived such compliance in writing.

E. Upon completion of the Final Observation and the Work of this Section, the Contractor will be notified in writing: (1) whether the work is acceptable; and (2) of any requirements or corrective measures necessary for completion and acceptance in the form of a Punch List.

F. Failure to execute completion of the Punch List requirements shall make the Landscape Contractor responsible for reimbursement of time and travel expenses at current billing rates incurred by the Architect.

1.6 Quality Control

A. Inspection: Plants shall be subject to inspection by the Engineer at the job site upon delivery to the site. Plants not conforming to specifications shall be rejected and removed immediately from the site.

B. The presence of noxious weeds in plant balls shall be cause for rejection of any or all plants from that source.

1.7 Delivery

A. Deliver packaged materials to site in original unopened containers bearing manufacturer's guarantee chemical analysis, name, trade name, and trademark.

B. Remove unacceptable plant material immediately from project site.

C. Plant Materials:

1. Deliver trees and shrubs after preparations for planting have been completed, and plant immediately.

2. Do not prune prior to delivery unless otherwise approved by Engineer.

3. Do not bend or bind-tie trees or shrubs in such a manner as to damage bark, break branches, or destroy natural shape.

4. Provide protective covering during delivery.

5. Protect plants during delivery to prevent damage to root ball or desiccation of leaves.

6. Apply anti-desiccant using a pump sprayer to provide adequate film over trunks, branches, stems, twigs and foliage of plants.

7. If deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving, and sprayed again 2 weeks after planting.

8. Label one of each tree and shrub species with securely attached waterproof tag bearing botanical name and supplier's name.

1.8 Storage

A. Contractors shall schedule and conduct planting operations to minimize storage of plant materials on the project site. The location and conditions of storage shall be reviewed for approval by the Contractor, Owner, and Engineer.

B. Plants that cannot be planted within one day after arrival shall be "heeled-in" in accordance with accepted horticultural practices and the following requirements:

1. Protect root ball of balled and burlapped plants with moist earth, sawdust or other acceptable material.

2. Protect plant at all times from injury, extreme weather conditions, and keep moist.

3. Store plants in shade until planted.

4. Store plants in upright position and allow sufficient ventilation.

C. All plants that are to be stored longer than one month shall be planted in nursery rows and maintained at Contractor's expense.

1.9 Handling

A. Do not drop plants.

B. Do not pick up container or balled plants by stems, trunk, or foliage. Handle balled & burlapped plants by the ball of earth.

1.10 Notifications

A. Notify Engineer a minimum of 48 hours in advance of plant material delivery so that plants may be inspected upon site delivery. Unapproved materials to be immediately removed from job site.

B. Notify Engineer a minimum of one week in advance for request of Substantial Completion and Final Acceptance inspections.

1.11 Site Conditions

A. Existing Improvements to Remain: Locate underground utilities prior to start of work.

B. Protect existing improvements from damage, soiling or discoloration. Repair or replace damaged, soiled or discolored improvements as directed by Engineer.

C. Planting Conditions: Planting not permitted during the following conditions, unless otherwise approved:

1. Cold weather: less than 32 degrees Fahrenheit.
2. Hot weather: greater than 90 degrees Fahrenheit.
3. Wet weather: saturated soil.
4. Windy weather: wind velocity greater than 20 m.p.h.

1.12 Warranty

A. Warrant all plant material to be true to botanical name and specified size.

B. After receiving notice of Substantial Completion, maintain all plant material in a vigorous condition for 90 days.

C. Immediately replace plant material which is dead, not surviving or in poor condition in accordance with these specifications during current or if necessary, next planting season and at no cost to the Owner for a period of one year from the date of Substantial Completion. Contractor shall provide, at his

expense, a timely written diagnosis of plant health by a certified Arborist, should a dispute arise concerning plant vitality or viability. Arborist's report shall indicate reason for lack of vigor, potential remedies, if any, and estimated time required to regain vigor and specified size.

D. Plants used for replacement shall be the same variety as originally specified. Replacement plant size shall match the physical size of the adjacent, healthy plants of the same species at the time of replacement. Replacement plants shall be furnished, planted and fertilized as originally specified.

E. Contractor shall repair at no additional cost to the Owner, all damage to vegetation, site improvements and property caused by replacement of plant materials during the Maintenance Period.

1.13 Acceptance

A. Substantial Completion:

1. Notify the Engineer in writing of the completion of planting and ancillary landscape work.

2. Within 10 days after notification of completion of work, the Engineer will inspect the work and prepare a Notice of Substantial Completion, along with a Punch List identifying items that require completion or correction.

3. Notice of Substantial Completion constitutes the commencement of the Maintenance Period.

B. Final Acceptance:

1. Final inspection of all planting will be made by the Owner, Engineer and the Contractor. Prior to executing a final inspection, the Contractor must furnish the Engineer with written documentation identifying how each Punch List item has been corrected. If such written documentation is not provided to the Engineer, all requirements of the Maintenance Period shall remain in force indefinitely until such time as the written documentation is received. Any extension of the Maintenance Period due to the failure of the Contractor providing written documentation of Punch List completion will be considered incidental to the Work and shall be performed by the Contractor at no additional cost to the Owner.

2. Before Final Acceptance is granted the following must be completed by the Contractor and receive approval from the Engineer:

a. Written documentation identifying how each item on the Punch List has been corrected.

b. Replacement planting and correction of all items identified on the Punch List prior to expiration of the specified Maintenance Period.

c. The project site must meet all conditions stipulated within the "Maintenance" and "Clean Up and Protection" sections of the specifications.

3. If Final Acceptance is not granted at the end of the specified Maintenance Period, the Contractor shall continue maintaining plantings until Final Acceptance is granted, at no additional cost to the Owner.

C. Necessary Observations Beyond Final Acceptance:

1. If any of the items identified on the Notice of Substantial Completion and Punch List have not been fully corrected or repaired to the complete satisfaction of the Engineer, the Contractor must schedule a field observation to substantiate claim of correction. The Contractor shall bear financial responsibility to reimburse the Owner for all time and travel costs incurred by the Engineer to confirm Punch List compliance.

PART 2 - PRODUCTS

2.1 Plant Materials

A. Provide plant materials as scheduled on Drawings.

B. Quantities indicated are for Contractor's convenience only. Contractor to verify and provide number of plants required to complete work graphically shown on Drawings.

C. Sizes and grade quality are maximums as listed. Larger sizes are not acceptable.

D. Plants shall be vigorous, well-formed and shaped, true to species and type, and free from disease, insects, and defects such as knots, girdled roots, poor branch attachment, sun-scald, windburn, injuries, abrasion, significant trunk scars, evidence of poor pruning, or disfigurement.

E. Plants shall be full foliaged when in-leaf.

F. Christmas tree stock shall not be used for conifer, evergreen material.

G. Conform to ANSI Z60.1, with additions and exceptions noted:

1. Groundcover Plants: Well-established root systems, and grown in flats or removable containers.

2. Containerized Plants: Grown in container in which delivered for at least 3 months, but not root-bound.

3. Greenhouse Grown Plants: Acclimated outdoors for 360 days prior to delivery.

4. Bare-root Stock: Well-branched, fibrous root system.

5. Balled and Burlapped Plants and Containerized Trees: All evergreen trees and deciduous trees over 1-1/2 inch caliper to be balled and burlapped with hemp burlap and twine only or grown in container in which delivered for 9 months minimum. Soil balls to be a minimum of 10 inches per caliper inch of tree.

6. Trees: Straight-trunked not varying from plumb more than 6 inches over 6 feet; well-branched, with no cross branches, dead or broken leaders, or broken major branches, no fresh cuts over 1 inch diameter, and not "topped" or sheared.

7. Grafted Trees: Base grafted or budded only.

2.2 Herbicides

A. Post-Emergent Herbicides: EPA registered and approved, of type recommended by manufacturer for selective herbicide application. “Round-Up,” or approved equal.

2.3 Pre-plant Fertilizer

A. (1-10-10) shall be a combination of natural organic and inorganic granular fertilizers, free-flowing, and shall contain the following minimum available percentage by weight of plant food:

Nitrogen	1.0% minimum
Phosphoric Acid	10.0% minimum
Potash	10.0% minimum

2.4 Post-plant Fertilizer

A. (7-9-4) shall be a long-lasting, organic and controlled release plastic-coated, uniform in composition, free-flowing and shall contain the following minimum available percentages by weight of plant food.

Nitrogen	7.0% minimum
Phosphoric Acid	9.0% minimum
Potash	4.0% minimum

2.5 Mulch

A. Provide standard, commercially produced, medium-course, dark brown, bark mulch. Bark shall be ground Fir or Hemlock bark of uniform color, free from weeds, seed, sawdust, and splinters and shall not contain resin, tannin, or other compounds detrimental to plant life. All material shall pass a 1-inch mesh screen.

2.6 Anti-desiccant

A. Emulsion type, film-forming agent designed to permit plant transpiration but retard excessive loss of moisture from plants. "Wilt-Pruf" or equal.

2.7 Planting Soil Mixes

A. Refer to Division 32 Section “Earthwork”.

B. Erosion Control Blanket shall be 100 percent coir twines with no seams. Matting shall be sisal jute mesh of uniform open weave, single jute yard, chemically treated to be fire-retardant. The blanket shall be Ludlow ‘Soil Saver’; Belton Industries; ‘Geojute’ or equal with the following minimum average roll properties:

1. Thickness 0.35 inches (ASTM D1777).
2. Average Tensile Strength 1450 lbs/ft (ASTM D4595).
3. Weight 14.7 oz/sy (ASTM D3776).
4. Open Area 60percent (measured).
5. Warp 78 per width, minimum. Weft 42 per linear yard, minimum.
6. Roll Width 6.5 and 9.8 feet (measured).
7. Roll Length 165 feet minimum (measured).
8. Color natural earth tone.

C. Wooden Stakes: Untreated Douglas fir 3/4 x 1/2 x 18 inch wood stakes.

D. Staples: Manufacturer’s recommended steel wire staples, 6 inches long, 11 gage galvanized steel.

2.8 Tree Staking and Guying

A. Deciduous Tree Tie: Plastic chain-type, minimum 1 inch wide by 1/8 inch thick.

B. Evergreen Tree Guy Wire: 12 gauge galvanized wire with 1/2 inch rubber hose collar, black color, to protect tree trunk.

C. Stakes: 2 inch x 2 inch x 8 feet Douglas fir for staking of deciduous trees; and 2 inch x 2 inch x 36 inch Douglas fir for guying of coniferous trees.

D. Provide miscellaneous hardware, wire, and accessories as shown on the Drawings.

E. PVC Flags: 1/2 inch or 3/4 inch diameter x 36 inches long PVC pipe.

2.9 Browsing Protectors

A. Provide 4 inch x 24 inch Photo-degradable Rigid Seedling Protection Tubes (Product Number ADC 1085). Available from Terra Tech in Eugene, OR (800) 321-1037.

B. Provide minimum 8-10 mm diameter, 3 foot length Bamboo Stakes (3 per Tube).

2.10 Tree Wrap

A. Corrugated or crepe paper, designed specifically to resist insect infestation and sun scald.

2.11 Mycorrhizal Innoculum

A. Available Products:

1. 'MycoApply All Purpose Granular' granular mycorrhizal inoculum. Available from: Mycorrhizal Applications, Inc., Grants Pass, OR (541) 476-3985.

2. 'PHC Plant Saver' blend of ecto and endomycorrhizal fungal spores, beneficial rhizospere bacteria, 4-7-4 fertilizer, organic amendments, and micronutrients. Available from Plant Health Care, Inc. (800) 421-9051.

3. Or equal.

2.12 Drainage Rock Backfill

A. 1-1/2 to 1/2 inches round washed river rock; no fines for non-percolating soil.

2.13 Filter Fabric

A. Non-woven filter fabric to cover drain rock: Mirafi 140N as available from TenCate, (360) 699-1426; Propex 451 as available from A.C.F. West Inc., (503) 771-5115; or equal.

PART 3 - EXECUTION

3.1 Preparation

A. Verify finish grades are properly achieved and soil preparation has been completed in accordance with the specifications; start of Work denotes acceptance by the Contractor and Contractor assumes responsibility for final results.

3.2 Soil Preparation

A. As specified in Division 2 Section “Earthwork”.

3.3 Herbicide Application

A. Spray herbicide as required to eradicate noxious weed growth.

1. Apply herbicide over all areas of weed or grass growth within landscaped area to eradicate weed growth. Apply in single application at manufacturer’s maximum recommended rate, as follows:

a. Apply after soil preparation has been completed and approved by Engineer.

b. Do not till pre-emergent herbicide into soil.

c. Observe manufacturer’s recommended period prior to working and planting in treated areas.

3.4 Erosion Control Matting

A. Provide erosion control blanket on slopes of gradient 3 horizontal to 1 vertical and greater. Install blanket after soil preparation and prior to planting.

B. Install erosion control matting after preparing soil and finish grading. Matting shall lie loosely in full contact with the soil without any tension.

C. Install from top of slope, working downward, and as recommended by material manufacturer for site conditions.

D. Fasten as recommended by material manufacturer if more stringent than these specifications. Provide temporary wood stakes as required. Remove wood stakes after planting and blanket has been securely stapled to the slope.

E. Secure the blanket with 6 inch minimum long staples on a 4 foot square grid. Tops, bottoms, and joints of matting shall have staples driven in at 12-inch centers.

F. Top of each length of erosion control matting shall be anchored in a 6 inch deep trench and shall terminate at the slope bottom with a 6 inch fold turned under. Adjoining lengths of matting shall have 6 inch minimum overlap.

G. Cut "X" slits into matting to plant trees and shrubs. Fold matting back around plants and staple to hold in place.

3.5 Layout

A. Mark locations of lines between the planting areas and the lawn areas on the finish with paint, chalk or equal material for approval by the Engineer. The method of marking shall be approved by the Engineer.

B. Mark locations of trees and shrubs for approval by the Engineer prior to digging. The method of marking shall be approved by the Engineer. After approval of layout, field place trees and shrubs in locations shown on Drawings. Engineer may request rotation or slight movement of tree to give a better appearance with respect to adjacent plants and structures. Placement must meet approval of Engineer prior to excavating planting pits.

3.6 Excavation for Trees and Shrubs

A. Excavate planting holes, with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation.

B. For trees and shrubs, make excavations at least 2 times wider than root spread; equal to the rootball height directly beneath the rootball; and 1-1/2 times deeper than rootball height around the perimeter of the planting pit, as indicated in the Drawings.

C. If non-percolating soils are encountered, fill excavations for trees and shrubs with water and allow to percolate out before planting. If plant holes do not drain: Auger drill holes 36 inches deep by 8 inches wide and fill with drainage backfill. Cover top with filter fabric. Notify Engineer to observe prior to planting.

D. If conditions detrimental to plant growth are encountered, such as rubble fill, or obstructions, notify Engineer and resolve before planting.

E. Scarify bottom and sides of hole with shovel to eliminate "glazed" surfaces.

F. Set plants on native soil where possible.

3.7 Placing

A. Set top of root ball slightly higher than finish grade; deep planting not permitted. If hole for trees is too deep, fill hole with native soil only where applicable or prepared soil to correct levels.

B. Set plants plumb and faced for best appearance.

C. Remove wire baskets, burlap, fasteners from rootball completely if rootball will not be damaged. If damage is suspected, notify Engineer for concurrence and remove tops and sides of baskets minimum. Use bolt cutters on wire if necessary to remove wire baskets. Bending back not acceptable. Remove all burlap and twine from planting pit.

D. Remove metal cans or plastic containers completely from rootball.

E. Neatly cut off broken, girdling, or frayed roots and any root growth growing in a circular manner conforming to its container.

3.8 Backfilling - General

A. Before mixing, clean topsoil of extraneous materials and other materials harmful or toxic to plant growth.

B. Prepare planting backfill soil mix prior to backfilling. Stockpile on site.

C. Planting backfill soil mix shall be as follows: 1/4 compost material, and 3/4 soil excavated from planting pit.

D. Backfill half of plant pit around rootball with backfill soil mix, carefully tamp soil around rootballs.

E. Add 3 ounces mycorrhizal inoculum per caliper-inch to backfill around trees. Add 3 tablespoons mycorrhizal inoculum per gallon planting size. Add 1 teaspoon mycorrhizal inoculum per ground cover plant.

F. Complete backfilling, firming to surface grade.

G. Form watering basin from site topsoil as shown on Drawings.

H. Thoroughly hand water each plant and entire bed immediately after planting. Adjust rootball and soil as required if settlement of soil occurs.

I. Remove plant tags and ribbons.

3.9 Planting Trees and Shrubs

A. Set roots or rootball on layer of compacted planting soil backfill mix or native suitable topsoil from planting pit, plumb and in center of pit or trench with top of rootball at 1 inch above elevation of adjacent finished grade.

B. Place additional planting soil backfill mix around base and sides of ball and eliminate voids and air pockets. When backfill is approximately 2/3 complete, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill. Cut burlap from top of rootball and roll back to sides of planting hole; form watering basin; stake and guy immediately after planting.

C. After planting, apply fertilizer at the following rates:
0-1 foot tall shrub = 0.4 oz.
1-2 foot tall shrub = 0.8 oz.
2-4 foot tall shrub or tree = 1.75 oz.
4-8 foot tall shrub or tree = 4 oz.
8+ feet = 4 oz. plus proportional amount per foot.

3.10 Planting Groundcover

A. Space plants as shown or scheduled on Drawings. Dig holes 3 times the width and 1-1/2 times the depth of the rootball. Plant with planting soil backfill mix. Work soil around roots to eliminate air pockets. Water thoroughly after planting.

B. After planting, apply fertilizer at the rate of 50 pounds per 1,000 square-feet, or apply 1 slow-release fertilizer tablet per plant during backfill.

3.11 Root Control Barriers at New Plantings

A. Provide linear and surround root barrier applications at trees within 5 feet of paving, curbs, walls, utility ducts or other appurtenances.

1. For linear applications provide sufficient lengths of panels to equal mature width of tree canopy plus 2 feet, 10 feet minimum length. Provide on both sides of the tree trunk adjacent to curb and paving per manufacturer’s recommendations.

2. For surround applications provide a minimum of five 24-inch long panels where trees are planted on an individual basis. Shape connected panels to form an oval around the tree rootball.

B. Excavate planting hole as specified for tree planting.

C. Begin backfilling with soil mix and install tree as specified. Backfill up to depth equal to depth of root control barrier panel. Install interlocking root control panels around rootball, with minimum 8 inches clearance to rootball and with top 1/2 inch above finish grade.

D. Backfill around rootball with planting soil backfill mix as specified for tree planting. Backfill outside of root control barriers with 3/4 to 1-1/2-inch crushed gravel, no fines (not pea gravel), to full depth of panels and minimum 4 inch wide area.

3.12 Trunk Wrapping

A. Deciduous trees over 1-1/2 inch caliper when within five feet of pavement shall be wrapped promptly after planting to prevent sun scald, wrapping as approved by American Association of Nurserymen. Wrap spirally from ground line to the height of the first branch. Wrap in neat and snug manner and secure with tape similarly colored to tree wrap at bottom, top and in the middle. Wrap before staking or guying.

3.13 Staking

A. Deciduous Trees 1-inch caliper and larger: Provide 2 stakes per tree 180 degrees from each other in the direction of prevailing winds. Drive plumb outside of rootball as shown on Drawings. Place tree ties around tree trunk, approximately 4 feet from ground level, one from each side.

B. Coniferous Trees 4 feet tall and larger: Provide 3 guys evenly spaced around trunk of tree. Set guys at a 60 degree angle to the trunk at 2/3 the height of the tree. Drive 2 by 2 inch wood stakes perpendicular to angle of cable. Secure guys taunt at trees passing each guy wire through a collar and setting the collar at the tree trunk where contact is made. Secure a warning flag on each cable as shown on Drawings.

3.14 Mulch

A. Place mulch **3** inches deep in all planting beds. Rake smooth. Mulch shall be pulled away from crowns of shrubs, perennials and groundcover plants. Mulch shall be flush with adjacent curbs and paving. Taper mulch thickness from full **3**-inches depth to **2**-inch depth over a 12-inch horizontal run at paving edges so mulch will be flush with adjacent curbs and paving.

B. Tree Plantings in Lawns:

1. Deciduous Trees: Cut away and remove lawn to establish a 4-foot radius circle from center of tree. Cut clean edge and fill with mulch.

2. Coniferous Trees: Cut away and remove lawn to establish a circular ring 2 feet beyond the outside dimension of drip line of tree. Ring to be centered on tree minimum 4-foot radius. Cut clean edge and fill with mulch.

3. For trees in pavement cut outs, provide minimum 3 inches depth of mulch.

C. Ground Cover Plantings:

1. After fertilizing, mulch areas between groundcover plants; place minimum 2-inch thick specified mulch.

3.15 Pruning

A. Prune plant material if necessary and as directed by Engineer to balance root and top growth. Prune, thin, and shape trees and shrubs in accordance with standard horticultural practices.

B. Prune all dead and broken limbs.

C. Prune without distorting basic form of the plant and only to the extent necessary for each plant except where directed by Engineer. Do not prune plants into boxes or balls.

3.16 Maintenance

A. Begin plant maintenance immediately after planting and continue until the end of the Maintenance Period or through any extensions of the Maintenance Period due to failure to supply written documentation of Punch List completion.

B. Store maintenance materials and equipment where directed by Engineer. Keep pavements clean and work areas in an orderly condition.

C. Maintain plants for an additional 90 days minimum after written notice of Substantial Completion of the Project and until Final Acceptance (which ever is later). If plants are not installed before the dormant period, November 15th to March 1st, maintain for a period of 90 days after the dormant period or until Final Acceptance, whichever is later.

1. Inspect plants at least once a week and perform maintenance promptly.

2. Maintain trees, shrubs and ground covers by watering, pruning, spraying, cultivating, and weeding as required for healthy growth.

3. Water when soil moisture is below optimum level for best plant growth.

4. Remove and replace impaired or dead plants promptly during specified planting season.

5. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required.

6. Eradicate all weeds, grass, and other undesired vegetation growth from planting areas. Remove dead weeds and dispose of legally off-site. Remove all perennial weeds completely, including all underground parts.

7. Restore all soil settlement to original grade.

D. Fertilizing and Liming: Perform as recommended in the soil fertility analysis reports and as necessary to maintain cover crop in a healthy growing condition.

1. Fertilize trees, shrubs and ground cover once at the end of the Maintenance Period. Work the fertilizer thoroughly into the top 2 inches of soil.

2. In March, within the first growing season, fertilize all planting areas with 1 application of each of the maintenance fertilizers, at the rate of 7 pounds per 1,000 square feet of soil surface.

E. Hand-water plant material as indicated on Drawings for a period of 90 days.

3.17 Clean-up and Protection

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Sweep and wash paved surfaces to remove soil and soil stains.

C. Clean all mud and debris from catch basins, which is caused by Work of this Section.

D. Remove plant containers, trimmings, clippings, and all extraneous debris unearthed or resulting from any operations specified herein, from Project Site and dispose in a lawful manner.

E. Protect landscape work and materials from damage.

F. Maintain protection during installation and Maintenance Period.

G. Treat, repair or replace damaged Work as directed by Engineer, at no additional cost to the Owner.

END OF SECTION

Appendix C

TECHNICAL SPECIAL PROVISIONS FOR RESERVOIR SITE, PUMP STATION, AND OFF-SITE WATER MAIN REPLACEMENTS (SCHEDULES A, B, & C)

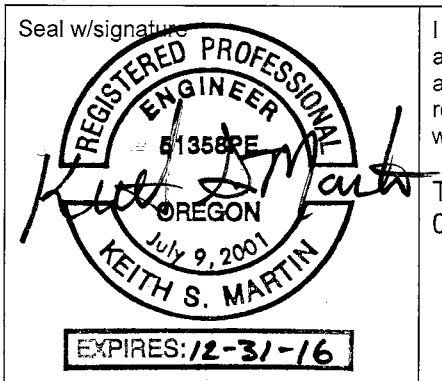
CITY OF WEST LINN, OREGON
PROJECT NUMBER: PW-14-06
BOLTON RESERVOIR REPLACEMENT

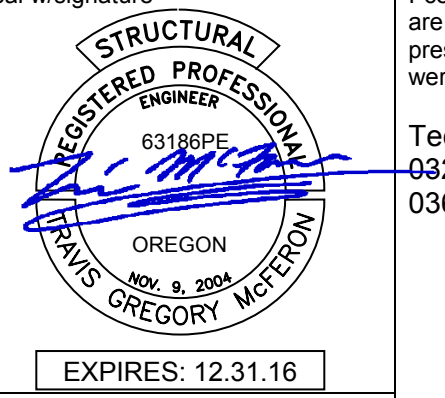
APPENDIX C

TECHNICAL SPECIAL PROVISIONS FOR RESERVOIR SITE, PUMP STATION, AND OFF-SITE WATER MAIN REPLACEMENTS (SCHEDULES A, B, & C)

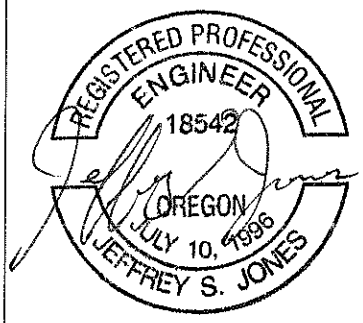
Seal w/signature	I declare the Technical Special Provisions Section(s) listed below are applicable to the design for the subject project for a new prestressed concrete reservoir and foundation, the reservoir accessories and appurtenances, piping and grading, and metal fabrications and protective coatings associated with the reservoir and applicable site work. Technical Special Provisions were prepared by me or under my supervision. Technical Special Provisions Sections 01300, 01550, 01650, 01652, 01655, 02010, 02050, 02060, 02100, 02140, 02200, 02205, 02221, 02222, 02230, 02505, 02510, 02620, 02641, 02642, 02644, 02664, 02700, 02800, 03400, 05500, 07240, 09800, 11268, 11900, 13100, 13207, 13989, 15000, 15100, 15101, 15102, 15105, 15107, 15108, 15111
REGISTERED PROFESSIONAL ENGINEER 65640 Michael L McKillip OREGON DEC. 29, 2009 MICHAEL L. McKILLIP RENEWS 12/31/16 Date Signed: 9/4/15	

CITY OF WEST LINN, OREGON
PROJECT NUMBER: PW-14-06
BOLTON RESERVOIR REPLACEMENT

Seal w/signature  EXPIRES: 12-31-16	I declare the Technical Special Provisions Section(s) listed below are applicable to the design for the subject project for an aggregate pier foundation system for a new prestressed concrete reservoir foundation improvements. Technical Special Provisions were prepared by me or under my supervision. Technical Special Provisions Sections 02255
Date Signed: 9-4-15	

Seal w/signature  EXPIRES: 12.31.16	I certify the Technical Special Provisions Section(s) listed below are applicable to the design for the subject project for a new prestressed concrete reservoir. Technical Special Provisions were prepared by me or under my supervision. Technical Special Provisions Sections 03210, 03230, 03251, 03255, 03300, 03301, 03302, 03600, 03740, 13206
Date Signed: September 3, 2015	

CITY OF WEST LINN, OREGON
PROJECT NUMBER: PW-14-06
BOLTON RESERVOIR REPLACEMENT

Seal w/signature	I declare the Technical Special Provisions Section(s) listed below are applicable to the design for the subject project for mechanical and building improvements to an existing pump station structure at the new prestressed concrete reservoir site. Technical Special Provisions were prepared by me or under my supervision. Technical Special Provisions Sections 01210, 06050, 06100, 06175, 07200, 07400, 07460, 07610, 07810, 07920, 10210, 11000, 11100, 11101, 15114, 15116, 16905
 RENEWS: 6-30-17	
Date Signed: 9-3-15	

Seal w/signature  RENEWAL DATE: 6/30/16	I certify the Technical Special Provisions Section(s) listed below are applicable to the design for the subject project for a new prestressed concrete reservoir and foundation, the reservoir accessories and appurtenances, piping and grading, and metal fabrications and protective coatings associated with the reservoir and applicable site work. Technical Special Provisions were prepared by me or under my supervision. Technical Special Provisions Sections 17000
Date Signed: September 2, 2015	

Seal w/signature  Gregg H. Scholz P.E. Sep 3 2015 3:52 PM	I certify the Technical Special Provisions Section(s) listed below are applicable to the design for the subject project for electrical improvements to an existing pump station and electrical improvements to accessories for new prestressed concrete reservoir. Technical Special Provisions were prepared by me or under my supervision. Technical Special Provisions Sections 16010, 16100, 16450, 16500, 16900
Date Signed: _____	

APPENDIX C – TECHNICAL SPECIAL PROVISIONS FOR RESERVOIR SITE, PUMP STATION, AND OFF-SITE WATER MAIN REPLACEMENTS (SCHEDULES A, B, & C)

TABLE OF CONTENTS

SECTION 01210

ALLOWANCES

PART 1 GENERAL

1.1 Description

A. Section includes:

1. Listing of Allowance items.

2. Related responsibilities of ENGINEER and CONTRACTOR, and procedures.

1.2 Allowance Amounts

A. Include the following amounts in the Contract Price:

1. Pumps: $73,192.00 for furnishing vertical turbine pump and motor, and manufacturer's services as identified in the quotation attached to this Specification. Price includes products and services in compliance with Specification Section 11101. CONTRACTOR is responsible for coordinating and/or providing any materials or services required by the Contract Documents that are not included in the quotation attached to this Section, including but not limited to the Variable Frequency Drive.

1.3 Costs Included and Excluded in Allowances

A. Costs included in Allowances for furnishing Products only:

1. Net cost of product

2. All factory testing and field services.

3. Applicable taxes.

B. Costs included in the lump sum contract price, but not included in Allowances:

1. Handling at Site, including uncrating and storage.

2. Protection from elements, theft and damage.

3. Labor for installation.

4. Other expenses required to complete installation.

5. Freight costs.

6. Overhead and profit.

7. Additional manufacturer on-site services beyond the provisions identified in the attached quotations, as required by the Contract Documents.

1.4 Duties of CONTRACTOR in Providing Products by Allowance

A. Establish any necessary contract(s) with manufacturer. OWNER is not responsible for provision of materials, services or execution of contract(s).

B. Schedule work with manufacturer.

C. Arrange for delivery and unloading.

D. Install products in accordance with Contract Documents.

1.5 Supplements

A. The supplements following "END OF SECTION" are part of this Specification:

1. Triangle Pump & Company pump quote with terms and conditions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

BID SHEET

Proposer Information	
Company Name:	Triangle Pump & Equipment, Inc.
Contact Name:	David W. Flack
Email:	david@trianglepump.com
Phone:	360-887-9530
Address:	7509 South 5th Street, Ridgefield, WA 98642
Resident Bidder as defined in ORS 279A.120:	Yes [x] No [ ]

Payment Item	Units	Quantity	Unit Price	Total Price
Furnish 100 HP Vertical Turbine Pump, Motor, and accessories as specified in the Technical Specifications and shown on drawings attached to this Request for Quotes	LS	1	$69,592.00	$ 69,592.00
Furnish all pump testing, field services and start-up services as specified in the Technical Specifications	LS	1	$3,600.00	$3,600.00

Note: Manufacturer must include all items included in procurement details and in accordance with attached specification and plans. Manufacturer must be able to deliver to the location specified at the cost provided in the bid.

The Proposer, by his/her signature below, hereby represents as follows:

a) That Proposer has not and shall not provide or offer to provide any appreciable pecuniary or material benefit to any officer or employee of City in violation of ORS Chapter 244;

b) That this proposal is made without connection with any person, firm or corporation making a proposal for the same material, and is in all respects, fair and without collusion or fraud.

c) The proposer agrees to accept as full payment for the services specified herein, the amount as shown in his/her proposal as the guaranteed maximum price.

d) Proposer shall use recyclable products to the maximum extent economically feasible in the performance of the contract work set forth in this document.

e) Proposer guarantees price as submitted for 60 days.

f) If Proposer is a non-resident bidder as defined in ORS 279A.120(1) and the contract price exceeds $10,000, Proposer shall promptly report to the Department of Revenue on forms to be provided by the Department, the total contract price, terms of payment, length of contract and such other information as the Department may require before the Proposer may receive final payment on the public contract.

g) Proposer declares that he/she has examined all related proposal documents, agrees to provide the goods or services as shown at the prices provided in their bid and shall comply with all requirements, specifications, and terms and conditions included with this Request for Quotes if awarded a contract under this solicitation.

Authorized Signature: David W. Flack	Date: 8-31-2015
Print Name: David W. Flack	
Title: President	

Weir Floway - Fresno Main Office

FLOWAY® PUMPS
Vertical Turbine Pumps

FLOWAY SCOPE OF SUPPLY

28 Aug 2015

Quotation number: 457473
Revision: 0

City of West Linn, OR.

Please Remit Purchase Orders To:

Triangle Pump & Equipment, Inc.
P.O. Box 2890
Battle Ground, WA 98604

Project: West Linn
Your reference:

We thank you for your above referenced inquiry, and are pleased to submit our quotation for your consideration.

The following is a firm price summary for this quotation. Please see item specific pages for more details.

Item number	Service	Size
Pump No. # 1	Bolton Pump Station	11JKM - 7 stage Product lube - Barrel Pump

COMMENTS: Weir Floway has reviewed the specifications for this project and our bid is in compliance with the following specs sections, except as noted :

Sections:
01300 - Submittals
11000 – Equipment, General
11100 – Pumps, General
11101 – Vertical Turbine Pump
16905 – Premium Efficiency Vertical Motors
Addendum # 1 Dated 8/18/15
Drawing M-B2
Drawing M-B3

As the specifications address many requirements beyond the scope of the pump manufacturer we have isolated and reviewed only the aforementioned sections. If there are requirements not cross referenced in our equipment sections, we will not be responsible for those omissions in the specifications and they are not part of our scope.

OUR QUOTE DOES NOT INCLUDE:

Oil & Grease
Gauges
Gauge Fitting
Valves
Controls
Anchor Bolts / Seismic Analysis for Anchorage
Pump Performance Testing
Vibration Isolators/Pads

Costs for Owner selected certified vibration testing agency not included. Triangle can provide vibration test data using our Ludeca VIBXPRT II complimentary as part of our startup service.

Can (Existing)
Sales tax
Installation and Field Testing
Start-Up
Export Boxing Or Crating For Long Term Storage

COMMENTS & CLARIFICATIONS

11000 – Equipment, General
2.1.C – Pump will be coating per the requirements listed in the VTP spec 11101. Section 09800 was not provided.
2.1.F – Vibration Isolators or pads are not applicable
2.1.A. - Sound attenuating hearing protectors, storage cabinets, or enclosures not included.
11100 – Equipment, General
2.5 – Factory testing not included in base scope. Listed as an adder per Addendum # 1

11101 – Vertical Turbine Pumps
1.5 - Floway is offering a 2 year warranty (24 months after start-up or 30 months after shipment, which ever occurs first)
2.2 – Bowl and Impeller Wear rings will be Alloy 954 & Alloy 952) min. Aluminum Bronze
2.6 – Pump Controls not in our scope.
3.1.A. - Triangle will not be continously present at jobsite to supervise assembly and installation but will be available immediately with some advance notice due to proximity to jobsite.

16905 – Premium Efficiency Vertical Motors

1. [Clarification] 1.3 – Motor includes Non-Witnessed Short Commercial Test, Complete Initial Test, Polarization Test and Surge Test. See Below for test description list all the procedures included and standards used on each test. Exception to ANSI and NEMA MG2. Surge test will only have a pass/fail report.
2. [Clarification] 2.2.B – Motor shall be designed and built in accordance to NEMA MG1 Standard. Exception to other standards.
3. [Clarification] 2.2.H – Sound level shall be determined per ANSI S12.51 & NEMA MG1 standard. Taking exception to IEEE85. Motor will meet 85 dBa at 1 meter sound pressure, not 5 feet.
4. [Exception] 2.2.Q – Motor conduit box shall be cast iron, not fabricated steel.
5. [Clarification] 2.3.A – Inverter Duty motors come standard with Thermostats (Normally Closed). Calibration by others

Motor Testing Description
Short Commercial Test (Routine Test) – Test per NEMA MG1-12.55, consist of no load current, locked rotor current (performed at reduced voltage, typically 25-50%), winding resistance, high potential, and bearing inspection. A test report is provided to the customer.
Complete Initial Test – Test per IEEE standard 112 method B, dynamometer test, this test consist of full-load heat run, percent slip, no-load current, locked rotor current, locked rotor torque, breakdown torque (calculated), efficiency and power factor at 100%, 75%, and 50% full load, insulation resistance per IEEE Standard 43, winding resistance, high potential and bearing inspection. A test report is provided to the customer.
Polarization Index Test – In accordance to IEEE Standard 43.

SHIPMENT AND FREIGHT TERMS: Shipment is quoted with freight term: Per the freight term listed in the Comments and Clarifications Section. Partial shipment allowed. Shipment & invoicing will occur upon shipment of equipment. Shipment schedules are based on factory loading at time of order. Should shipment be postponed due to project or site delays Weir

Floway will invoice and hold the shipment. Shipment delays exceeding 30 days from the completed date may be subject to reasonable storage charges.

LEADTIME: Submittal will be approximately 8 weeks after order receipt, contingent upon order acceptance within 10 business days of receipt. Orders will be accepted subject to buyer's credit approval and subject to Weir Floway, Inc.'s Terms and Conditions of Sale.
Shipment lead time will be approximately 19 weeks after written release to manufacture. Shipment lead times are an estimate at time of quotation and subject to change based on quote validity.

SCOPE OF SUPPLY: Please note any requirements not outlined in the referenced specification sections as noted on the cover page of this quotation will not be the responsibility of Weir Floway. Any separate specifications made reference to within the noted specifications, whether in part or whole, will not be considered in this quotation.

Weir Floway, Inc. Terms and Conditions of Sale per attached will apply to this quotation. If this is not acceptable, mutually agreeable terms and conditions may be negotiated at time of order placement.

SPECIFICATIONS: Written request. See above listing of specifications received.

VALIDITY: This offer is valid for 60 days from date issued. Quoted prices will be held firm thru shipment if order is released for manufacture within 60 days from order entry date. Otherwise, a price adjustment may be applied.

PRICE: Quoted prices will be held firm through shipment if order is released for manufacture within 60 days from order entry date, and approved for shipment within the leadtime quoted. Otherwise, a price adjustment may be applied. Price quoted is for all items purchased and shipped at one time. In the event of a partial order, we will review and adjust the freight price accordingly. Freight charges will be those in effect at time of shipment. Due to volatility in the commodities markets, Weir Floway reserves the right to add a material surcharge on pipe, plate, and other materials in line with the commodity indices. Cost surcharges must be agreed to prior to order acceptance.

PAYMENT TERMS: Orders & contracts are subject to approval by Weir-Floway and Triangle prior to acceptance. Standard terms for orders <= $150,000 are net thirty (30) days from date of invoice for both Weir-Floway and Triangle. For orders >=$150,000, progress payments will apply. Weir-Floway's standard progress payment schedule is attached for consideration.

PACKAGING: For domestic shipment via commercial carrier. Export boxing and documentation requirements are an option with price adder.

START-UP: Start-up/assistance not included. Quoted as a separate line item.

QUALITY STANDARDS: All our manufacturing locations are ISO 9001-2008 certified.

TERMS AND CONDITIONS: This quotation is based solely upon the terms and conditions set forth herein including attachments. They supersede and reject any conflicting terms and conditions of Purchaser. Any other terms and conditions that Purchaser may propose are subject to requotation.

We hope you find our quotation in line with your requirements. However, if you have any questions, please do not hesitate to contact us.

Sincerely,
Brandon Toms
Weir Floway - Fresno Main Office

FLOWAY® PUMPS
Vertical Turbine Pumps

Customer Price Sheet

Customer:	Triangle Pump & Equipment Co.	Date:	28 Aug 2015	
Project Name:	West Linn	Quote No.:	457473	Rev.: A
Item Number:	Pump No. # 1			
Service:	Bolton Pump Station			
Pump Type:	Barrel Pump			

Totals

Unit Price	- - - - -
Unit Freight	- - -
Quantity	1
Grand Total	- - - - -

Conditions

Condition Point:	900.0 USgpm@ 325.0 ft TDH
Pumpage:	Water - Potable
Specific Gravity	1.000 SG
Temperature	68.00 deg F
Pump Speed:	1770 rpm
Overall Pump Length:	17.68 ft

Pump

Qty	Description
1	*Units - 11JKM - 7 stage Product lube - Barrel Pump* OEM Variable speed operation Product lube 11JKM bowl assembly - 7 stage Cast iron bowls (ASTM A48 cl 30-epoxy lined Flanged bowls Bowl bolting - 304SS (ASTM F593 Gr CW1), Floway material code - 106 Wear rings - Bowl and Impeller Bowl/Impeller wear ring materials - aluminum-bronze/aluminum-bronze (Alloy 954/Alloy 952) min. 50 BHN difference Bismuth tin bronze bowl bearings (UNS C89835) Bronze impellers (ASTM B584 C90300) Finished Impellers Dynamic balanced impellers to ISO 1940 G6.3 Steel collets (ASTM A108-90a Gr 1215) Bowl shaft 1.6875" (Standard) 416SS bowl shaft (ASTM A582-88a Type 416) Suction bell Bismuth tin bronze suction bearings (UNS C89835) Stainless steel nameplate - bowl Bowls fully assembled Column 8" - (0- 20' and 0- 10' and 1- 5' and 1 - 5.04' Top) Column pipe ASTM A53 Gr. B rolled and welded steel Schedule 40 column pipe .322" wall thickness Threaded Bronze bearing retainer (ASTM B584 Alloy 844) Lineshaft 1.25" 416SS lineshaft (ASTM A582-88a Type 416) 416SS lineshaft coupling (ASTM A582-88a Type 416) Styrene Butadiene Rubber(SBR) line shaft bearings (Qty 1 per pump) Discharge head material - Steel (A36 plt, A105 flg, A53-Gr B pipe) 8x16.5x20 "VF" Discharge head 8" discharge 150# flange (Stl. std.) Mechanical seal

FLOWAY® PUMPS
Vertical Turbine Pumps

Customer Price Sheet

Customer:	Triangle Pump & Equipment Co.	Date:	28 Aug 2015	
Project Name:	West Linn	Quote No.:	457473	Rev.: A
Item Number:	Pump No. # 1			
Service:	Bolton Pump Station			
Pump Type:	Barrel Pump			

Pump

Qty	Description
	Cast iron seal housing
	Single balanced mechanical seal
	John Crane type 5610 mechanical seal
	Plan 13 Seal flush piping
	316SS tubing-Primary SFP
	Bismuth tin bronze seal housing bearing (UNS C89835)
	Type CPAT flanged adjustable spacer coupling
	Coupling guard for 16.5" discharge head
	Aluminum coupling guard
	Stainless steel nameplate - discharge head
	Individual selection of components/coatings
	Std Coating - Carboline 635 HAR primer (above-grade components top coated with Carboline 3359) - Disch. head - exterior only
	Fusion bonded epoxy, Scotchkote 134W - Disch. head - interior only
	Carboguard 891 epoxy coating - Column - interior and exterior
	Std Coating - Carboline 635 HAR primer Bowl exterior only
	Fusion bonded epoxy, Scotchkote 134W - Bowl, interior only
	Factory assembled (bowl, head, and column only) shipped assembled
	Domestic packaging
	Standard shipping mode

Testing

Qty	Description
1	
	Lateral and torsional rotordynamic analysis, stamped by Floway P.E. - 1 units
	Structural natural frequency analysis (head/motor only), stamped by Floway P.E. - 1 units

Spare Parts

Qty	Description
1	Spare parts
	Seal

FLOWAY® PUMPS
Vertical Turbine Pumps

Customer Price Sheet

Customer:	Triangle Pump & Equipment Co.	Date:	28 Aug 2015	
Project Name:	West Linn	Quote No.:	457473	Rev.: A
Item Number:	Pump No. # 1			
Service:	Bolton Pump Station			
Pump Type:	Barrel Pump			

Driver

Qty	Description
1	Driver type - Motor Nidec Electric Motor 100HP - 1800 RPM 3 Phase 60 Cycle 480v NEMA Vertical Solid Shaft High Thrust Weather Protected Type I Enclosure Random Wound 1.15 Service Factor on Sine Wave Power / 1.0 Service Factor on VFD Power Class “F” Insulation Insulife 2000 Insulation Treatment Premium Efficient Base Diameter: 16.5 Inches Non-Reverse Ratchet Inverter Duty Rating: Variable Torque ~ 10:1 Speed Range 90°C Rise @ 1.15 Service Factor (by Resistance Method on Sine Wave Power) NEMA Design B KVA Code Letter “G” Direct-On-Line Start/VFD Continuous Duty 85 dBa @ 1M Sound Pressure 650% Inrush Current Limit Load Inertia (lb-ft2): 1.32 60,000 Hours L-10 Bearing Life Counter Clockwise Rotation Facing Opposite Drive End

FLOWAY® PUMPS
Vertical Turbine Pumps

Customer Price Sheet

Customer:	Triangle Pump & Equipment Co.	Date:	28 Aug 2015	
Project Name:	West Linn	Quote No.:	457473	Rev.: A
Item Number:	Pump No. # 1			
Service:	Bolton Pump Station			
Pump Type:	Barrel Pump			

Driver

Qty	Description
	Shaft Ground Ring
	Insulated Bearing - Upper Bracket
	Special Balance
	Thermostats - Normally Closed, 1/Phase
	One Size Larger Than Nidec/US Motors Standard Conduit Box
	Q-1 Accessory Outlet Box
	Non-Witnessed Short Commercial Test
	Non-Witnessed Complete Initial Test
	Non-Witnessed Polarization Index Test
	Non-Witnessed Surge Tests Per 632179
	Lateral Data, Rotor Detail & Shaft Print
	Motor NOT to be shipped to Floway factory

Miscellaneous1

Qty	Description
1	90 Degree Turning Vane as per drawing M-B3. Special lagged Bell.
	891 Carboline ID and OD of Turning Vane

Analyses

Qty	Description
1	Lateral rotordynamic analysis report
	Structual natural frequency analysis report (head, motor)

Reports

Qty	Description
1	Hydro test report

Drawings

Qty	Description
1	Seal flush piping drawing

VendorDrawings

Qty	Description
1	Mechanical seal drawing

Pump Performance Datasheet

Customer	: Triangle Pump & Equipment Co.	Quote number	: 457473
Customer reference	:	Size	: 11JKM
Item number	: Pump No. # 1	Stages	: 7
Service	: Bolton Pump Station	Based on curve number	: 11JKM 1770 Rev. 0
Quantity	: 1	Date last saved	: 28 Aug 2015 4:59 PM

Operating Conditions

Flow, rated	: 900.0 USgpm
Differential head / pressure, rated (requested)	: 325.0 ft
Differential head / pressure, rated (actual)	: 329.4 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available, rated	: Ample
Frequency	: 60 Hz

Performance

Speed, rated	: 1770 rpm
Impeller diameter, rated	: 8.09 in
Impeller diameter, maximum	: 8.31 in
Impeller diameter, minimum	: 7.20 in
Efficiency (bowl / pump)	: 81.85 / 80.91 %
NPSH required / margin required	: 12.28 / 0.00 ft
nq (imp. eye flow) / S (imp. eye flow)	: 45 / 166 Metric units
MCSF	: 236.4 USgpm
Head, maximum, rated diameter	: 511.0 ft
Head rise to shutoff	: 56.36 %
Flow, best eff. point (BEP)	: 770.3 USgpm
Flow ratio (rated / BEP)	: 116.84 %
Diameter ratio (rated / max)	: 97.42 %
Head ratio (rated dia / max dia)	: 88.89 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Near miss

Liquid

Liquid type	: Water - Potable
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids concentration, by volume	: 0.00 %
Solids concentration, by weight	: 0.00 %
Temperature, max	: 68.00 deg F
Fluid density, rated / max	: 1.000 / 1.000 SG
Viscosity, rated	: 1.00 cP
Vapor pressure, rated	: 0.00 psi.a

Material

Material selected	: Cast Iron/Bronze

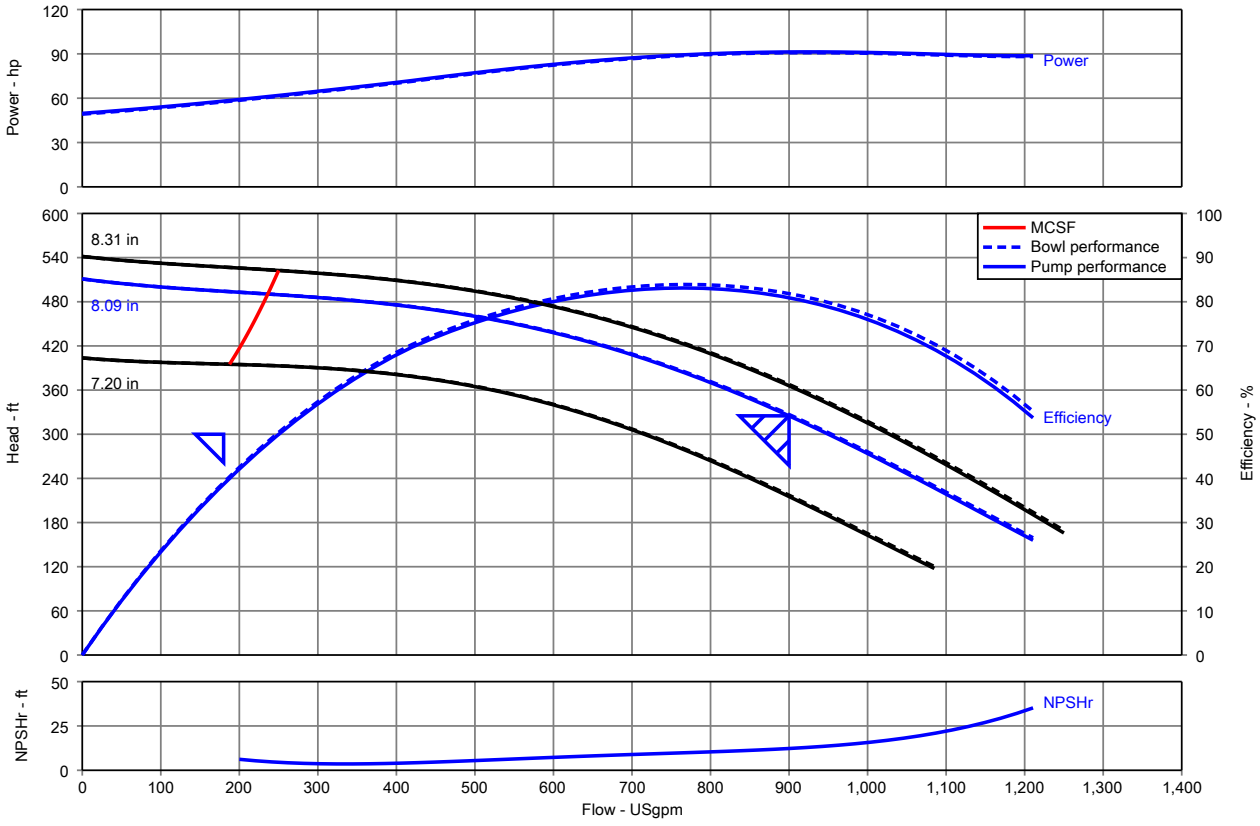
Pressure Data

Maximum working pressure	: See the Additional Data page
Component pressure limit	: See the Additional Data page
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: See the Additional Data page

Driver & Power Data

Driver sizing specification	: Max power + 5%
Margin over specification	: 0.00 %
Service factor	: 1.15
Power, hydraulic	: 74.28 hp
Power (bowl / pump)	: 90.75 / 91.29 hp
Power, maximum, rated diameter	: 91.34 hp
Minimum recommended motor rating	: 100 hp / 74.57 kW

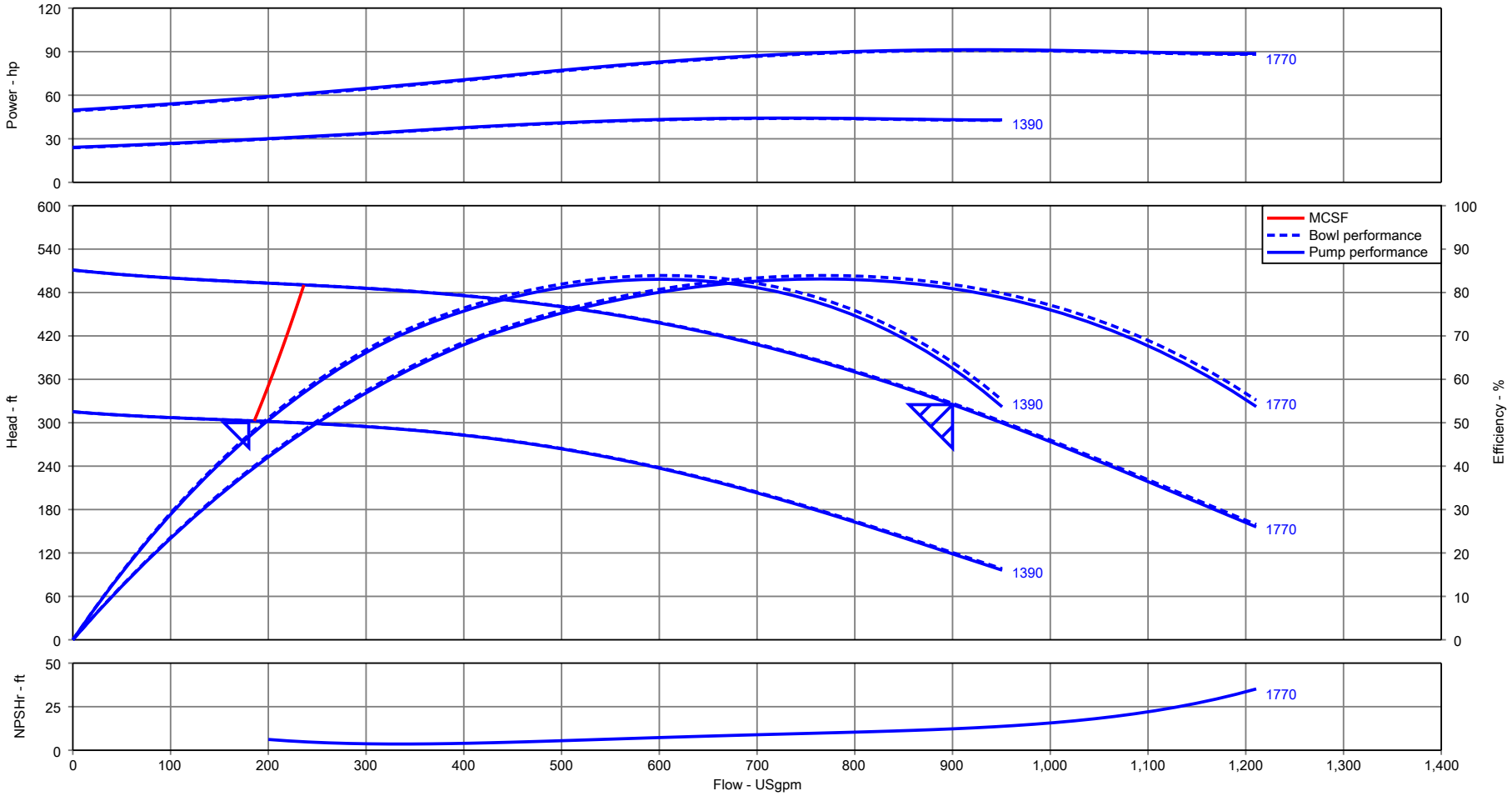
Pump and bowl (dashed) performance. Bowl adjusted for construction and viscosity.
Pump further adjusted for friction and power losses of lineshaft and thrust bearings. Pump is not adjusted for any static lift.
The duty point represents the pump performance head.



FLOWAY® PUMPS
Vertical Turbine Pumps

Multi-Speed Performance Curve

Pump and bowl (dashed) performance. Bowl adjusted for construction and viscosity.
Pump further adjusted for friction and power losses of lineshaft and thrust bearings. Pump is not adjusted for any static lift.
The duty point represents the pump performance head.



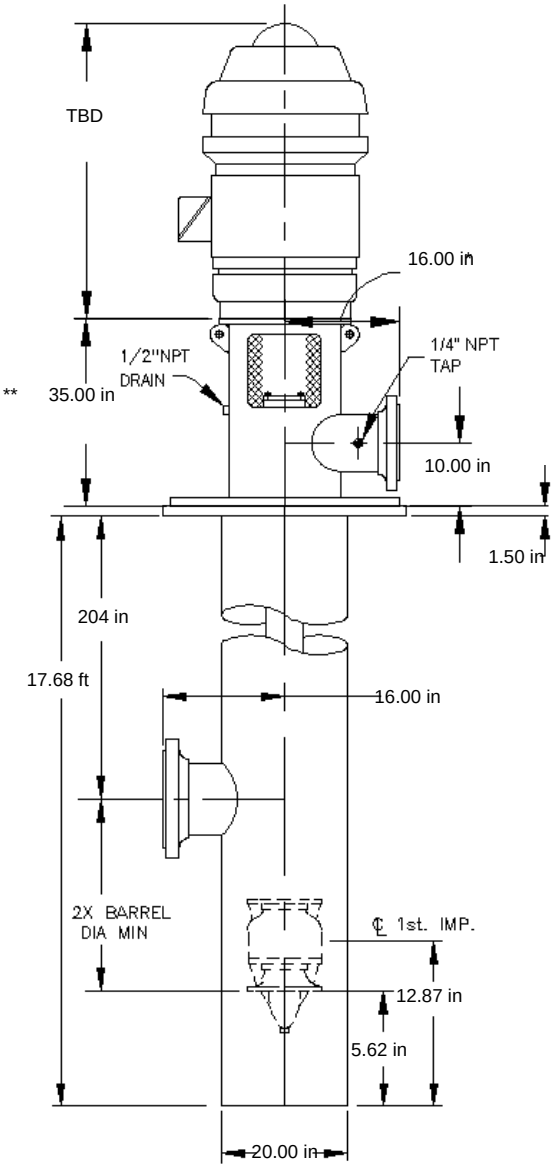
Customer	: Triangle Pump & Equipment Co.	Pump Type	: 11JKM	Quote number	: 457473
Address	: 14940 S. E. 82nd Drive PO Box 950, Clackamas, OR 97015	# of Stages	: 7	Customer PO #	:
Location	:	Quantity	: 1	CO #	:
Project	: West Linn	Flow	: 900.0 USgpm	Item #	: Pump No. # 1
Tag	:	Head	: 325.0 ft	JOL #	:
Bowl/Pump	:	Speed	: 1770 rpm	Serial #	:
Eff (bowl / pump)	: 81.85 / 80.91 %	Fluid Density	: 1.000 / 1.000 SG	Drawing #	:
Power (bowl / pump)	: 90.75 / 91.29 hp	Viscosity	: 1.00 cP	Drawn By	:
NPSH required	: 12.28 ft	Impeller Trim	: 8.09 in	Last Modified	: 28 Aug 2015 4:59 PM

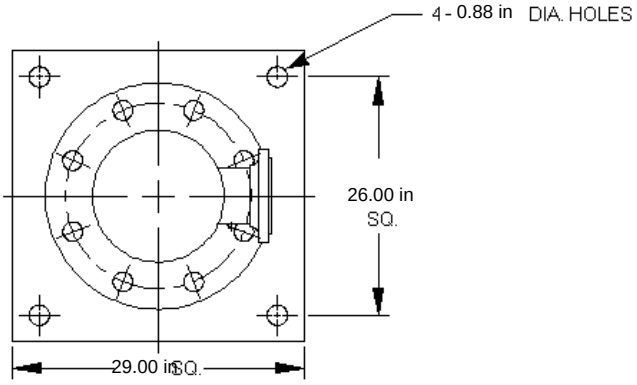
The head and power may be different than that shown in accordance with Hydraulic Institute / API 610 Standards

Additional Notes:

VERTICAL TURBINE PUMP

900.0 USgpm 326.8 ft TDH
7 STAGE TYPE 11JKM
8x16.5x20VF DISCHARGE HEAD





Discharge	Suction
8 in. 150#RF - ANSI Flange	24 in. 150#RF - ANSI Flange
13.5 in. Dia. Flange	32 in. Dia. Flange
8 - .88 in. Dia. holes	20 - .75 in. Dia. holes
11.75 in. Bolt circle	29.5 in. Bolt circle

* TYPICAL LOCATION FOR DISCHARGE NOZZLE

** FINAL HEAD HEIGHT WILL BE DETERMINED BASED ON INTERNAL ANALYSIS AND SPECIFICATION REVIEW

NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED.

NOTES:
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.
DRAWING NOT TO SCALE.

REV.	BY	DATE	DESCRIPTION

Customer: Triangle Pump & Equipment Co.
Customer Reference:
Item Number: Pump No. # 1
Curve Number: 11JKM 1770
Date: 28 Aug 2015

OUTLINE DRAWING

DRAWING

SECTION 01300

SUBMITTALS

PART 1 GENERAL

The CONTRACTOR shall provide submittals including shop drawings, schedules, drawings, and such other information as may be necessary for the prosecution of the work in the shop and in the field as required by the contract documents or the ENGINEER's instruction. There may be other submittals required elsewhere in these Specifications that are not necessarily included or mentioned in this Section.

Within fourteen (14) days after award of the contract, the CONTRACTOR shall submit to the ENGINEER a proposed list of manufacturers, suppliers, and subcontractors and a schedule of specific target dates for the submission and return of shop drawings required by the contract documents. The list and schedule shall be updated and re-submitted when requested by the ENGINEER. All shop drawings for interrelated items shall be scheduled for submission at the same time. Not less than one (1) week shall be allocated to each submittal for processing by the ENGINEER. **It is the preference of the ENGINEER that all submittals are provided electronically, in PDF format, via email.** Should the CONTRACTOR opt to submit information in hard copy format, at least six (6) copies of all submittals shall be provided to the ENGINEER. Four (4) copies of all submittals will be kept by the ENGINEER. If the CONTRACTOR requests that more than two (2) copies be returned, then the CONTRACTOR shall submit the appropriate quantity of submittals.

The ENGINEER will review shop drawings to determine compliance with the design concept of the project and return them to the CONTRACTOR within the period established in the shop drawings schedule. The ENGINEER may hold shop drawings in cases where partial submission cannot be reviewed until the complete submission has been received or where shop drawings cannot be reviewed until correlated items affected by them have been received. When such shop drawings are held, the ENGINEER will advise the CONTRACTOR in writing that the shop drawing submitted will not be reviewed until shop drawings for all related items have been received.

The CONTRACTOR shall submit to the ENGINEER, for review, all required shop drawings, electrical diagrams and catalog information for fabricated items and manufactured items required for construction. The 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". The ENGINEER will then return two copies of the submitted data and shop drawings to the CONTRACTOR. The ENGINEER’s review of submittals and shop drawings is not a check of any dimension or quantity, and will not relieve the CONTRACTOR from responsibility for errors of any sort in the submittals and shop drawings.

When shop drawings and/or submittals are required to be revised or corrected and resubmitted, the CONTRACTOR shall make such revisions and/or corrections and resubmit those items or other materials in the same manner as specified above.

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 the CONTRACTOR has received review from the ENGINEER.

Regardless of corrections made in or review given to the drawings by the ENGINEER, the CONTRACTOR shall be responsible for the accuracy of such drawings and for their conformity to the drawings and specifications. The CONTRACTOR shall check all submittals before submitting them to the ENGINEER and shall stamp its approval on all copies of the shop drawing documents. Any submittals received by the 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 the CONTRACTOR and the OWNER may withhold the funds necessary to cover these costs.

Materials and equipment shall be ordered a sufficient time in advance to allow time for reviews, and shall be available on the job when needed. Last minute review will not be given for inferior substitutes for material or equipment.

Required submittals include items listed below. This list is provided for CONTRACTOR's convenience only and may not be complete in all respects. CONTRACTOR shall provide all submittals required, whether or not specifically listed herein.

A. Schedules -- The CONTRACTOR shall prepare and submit to the ENGINEER, within fifteen (15) days after notice to proceed, a practicable schedule showing the order in which the CONTRACTOR proposes to carry out the work, the dates on which the important features of the work will start, and the contemplated dates for completing same. In addition to a time-scaled bar chart schedule depicting the project critical path, the 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 material 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 the CONTRACTOR upon the request of the 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 the CONTRACTOR shall coordinate work accordingly.

B. Breakdown of Contract Price -- The 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 contract price. Breakdown of lump sum bids shall be coordinated with the 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 percent of the total base bid. Upon acceptance of the breakdown of the contract price by the ENGINEER, it shall be used as the basis for all requests for payment.

C. Shop Drawings, Schedules and Drawings -- The CONTRACTOR shall provide shop drawings, schedules and such other drawings and information as may be necessary for the prosecution of the work in the shop and in the field as required by the contract documents and/or ENGINEER's instruction.

D. Design Submittals -- Design submittals as may be required for equipment and systems elsewhere in these Specifications.

E. Erosion and Sedimentation Control Plan

F. Materials Lists

G. CONTRACTOR Contact Persons

H. Material Safety Data Sheets

I. Traffic Control and Protection Plan

J. Miscellaneous Materials and Other Submittals As Required Elsewhere in the Specifications

K. Operation and Maintenance Instructions

Before acceptance of the installation, the CONTRACTOR shall submit four (4) copies of complete operation and maintenance instructions for all equipment supplied. Submit items in 8-1/2 x 11-inch heavy-duty three-ring binders when appropriate, or in 8-1/2 x 11-inch file folders. All binders and folders shall have clear plastic pockets on the front of the cover and the spine to allow for insertion of identifying information. The equipment manufacturer may furnish instruction manuals prepared specifically for the equipment furnished or standard manuals may be used if statements like "if your equipment has this accessory..." or listings of equipment not furnished are eliminated. Poorly reproduced copies are not acceptable. Operation and maintenance instructions shall contain the following as a minimum:

1. Approved shop drawings and submittal data

2. Model, type, size and serial numbers of equipment furnished

3. Equipment and driver nameplate data

4. List of parts showing replacement numbers

5. Recommended list of spare parts

6. Complete operating instructions including start-up, shutdown, adjustments, cleaning, etc.

7. Maintenance and repair requirements including frequency and detailed instructions

8. Name, address and phone numbers of local representative and authorized repair service

END OF SECTION

SECTION 01550

QUALITY CONTROL

PART 1 GENERAL

1.1 Description

A. This section covers quality control requirements supplementary to those of the General Conditions and Technical Specifications.

1.2 Provisions

A. Contractor's Responsibility for Testing

The Contractor shall be responsible for the cost of all testing as specified in this section.

B. Owner's Right to Perform Additional Tests

The OWNER reserves the right to complete additional testing. In such cases the CONTRACTOR shall provide safe access for the OWNER and their inspectors to adequately inspect the quality of work and the conformance with project specifications.

1.3 Quality Assurance

A. Testing Requirements

An independent owned and operated laboratory approved by the ENGINEER shall perform all testing as specified herein.

B. Testing

1. General

a. All required testing of work and/or materials shall be conducted in the presence of the OWNER or OWNER's Representative. The CONTRACTOR shall provide seventy-two (72) hour notification to the OWNER and OWNER's representative prior to conducting any and all quality assurance testing. Where applicable, work and materials shall only be buried with the consent of the OWNER or OWNER's representative.

b. Where such inspection and testing are to be conducted by an independent laboratory or agency, the sample or samples of material to be tested shall be selected by such laboratory or agency or by the OWNER or OWNER's representative. The CONTRACTOR shall furnish such samples of all materials without charge to OWNER.

c. The results from any and all tests are made for the information of the OWNER. Regardless of any test results, the CONTRACTOR is solely responsible for the quality of workmanship and materials and for compliance with the requirements of the Drawings and Specifications.

2. Costs of Testing

a. The CONTRACTOR shall be responsible for and shall pay for all tests as specified in Part 3 of this Section.

b. Where test results demonstrate that the material or workmanship does not meet the minimum requirements of the Contract Documents, additional testing shall be completed and shall be paid for by the CONTRACTOR with no reimbursement by the OWNER.

1.4 Submittals

A. Laboratory Test or Inspection Reports

Each report shall be signed and certified by the independently owned and operated testing laboratory. Unless otherwise specified, submit three (3) copies of each report to the ENGINEER.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 Field Testing Schedule

A. The CONTRACTOR shall complete field testing in accordance with the following schedule. Additional source material testing shall be completed as necessary to establish the basis of field tests. The frequency of testing listed in this schedule lists the minimum number of tests per quantity of work completed by the CONTRACTOR. Testing locations to be determined by OWNER's representative.

Material to be Tested	Payment Responsibility for Initial Testing	Minimum Testing Frequency
Structural Backfill	OWNER	In-place compaction testing (w/ nuclear compaction gage) performed at 2-foot elevation increments, one test per 2,500 sf of material placed. See Section 02221-1.3 for further details on payment responsibilities.
Trench Backfill	OWNER	In-place compaction testing (w/ nuclear compaction gage) performed at 2-foot elevation increments, one test per 200 lineal feet of pipeline trench as measured along pipe centerline. OWNER or OWNER's REPRESENTATIVE may reduce frequency to one test per lift for every 1,500 lineal feet of pipeline trench when satisfied with CONTRACTOR's method of compaction. See Section 02222-1.5 for further details.
Asphalt Concrete	OWNER	As required when placed. See detailed requirements in 02510-1.5.
Concrete	OWNER	As required when placed. See detailed requirements in Section 03300-3.13.
Grout	OWNER	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 OWNER or OWNER's REPRESENTATIVE to insure continued compliance with Specifications. See detailed requirements in Section 03600-1.4.
Waterline – Hydrostatic testing & disinfection	CONTRACTOR	As required. See Section 01650, Pipeline Testing and Disinfection.
Waterline - Microbial testing	CONTRACTOR	As required. See Section 01650, Pipeline Testing and Disinfection.
Reservoir – Testing and repair of leaks	CONTRACTOR	As required. See Section 13206-3.17, Testing and Repairing Leaks for Prestressed Concrete Reservoir.
Reservoir - Microbial testing	CONTRACTOR	As required. See Section 01652, Reservoir Disinfection

END OF SECTION

SECTION 01650

PIPELINE TESTING AND DISINFECTION

PART 1 GENERAL

1.1 Description

A. This Section covers field pressure testing, disinfection and purity testing of potable water systems piping, fittings, and valves and field pressure testing of sewage force mains. All piping shall be flushed and hydrostatically pressure and leak tested. Defective items revealed by the testing procedures shall be removed and replaced or otherwise corrected as directed by the ENGINEER. All costs for labor and materials necessary to conduct the flushing, testing and disinfecting procedures specified herein, and all costs of labor and materials required to remedy defective items shall be borne by the CONTRACTOR.

B. The CONTRACTOR shall provide 48-hour notification to the ENGINEER and OWNER prior to conducting flushing, hydrostatic testing and disinfection. CONTRACTOR shall provide coordination and scheduling required for the OWNER and ENGINEER to witness and provide necessary labor for operating OWNER's existing system during hydrostatic testing and disinfecting procedures. CONTRACTOR shall not operate any part of the existing water or sewer systems.

C. The CONTRACTOR shall perform flushing and testing of all pipelines and appurtenant piping for water and disinfection of all pipelines and appurtenant piping for potable water, complete, including conveyance of test water to point of use and all disposal thereof, all in accordance with the requirements of the Contract Documents.

D. Unless otherwise directed by the ENGINEER, new water mains and appurtenances must be completely installed, flushed, tested, disinfected, and satisfactory bacteriological sample results received prior to completing permanent connections to existing water system.

1.2 Reference Specifications, Codes, and Standards

A. Comply with the provisions of the latest versions of the following Codes, Specifications and Standards, except as otherwise shown or specified.

B. The following is a list of standards which may be referenced in this Section:

1. American Water Works Association (AWWA):

a. B300, Hypochlorites.

b. B301, Liquid Chlorine.

c. C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

d. C604, Installation of Buried Steel Water Pipe - 4 In. and Larger.

e. C651, Disinfecting Water Mains.

2. National Sanitation Foundation (NSF):

a. Standard 60, Drinking Water Treatment Chemicals – Health Effects.

1.3 Contractor Submittals

A. Pipeline Testing and Disinfection Plan: Submit to Owner's Representative for approval a minimum of two weeks before testing is to start. As a minimum, the plan shall include the following:

1. Testing schedule.

2. Flushing Plan:

a. Proposed plan for water conveyance, including flow rates.

b. Proposed plan for water control.

c. Proposed plan for water disposal, including flow rates.

d. Proposed measures to minimize erosion while discharging water from the pipeline.

3. Hydrostatic Testing Plan: A narrative of the proposed process, proposed equipment to be used and disposal location for excess water used to fill mains.

4. Disinfection Plan: A narrative of the proposed process, proposed equipment to be used including list of all pumps and meters, and proposed testing locations.

5. Calculations for the amount of calcium hypochlorite or chlorine is required to achieve required chlorine residuals

6. Proposed method of mixing, injecting, and distributing the chlorine solution throughout all portions of the new water system facilities

7. Proposed plan for dechlorination, including discharge points and discharge rates.

8. Proposed plan for monitoring the chlorine residuals throughout the individual lengths of the pipeline.

B. Proposed plan for backflow protection to prevent super-chlorinated water from entering the existing water system

PART 2 PRODUCTS

2.1 General

A. All test equipment, chemicals for chlorination, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the CONTRACTOR subject to the ENGINEER's review. No materials shall be used which would be injurious to the construction or its future functions.

B. All temporary thrust restraint and equipment and facilities required for hydrostatic testing will be considered incidental.

2.2 Equipment

A. As a minimum, the CONTRACTOR shall furnish the following equipment and materials for the testing:

Amount	Description
1	Hydraulic pump approved by the ENGINEER with hoses, valves and fittings as needed and required for the testing and disinfection of the facilities.
2	Pressure gauges with pressure range at least 120% greater than the required maximum test pressure with graduations in two (2) psi increments. Gauges shall have been calibrated with 90 days of pressure testing.

2.3 Chemicals for Chlorination

A. Chlorine for disinfection shall be in the form of liquid chlorine or calcium hypochlorite solution.

1. Calcium hypochlorite shall be in accordance with the requirements of AWWA B300.

2. Liquid chlorine shall be in accordance with the requirements of AWWA B301.

2.4 Water

A. Water used in testing and flushing the pipeline shall be purchased from the OWNER.

PART 3 EXECUTION

3.1 Flushing of Water Mains

A. Flushing of water mains is to be completed accordingly to the approved Flushing Plan.

B. Minimum 48-hour notice shall be provided to ENGINEER prior to any system shutdown or flushing procedures.

C. All pipe, valves and fittings shall be thoroughly flushed prior to pressure testing and chlorination.

D. Flushing shall be done through blow-off units, hydrants, individual services and main.

E. All flushing and test water shall be delivered to the new water main through an Oregon State Health Division approved double check valve backflow prevention device provided by the CONTRACTOR.

F. Minimum flushing velocities shall be at 2.5 fps.

1. For large diameter pipe where it is impractical or impossible to flush the pipe at 2.5 fps velocity, clean the pipe in place from the inside by brushing and sweeping, then flush the line at a lower velocity.

G. Existing water system valves shall be operated by City staff only.

H. The CONTRACTOR shall make all necessary provisions for conveying water to the points of use and for the proper disposal of test water.

3.2 Hydrostatic Testing of Water Mains

A. All new piping, fittings, services and individual valves shall be pressure tested.

B. No section of the pipeline shall be hydrostatically tested until all field-placed concrete or mortar has attained full strength.

1. At the CONTRACTOR's option, early strength concrete may be used when the full strength requirements conflict with schedule requirements. All such early applications shall be approved by the ENGINEER prior to each installation.

C. All trench backfill and roadway base rock must be placed and have passed required compaction testing prior to commencing hydrostatic testing.

D. All piping shall be tested under a hydrostatic test pressure not less than 180 psi at the lowest point along the test section or as shown on the Drawings. Test pressure at any point along the test section shall not exceed 150% of pipe's working pressure rating.

E. Testing shall be performed by filling the pipe with water, allowing for natural absorption to occur under slight pressure for a minimum of 24 hours, and applying the specified test pressure by pumping. Once the test pressure has been attained and stabilized, the pump shall be valved off. The test will be conducted for a one-hour period in the presence of the ENGINEER.

F. No leakage is acceptable during hydrostatic testing.

G. If the test reveals any defects, leakage, or failure, the CONTRACTOR shall furnish all labor, equipment and materials required to locate and make necessary repairs. The testing of the line (and repairing of defects, leakage, and failures) shall be repeated until a test satisfactory to the ENGINEER has been achieved. All costs for locating of leaks, excavation of trenches, and repairing and retesting of mains shall be borne by the CONTRACTOR.

3.3 Disinfection of Water Mains

A. Following successful hydrostatic testing of the mains, all potable water systems shall be thoroughly flushed, cleaned, and disinfected by the CONTRACTOR in accordance with the latest version of AWWA C651.

B. Flushing of the mains shall be in accordance with Paragraph 3.1 herein.

C. Chlorination by means of tablets or powders (calcium hypochlorite) placed in each length of pipe during installation is specifically prohibited.

D. Chlorine may be applied by the following methods:

1. Liquid chlorine gas/water mixture.

2. Direct chlorine gas feed.

3. Calcium hypochlorite and water mixture.

E. The chlorination agent shall be applied at the beginning of the test section adjacent to the feeder connection and shall be injected through a corporation cock, hydrant or other connection to ensure treatment of the entire test section.

F. All valves and accessories shall be operated during the chlorination process. All parts of the line and services shall be chlorinated.

G. Potable water piping shall be disinfected with a solution containing a minimum 50 parts per million (ppm) and a maximum 200 ppm chlorine. The chlorine solution shall remain in the piping system for a period of 24 hours, at which time the sterilizing mixture shall have a strength of at least 25 ppm of chlorine in all parts of the line. If check samples fail to produce acceptable results, the disinfection procedure shall be repeated at the expense of the CONTRACTOR until satisfactory results are obtained.

H. Following successful chlorination of the main, water shall be flushed from the line at its extremities until replacement water is equal chemically and bacteriologically to the permanent source of supply.

I. Disposal of any water containing chlorine shall be performed in accordance with the latest edition of AWWA C651, Section 01100 Special Provisions of this specification, and any other state or local requirements.

J. All chlorinated water shall be discharged to the existing sanitary sewer system. If a sanitary sewer system is not available, the Contractor shall employ the use of storage tanks, basins, or other means to transport or treat the chlorinated water for discharge to a point of disposal approved by the ENGINEER. No chlorinated water shall be discharged to open stream channels.

K. The OWNER will collect two consecutive samples, 24 hours apart, after the pipeline is flushed in accordance with the latest edition of AWWA C651 at locations directed by ENGINEER. The chlorine residual must be below 1.5 mg/L when the sample is taken.

L. Results of the bacteriological testing shall be satisfactory with the water system owner and the State Department of Health and/or other appropriate regulatory agencies, or disinfection shall be repeated at the expense of the CONTRACTOR.

3.4 Disinfection of Water Main End Connections and Tie-Ins

A. Disinfection and pressure testing of potable water piping and appurtenances at end connections which are required to remain in service due to restrictions in allowable shutdown time shall be pressure tested and disinfected as described below:

1. The CONTRACTOR shall conduct an on-site pre-connection meeting at each connection location, no longer than one week prior to construction of the connection.

a. Meetings shall be attended by on-site foreman, inspector, City operations personnel, and ENGINEER.

b. CONTRACTOR shall have on-hand all fittings, pipe, chlorine swabbing equipment, pumps and hoses, other miscellaneous equipment and materials anticipated for the connection.

c. Cut-in schedule and coordination with OWNER shall be discussed.

2. Prior to connecting new potable water piping and appurtenances with existing piping and appurtenances, the interior of all new pipe, fittings, valves and appurtenances shall be swabbed or sprayed with a 1% to 5% percent calcium hypochlorite solution.

3. Groundwater shall not be allowed around any of the existing piping during the connection.

4. Work at each connection shall proceed without breaks until the connection is completed and water service is turned back on.

5. During the system startup, the ENGINEER and CONTRACTOR shall visually inspect all new fittings, piping, valves and appurtenances for evidence of leakage prior to backfilling.

6. Any leakage observed during this period shall be promptly repaired by the CONTRACTOR, at CONTRACTOR's expense as required by the ENGINEER.

B. All new lines under construction shall be physically disconnected from the OWNER's existing system. Under no circumstances shall a new line be connected to the existing water system prior to complete testing and acceptance by the OWNER.

END OF SECTION

SECTION 01652

RESERVOIR DISINFECTION

PART 1 GENERAL

1.1 Description

A. This section covers disinfection of new and existing potable water storage reservoirs, complete. All costs for labor and materials necessary to conduct the disinfecting procedures specified herein shall be borne by the CONTRACTOR.

B. Following painting of existing potable water facilities, those portions of the facilities which will be in contact with the water delivered to users shall be disinfected with chlorine before they are placed into service.

C. For reservoirs and tanks, disinfection by chlorination shall be accomplished in accordance with AWWA Standard C652 and as described below, whichever is most restrictive:

1. Spray or brush a solution of 200 mg/L available chlorine directly on the surfaces of all parts of the storage facility that will be in contact with water when the storage facility is full to the overflow elevation.

2. The solution shall thoroughly coat all surfaces to be treated, including the inlet and outlet piping and shall be applied to any separate drain piping such that it will have available chlorine of not less than 10 mg/L when filled with water.

3. The disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30 min.

Following the completion of the chlorination procedure, potable water shall be admitted, the drain piping purged of the 10 mg/L chlorinated water, and the storage facility shall be filled to its overflow level. A sample shall be taken by the OWNER for microbiological analysis. It will not be necessary to flush the reservoir or tank after the chlorine solution is applied by spraying or brushing providing a passing microbiological test is achieved. Microbiological analysis must indicate that the water is free of coliform organisms before the facility can be put into service.

The CONTRACTOR shall contact the OWNER representative to arrange for samples to be taken for microbiological analysis.

D. Any superchlorinated water shall be discharged through an approved connection to the public sanitary sewer system or shall be dechlorinated to limits acceptable by the Oregon State Department of Environmental Quality (DEQ) for discharge into the existing storm drainage system. If superchlorinated water is to be discharged into the public sanitary sewer system, the CONTRACTOR shall notify the sewage treatment plant notifying the planned time, location, and quantity of discharge. No superchlorinated water shall be discharged into the storm drainage system or natural drainage way prior to approved dechlorination treatment.

END OF SECTION

SECTION 01655

TESTING, TRAINING AND SYSTEM START-UP

PART 1 GENERAL

1.1 Scope

This section specifies equipment and system testing and start-up, services of manufacturer's representatives, training of OWNER's personnel and final testing requirements for the complete facility.

1.2 Contract Requirements

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

B. Complete all testing, training, and start-up within the Contract Time(s).

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. Submit start-up plan for each piece of equipment and each system not less than 2 weeks prior to planned initial equipment or system start-up.

B. Provide detailed 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 manual
5. Functional testing
6. Performance testing
7. Operational testing

C. Provide testing plan with test logs for each item of equipment and/or system. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.

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

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

1.4 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 system 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 insure 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. Perform direct current high potential tests on all cables that will operate at more than 2,000 volts. Obtain services of independent testing lab to perform tests.

5. 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.

1.5 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.

1.6 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.

6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly functioning.

B. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:

1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.

2. Control logic for equipment start-up, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating.

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

1.7 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 City staff. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than 2 sessions per week.

C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems 2 weeks prior to training session for that piece of equipment or system.

D. Satisfactorily complete functional testing before beginning operator training.

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

F. Minimum services as specified shall be provided in accordance with the following schedule:

Specification Section	Equipment	Minimum On-Site Time Requirements		
		Equipment Installation	Equipment Testing	Operator Training
11101	Vertical Turbine Pumps	½ day	1 day	1 day
17000	Instrumentation & Control	1 day	½ day	½ day

NOTE: CWD is defined as a consecutive working day consisting of 8 hours each from 8:00 a.m. to 5:00 p.m.

1.8 Operational Testing

A. Conduct operational test of the entire facility after completion of operator training. Demonstrate satisfactory operation of equipment and systems in actual operation.

B. Conduct operational test for continuous 7 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.

1.9 Record Keeping

A. Maintain and submit to ENGINEER the following records generated during start-up and testing phase of project:

1. Daily logs of equipment testing identifying all tests conducted and outcome.

2. Logs of time spent by manufacturer's representatives performing services on the job site.

3. Equipment lubrication records.

4. Electrical phase, voltage, and amperage measurements.

5. Insulation resistance measurements.

6. Pump torsional and lateral vibration analysis report.

7. Data sheets of control loop testing including testing and calibration of instrumentation devices and set-points.

END OF SECTION

SECTION 02010

SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.1 Description

Subsurface investigations and reporting have been performed for the purpose of obtaining data for the planning and design of this project. Copies of such reporting are attached to the Contract Documents as Supplementary Information. Subsurface samples that have been retained are also available for inspection. Bidders and the CONTRACTOR shall make arrangements for viewing the samples through the ENGINEER's office.

1.2 Limitations

A. 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 any responsibility under the Contract Documents.

B. 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 and test pits is intended to represent with reasonable accuracy conditions and material found in specific borings and test pits at the time the borings and test pits were made.

C. 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.

D. The OWNER's subsurface investigations and reporting are made available to Bidder or CONTRACTOR only on the basis of the understandings and agreement herein stated.

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 as may be required for disposal of materials.

1.3 Requirements of Regulatory Agencies

A. Permits -- The CONTRACTOR is responsible for obtaining all necessary permits required for completion of the work described herein at no cost to the OWNER.

B. Protection of Persons and Property -- Meet all federal, state and local safety requirements for the protection of workmen, 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. If the demolition site contains any hazardous materials such as asbestos, that will require special handling, it is the responsibility of the CONTRACTOR to

remove and dispose of the material in accordance with all applicable federal, state and local regulations.

B. The 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 by the OWNER.

2.2 Filler Sand

The 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.

2.3 Salvage of Water Works

Per City Standards, valves, fittings and fire hydrants removed shall be transported to the OWNER's designated storage yard unless otherwise directed by the OWNER. Piping and valving removed as part of the pump station work outlined in Schedule B shall become the property of the CONTRACTOR.

PART 3 EXECUTION

3.1 Demolition

A. All exposed and/or protruding metalwork, piping, plumbing and conduits, and all woodwork, roofing, and electrical and mechanical equipment shall be removed and disposed of by the CONTRACTOR. No detached metalwork, excluding concrete reinforcing bars, shall be buried with the concrete and masonry rubble.

B. 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.

C. Any floors that are to remain in place shall be completely cracked through to allow for drainage. Cracking shall be accomplished by dropping a demolition ball or by other methods approved by the ENGINEER.

D. The 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. For structures designated to be abandoned and/or demolished in place, excavated material shall be used for backfill or placed in the bottoms of the structures only as directed by the ENGINEER, along with the rubble and imported filler sand to create a dense, compacted backfill. Backfilling or placement of the excavated material in the structures shall meet the following requirements.

1. The CONTRACTOR shall furnish, place and compact filler sand along with the concrete and masonry rubble so that all voids are filled and a dense, compacted backfill is obtained. Concrete and masonry rubble used for backfilling shall be broken into pieces no larger than 12 inches on any one side.

2. At locations where concrete and masonry rubble is used for backfill, it shall be placed such that a minimum of 3-feet of compacted non-rubble backfill material exists between any rubble and finished grade. Protruding reinforcing bars shall be cut to lengths that allow granular backfill to be placed and compacted to required levels in and above the rubble. Reinforcing bars shall be cut flush with final wall elevations as shown on the plans.

3. Filler sand shall be placed in horizontal layers completely filling all voids between pieces of rubble and not exceeding 12-inches in thickness. Each layer shall be compacted to obtain at least 90 percent of maximum density as determined by ASTM Method D-698-78 (AASHTO T-99). Water shall be furnished by the CONTRACTOR and added to each layer as required to maintain optimum moisture content. The amount of filler sand used shall only be the amount needed to fill all voids created by placement of the concrete and asphalt rubble, as directed by the ENGINEER.

E. Disposal of all materials not used for backfill 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 these 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 including but not limited to structures, pipelines, walls, footings, foundations, slabs, pavements, curbs, fencing and similar structures occurring 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.

3.3 Removal and Disposal of Asbestos Cement Pipe

When asbestos cement pipe is to be removed and disposed of, the CONTRACTOR shall comply with Oregon Administrative Rule 340-248.

3.4 Pipe Abandonment

A. Abandoned Pipes -- See Section 02060, Existing Pipe Abandonment.

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.

3.5 Permanent Abandonment of a Well

A. The CONTRACTOR shall be responsible for securing and paying any local, state or federal fees for abandonment of the well.

B. Abandonment of the well shall be performed by a licensed well constructor in the state in which the work is accomplished.

C. All work shall be performed according to federal, state and local standards for permanent well abandonment.

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 may be used as rubble fill provided it is broken up into pieces not exceeding 12-inches on any one side and is placed in accordance with the provisions stated for placing concrete and masonry rubble fill.

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 02060

EXISTING PIPE ABANDONMENT

PART 1 GENERAL

1.1 Description

A. Work covered in this Section includes the removal or abandonment of existing buried piping and abandonment in place of existing buried piping by filling with Controlled Low Strength Material (CLSM).

1.2 Submittals

A. See Section 01300 for CONTRACTOR submittals.

B. If there is piping on the project that will be abandoned and filled with Controlled Low Strength Material (CLSM), the CONTRACTOR shall submit a piping abandonment plan to the ENGINEER for review. The abandonment plan shall identify fill locations for pipe and a pumping plan. Upon completion of CLSM pumping, the CONTRACTOR shall submit volume quantities of CLSM used to fill abandoned pipe.

1.3 Requirements of Regulatory Agencies

A. Permits: The CONTRACTOR is responsible for obtaining all necessary permits required for completion of the work described herein at no cost to the OWNER.

B. Protection of Persons and Property: Meet all federal, state and local safety requirements for the protection of workmen, other persons, and property in the vicinity of the work and requirements of the General Provisions.

1.4 Repair of Damage

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

B. Any damage to existing facilities or utilities 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 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 or utilities which are to remain in place, and be responsible for any damages to existing facilities or utilities, which are caused by the operations. The CONTRACTOR shall carefully coordinate the work of this section with all other work and construction.

1.6 Existing Conditions

A. If the pipe material contains any hazardous materials such as asbestos, that will require special handling upon removal, it is the responsibility of the CONTRACTOR to remove and dispose of the material in accordance with all applicable federal, state and local regulations.

PART 2 PRODUCTS

2.1 Ownership of Existing Materials

A. All materials, equipment, miscellaneous items and debris involved, occurring or resulting from pipe removal work shall become the property of the CONTRACTOR at the place of origin unless otherwise specified by the OWNER.

2.2 Controlled Low Strength Material

A. Refer to Section 02200, Earthwork, for description and required submittals.

PART 3 EXECUTION

3.1 General

A. Where shown on the Plans, all fire hydrants, air release valves service lines and appurtenances being abandoned shall be removed to 36-inches below finished grade. Existing service line appurtenances, including valve and meter boxes, shall also be removed. All exposed ends of pipes and fittings to remain in service shall be capped or plugged with an appropriate ductile iron blind

flange, cap or plug and restrained. A pipe shall be considered in service if it is possible to flood the pipe with water by opening valves in the water system. All excavation and backfilling for pipe abandonment or removal shall be performed in accordance with Section 02222, Excavating, Backfilling and Compacting for Utilities.

3.2 Filling Pipe with CLSM

A. Where identified on the Plans, abandoned pipe shall be filled with CLSM. CLSM shall be placed in a manner to ensure complete filling of the pipe, leaving no cavities or voids. The CONTRACTOR shall install hot taps, saddles, fill lines and appurtenances as necessary for pumping CLSM from the surface into the pipe being filled. CLSM shall be pumped up grade from fill lines rigidly connected to the pipes being filled. Fill lines shall be located at elevations lower than the pipe being filled. CLSM shall be pumped. Placement of CLSM by free-flowing (non-pumped) methods will not be acceptable. As the CLSM is being placed, use other fill lines as view ports to ensure complete filling of the pipes. Relocate pumping equipment as necessary to complete filling of the pipes. Excavate and cut access holes in the pipes as necessary to complete filling operations. The CONTRACTOR shall eliminate all air pockets and shall submit placed CLSM volume calculations for each filled segment to verify that pipelines have been completely filled.

3.3 Pipe Removal and In Place Abandonment

A. Where identified on the Plans, the CONTRACTOR shall remove and dispose of all pipe material and associated appurtenances. All exposed ends of pipes being abandoned in place shall be cut and plugged with grout. When existing pipe is removed, the CONTRACTOR shall plug any remaining piping being abandoned in place with a minimum of two (2) feet of non-shrink grout. Prior to placing grout, roughen interior pipe surface and apply epoxy bonding agent.

3.4 Cleanup

A. During and upon completion of work, the CONTRACTOR shall promptly remove all unused tools and equipment, surplus materials and debris. Adjacent areas shall be returned to their existing condition prior to the start of work.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.1 Description

Work includes all demolition, clearing and grubbing indicated on the Drawings or required for completion of work specified elsewhere.

1.2 Submittals

Submit to ENGINEER a copy of written permission of private property owners with copy of fill permit for said private property as may be required for disposal of materials.

1.3 Requirements of Regulatory Agencies

A. Permits -- Burning on project site will not be permitted.

B. Protection of Persons and Property -- Meet all federal, state and local safety requirements for the protection of workers, other persons, and property in the vicinity of the demolition and clearing work and requirements of General Provisions.

1.4 Site Conditions

A. Existing Conditions -- CONTRACTOR shall determine extent of work requirements and limitations before proceeding with work.

B. Protection -- Protect existing site improvements, trees and shrubs to remain to preclude damage during construction. Protect existing trees and shrubs against cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of roots by stockpiling construction materials, excavated materials, excess foot or vehicular traffic and parking of vehicles within drip line. Provide temporary guards, as necessary, to protect trees and vegetation to be left standing. Repairable damage to trees designated to remain shall be made by a professional tree surgeon approved by the ENGINEER. Cost shall be borne by the CONTRACTOR.

C. Existing Utilities -- Before starting clearing of site work, notify utility agencies; disconnect or arrange for disconnection of utilities (if any) affected by required work. Keep all active utilities intact and in continuous operation.

PART 2 PRODUCTS

2.1 Ownership of Existing Materials

All materials, equipment, items and debris involved, occurring or resulting from demolition, clearing and grubbing work shall become the property of the CONTRACTOR at the place of origin except as otherwise indicated.

2.2 Wound Paint

Emulsified asphalt formulated for use on damaged plant tissues, as approved by the ENGINEER.

PART 3 EXECUTION

3.1 Workmanship

Perform work in accordance with recognized standard and efficient methods. Operators of equipment shall be conscientious and skilled.

3.2 Clearing and Grubbing

A. Clearing -- Remove trees, saplings, snags, stumps, shrubs, brush, vines, grasses, weeds and other vegetative growth within the clearing limits except those trees and shrubs noted to remain or as directed by the ENGINEER. Clearing shall be performed in such a manner as to remove all evidence of the presence of vegetative growth from the surface of the project site and shall be inclusive of sticks and branches of thickness or diameter greater than 3/8-inch and of grasses, weeds, exceeding 12 inches in height except as otherwise indicated.

B. Grubbing -- Limits of grubbing shall coincide with the limits of clearing. Remove all stumps, roots over one inch in diameter and matted roots within the limits of grubbing work to the following depths.

1.	Future structures and building areas	24 inches
2.	Roads and parking areas	18 inches
3.	All other areas	12 inches

C. The CONTRACTOR shall remain within the property lines at all times.

D. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with the applicable sections of these Specifications.

3.3 Preservation and Trimming of Trees, Shrubs and Other Vegetation

The CONTRACTOR shall avoid injury to trees, shrubs, vines, plants, grasses and other vegetation growing outside of the areas to be cleared and grubbed and those trees and shrubs designated to be preserved. Provide protection for roots and limbs over 1-1/2-inch diameter cut during construction operations. Coat the cut faces with an emulsified asphalt. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

3.4 Landscaped Areas

When any portion of the work crosses private property or landscaped areas, the CONTRACTOR shall excavate the topsoil separately and pile it on the opposite side of the trench from the subsoil and shall conduct his work in a manner that will restore original conditions as nearly as practicable.

The CONTRACTOR shall remove and replace any trees, shrubs, plants, sod or other vegetative material. All shrubs or plants shall be balled by experienced workers, carefully handled and watered, and replaced in their original positions without damage. Sod shall be handled in a similar manner. Wherever sod cannot be saved and restored, the ground must be reseeded and cared for until a stand of grass is reestablished. Plants or shrubs killed or destroyed must be paid for by the CONTRACTOR. It is the intent of this paragraph that the CONTRACTOR shall leave the surface and plantings in substantially the same conditions as before the work is undertaken. All costs incurred by the CONTRACTOR shall be absorbed in the unit prices of his bid unless otherwise specified.

3.5 Demolition and Removal

Remove from the 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 Drawings or specified to be removed including but not limited to structures, pipelines, walls, footings, foundations, slabs, pavements, curbs, fencing and similar structures occurring above, at, or below existing ground surface shall be included in the demolition work. Unless otherwise specified, any resulting voids shall be thoroughly cracked out for drainage and backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

3.6 Disposal

A. Removal -- All material resulting from demolition, clearing and grubbing, and trimming operations shall be removed from the project site and disposed of in a lawful manner. Materials placed on property of private property owners shall be by written permission only.

B. Clean-up -- During the time that the work is in progress, the CONTRACTOR shall make every effort to maintain the site in a neat and orderly condition. All refuse, broken pipe, excess fill material, cribbing and debris shall be removed as soon as practicable. Should the work not be maintained in a satisfactory condition, the OWNER may cause the work to stop until the clean-up of the work has been done to the satisfaction of the ENGINEER. The work will not be considered complete or the final payment certificate issued until all rubbish, unused material, or equipment shall have been removed and the premises left in a condition satisfactory to the OWNER and the ENGINEER.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 GENERAL

1.1 Description

The CONTRACTOR shall provide all labor, materials, and equipment necessary to dewater trench and structure excavations, in accordance with the requirements of the Contract Documents. The CONTRACTOR shall secure all necessary permits to complete the requirements of this Section of the Specifications.

1.2 Submittals

The CONTRACTOR shall submit a dewatering plan to be reviewed by the ENGINEER prior to the beginning of construction activities requiring dewatering. Review by the ENGINEER of the CONTRACTOR's design shall not be construed as a detailed analysis of the adequacy of the dewatering system, nor shall any provisions of the above requirements be construed as relieving the CONTRACTOR of its overall responsibility and liability for the work.

A Dewatering Plan for the construction of the reservoir shall be submitted by the CONTRACTOR prior to any and all excavations at the site and prior to installation of Aggregate Pier Foundation Systems.

1.3 Quality Control

A. It shall be the sole responsibility of the CONTRACTOR to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the CONTRACTOR.

C. Where the critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the CONTRACTOR. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the CONTRACTOR.

PART 2 PRODUCTS

2.1 Equipment

Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pumping equipment shall be maintained on the jobsite.

PART 3 EXECUTION

3.1 Dewatering

A. The CONTRACTOR shall provide all equipment necessary for dewatering. The CONTRACTOR shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workers for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.

B. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

C. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock at no additional cost to the OWNER.

F. The CONTRACTOR shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation construction, backfilling, and up to acceptance.

G. Flotation shall be prevented by the CONTRACTOR by maintaining a positive and continuous removal of water. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the CONTRACTOR shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

I. The CONTRACTOR shall dispose of water from the work in a suitable manner without damage to the environment or adjacent property. The CONTRACTOR shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction without prior consent of the ENGINEER. Water shall be filtered using an approved method to remove sand and fine sized soil particles before disposal into any drainage system.

J. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.

K. Dewatering of trenches and other excavations shall be considered as incidental to the construction of the work and all costs thereof shall be included in the various contract prices in the bid forms.

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, the Oregon Department of Transportation, Standard Specifications for Highway Construction, and the City of West Linn Public Works Design Standards. 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 02205

EXISTING TREE PROTECTION

PART 1 GENERAL

1.1 Instructions

A. Provide temporary fencing, barricades, and guards as necessary or required to protect trees designated on the Drawings to remain, from damage above and below grade.

B. Protect root systems from smothering and compaction. Do not store construction materials or permit vehicles to drive or park within the drip line area of any tree to remain.

C. Protect all plant growth, including root systems of trees, from dumping refuse, chemically injurious material or liquids, and continual puddling or running of water.

D. This specification shall be applied concurrently and in conjunction with other plant material protection measures herein described and specified.

PART 2 MATERIALS

(Not Used)

PART 3 EXECUTION

3.1 Inspection

A. Inspect all trees specified on the Drawings for protection prior to construction. Document with written memorandum and photographs any unusual conditions. Submit copies of documentation to ENGINEER prior to beginning work. Verify all conditions regarding tree protection prior to any site disturbance.

B. The ENGINEER must be present during demolition of existing conditions occurring within the drip line of trees designated to remain.

C. Notify ENGINEER 24 hours prior to inspections and/or tagging of protected trees.

3.2 General

A. Install specified barricades at drip lines of trees designated to remain prior to the commencement of construction. Clearly designate protected trees to be clear of any material storage, personnel, or vehicular movement.

B. Protect root systems of trees to remain from damage due to noxious materials in solution caused by runoff or spillage during mixing and placement of construction materials.

C. Protect root systems of trees to remain from flooding, erosion, or excessive wetting resulting from dewatering operations and compaction.

D. Protect all existing trees to remain against unauthorized cutting, breaking, skinning roots and branches, or bruising bark. Refer to Site Preparation specification for damages caused by construction activity.

E. No burning on the site will be permitted.

F. Where cutting is necessary, review conditions with the ENGINEER before proceeding, and comply with directives of ENGINEER.

3.3 Excavation around Trees

A. Excavate within drip lines of trees only where indicated on plans or as directed by ENGINEER.

B. Where trenching for utilities is required within drip lines, tunnel under or around roots by hand excavating. Do not cut main lateral roots or tap roots over one inch in diameter. Where possible trench toward trunk of tree and tunnel under central root mass to avoid severing all lateral roots on side of trench. Temporarily support and protect from damage until permanently covered with approved backfill.

C. Do not allow exposed roots to dry out before backfill is placed. Provide temporary earth or burlap cover. Water roots daily when exposed and maintain in a moist condition.

D. Only backfill roots upon inspection approval from the ENGINEER. Backfill around root excavations only with clean imported topsoil free from materials deleterious to root growth. Backfill to eliminate voids and compact only by means of manual tamping at root areas. Water sufficiently to settle topsoil and eliminate voids or air pockets around roots. Allow for natural settlement of soil surface, and furnish and apply topsoil sufficient to bring to original finish grade after backfill settlement.

E. If during excavation, any condition arises that threatens the survivability of the protected tree, or an unknown condition arises that affects the stability or integrity of the root system, notify the ENGINEER immediately.

3.4 Repair and Replacement of Damaged Trees

A. In the event of damage to existing trees, the CONTRACTOR shall immediately prune limbs smaller than 3" caliper, or roots smaller than 2" caliper to repair trees damaged by construction operations. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees. Any such pruning and/or repairs shall be approved in advance and at completion by ENGINEER. The ENGINEER shall reserve the right, at cost to the CONTRACTOR, to obtain the services of a Certified Consulting Arborist with current membership in the American Society of Consulting Arborists to determine the severity of damage. The CONTRACTOR is responsible for the cost of repairs caused by their actions or by the actions of subcontractors engaged by the CONTRACTOR.

B. The CONTRACTOR shall remove and replace dead or damaged trees which are determined by the ENGINEER to be incapable of restoration to normal growth patterns.

C. The CONTRACTOR shall provide new trees of the same species as those removed or damaged, with size and/or quantity to be determined by ENGINEER. Furnish to the site and plant, maintain, and warranty as directed by the ENGINEER. If trees are not replaceable with the same species, and size, compensate the OWNER for the replacement cost of the trees based on the evaluation of a Certified Consulting Arborist. CONTRACTOR is responsible for additional costs of removing damaged trees and labor for planting new specimens.

3.5 Designated Tree Removal Procedures

A. If designated tree removal is specified by ENGINEER, furnish labor, material, and equipment necessary for removing and/or salvaging existing trees, if necessary, as designated on the Drawings for removal. Verify location and species with ENGINEER prior to removal.

B. Salable logs or timber, may be sold to CONTRACTOR's benefit, upon notification and prior approval of OWNER. Upon approval, remove promptly from site.

3.6 Designated Tree Transplanting Procedures

A. If designated tree transplanting is specified by ENGINEER, verify and identify existing trees to be transplanted.

B. All work shall be in accordance with the standards and practices outlined in the following: Tree and Shrub Transplanting Manual, E.B. Himelick, 1981 Ed., International Society of Arboriculture.

C. Prior to commencement of work, submit a coordination schedule, method of transplanting, traffic control, routing, etc., to ENGINEER, for review and approval.

D. Warranty for transplanted trees shall be determined and directed on a case by case basis by the ENGINEER, upon contracting of specified transplanting work.

E. Review and verify location of utilities in area of operation. Obtain location and jurisdictional approval from utilities prior to transplanting activities. Protect utilities and the public at all times.

F. Prior to transplanting, spray trees with an anti-desiccant emulsion-type film forming agent, "Dowax" by Dow Chemical Company, "Wilt-Pruf" by Nursery Specialty Products Inc., "D-Wax", by Plant Products Inc., or approved equal, prior to digging with two separate applications allowing 48 hours apart. Use a power sprayer to provide an adequate film over trunks, branches, stems, twigs, and foliage. Anti-desiccant must be dry prior to relocation.

G. Dig, ball and burlap, and move designated trees for relocation to the new planting location shown on the Drawings. In the event the new planting area is not prepared, place tree in a storage area approved by the ENGINEER solely designated for healing-in of plant materials until final planting may occur. Brace in a vertical position, provide shade, wind protection, and irrigation at plant storage area. Utilize all horticulturally proper methods for plant storage. Plants shall be maintained by CONTRACTOR while in storage.

3.7 Grading and Filling Around Trees

Maintain existing grade within drip line of trees unless otherwise indicated on the Drawings or directed by the ENGINEER.

3.8 Maintenance of Protective Measures

A. Maintain protective measures throughout the construction process. Immediately repair any alteration to protection measures throughout construction process. Repair or reinstall protective measures immediately upon alteration. Monitor protective measures daily.

B. Remove and clear area of debris and fencing, barricades, etc., upon final written approval of ENGINEER.

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 ENGINEER. 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 State Highway Department Standard Specifications for Highway Construction for base aggregates.

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.

B. Reservoir

After required subgrade has been established, place foundation base material to required grade as shown on the plans. Place a minimum of 12-inches of 3/4-inch-0" crushed rock to required grade under footing. Place all material 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.

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. Reservoir

The backfill material as shown on the plans shall be brought up on all sides of the 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.

D. 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 West Linn Design Standards and Oregon Department of Transportation Standard Specifications for Highway Construction 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

Class A: Backfill with suitable native excavated material. Place the material in lifts with mechanical compaction sufficient to insure that no bridging occurs. Mound the excess material over the trench.

Class B: Backfill with suitable native excavated material. Place the material in lifts and mechanically compact to a relative density as shown on the Drawings or specified herein. Remove and dispose of excess material.

Class C: Backfill with suitable native excavated material. Place the material in the trench and water settle to a relative density as shown on the Drawings or specified herein. Remove and dispose of excess material.

Class D: Backfill with approved imported granular material. Place the material in lifts and mechanically compact to a relative density as shown on the Drawings or specified herein. Remove and dispose of excess material.

Class E: Backfill with controlled low strength material (CLSM). See Section 2200, Earthwork.

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 the CONTRACTOR and approved by the ENGINEER will perform all soil sampling and testing. Testing locations and frequencies shall be determined by the ENGINEER. All testing will be paid for by the CONTRACTOR.

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 02230

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 Scope

A. This section covers the requirements for temporary and permanent erosion and sedimentation control necessary to prevent migration of sediment and silt laden water to adjacent surface water bodies and drainage structures.

B. The CONTRACTOR shall provide all materials, labor, and equipment necessary to install adequate erosion and sedimentation controls.

1.2 Permits

The CONTRACTOR shall obtain an Erosion and Sediment Control (ESC) Permit from the City of West Linn Engineering Department, and provide a copy of the permit to the ENGINEER as a submittal. The CONTRACTOR shall review and comply with the requirements set forth in the Erosion prevention and Sediment Control Planning and Design Manual (rev. December 2008, or latest edition). All fees and permit costs will be borne by the CONTRACTOR. After obtaining the Permit, if the CONTRACTOR proposes to modify the approved erosion control plan, the CONRACTOR shall work through the City to revise application/permit. CONTRACTOR shall be responsible for compliance with all permit provisions and shall accommodate all special inspections required thereof, all at no additional expense to the OWNER beyond prices as bid.

A. In addition to the conditions of the ESC Permit to be issued by the City of West Linn, erosion control provisions shall conform to regulatory requirements of the following agencies.

1. Federal Clean Water Act – Section 208.
2. Oregon Revised Statutes – Chapter 451.

1.3 Submittals

A. The CONTRACTOR shall submit a copy of the approved ESC Permit obtained from the City of West Linn. The CONTRACTOR will have sole responsibility for compliance with all of the permit requirements and the day-to-day implementation of the ESC Plan.

B. Upon completion of and acceptance of all Work, CONTRACTOR shall submit all required Permit Termination documentation to the City of West Linn, and send a copy to the ENGINEER for the project record.

1.4 Schedule

A. Required temporary sedimentation control facilities must be constructed and in operation prior to land clearing and other construction to ensure that sediment laden water does not enter the natural drainage systems.

B. Temporary sediment facilities shall be maintained in a satisfactory condition until such time that permanent ESC facilities are in place or sufficient vegetation has been established and potential for on-site erosion has passed.

C. The implementation, maintenance, replacement, and additions to ESC systems shall be the responsibility of the CONTRACTOR.

PART 2 PRODUCTS

2.1 Check Dam Sand or Gravel Bags

Bags to be either burlap or woven “Geotextile” fabric filled with gravel or sand.

2.2 Jute Matting

A. Be of a uniform open plain weave of unbleached, single jute yarn treated with a fire retardant chemical.

B. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than one-half of its normal diameter.

C. Furnished in rolled strips 48 inches wide by approximately 50 yards long.

D. Average weight of 0.92 pounds per square yard with an allowable tolerance of plus or minus 1 inch in width and 5 percent in weight.

2.3 Filter Fabric

Filter fabric for the erosion protection barriers shall be Mirafi 140, or equivalent.

2.4 Wire

Wire for the erosion protection barriers shall be 2 by 2 mesh, 12 gauge galvanized wire.

2.5 Support Posts

Support posts for the erosion protection barriers shall be minimum 2 inch by 2 inch, Douglas Fir No. 1, or better wood posts.

2.6 Clear Plastic Covering

Clear plastic covering for protection of slopes and cuts shall meet the requirements of the NBS Voluntary Product Standard, PS 17 for Polyethylene sheeting having a minimum thickness of 6 mil.

PART 3 EXECUTION

3.1 Erosion Control

A. Erosion control provisions shall meet or exceed the requirements of the local agency having jurisdiction.

B. When provisions are specified and shown on the drawings, they are the minimum requirements.

C. CONTRACTOR shall not permit sediment-laden waters to enter natural waterways.

D. As construction progresses and seasonal conditions dictate, more siltation control facilities may be required. It shall be the responsibility of the CONTRACTOR to address new conditions that may be created and to provide additional facilities over and above minimum requirements as may be required.

E. Provide temporary erosion control measures to prevent erosion from piles of topsoil or fill material. Before completing the Contract, any areas of bare soil shall be permanently seeded.

F. Additional measures may be necessary depending on construction activity and weather. CONTRACTOR will be responsible for carrying out the erosion control provisions of the approved ESC Plan.

G. Keep streets and paved surfaces clean of mud and debris. Install gravel construction entrances as shown on the Plans and maintain them for the duration of the construction period.

3.2 Siltation Control

Siltation control is required. Check dams or silt fences may be placed in streams or ditches receiving stormwater from areas disturbed by construction.

3.3 Filter Fabric Fences

A. Filter fabric fence shall consist of filter fabric fastened to wire fabric with staples or wire rings.

B. Wire shall be fastened to posts set at 6 foot-maximum centers.

C. Fabric shall be buried into ground a minimum of 12 inches to prevent silt from washing under fabric.

D. Fence shall be located to catch silt and prevent discharge to drainage courses.

E. Erosion Control Check Dam

F. Sand or gravel filled bags shall be installed in drainage way to catch silt.

G. Spillway shall be lower than outer edge of dam. Leave a one sand bag gap in top row to provide spillway.

3.4 Placing Jute Matting

A. Seed and fertilizer shall be placed prior to placing of matting.

B. Jute matting shall be unrolled parallel to the flow of water. Where more than one strip of jute matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 4 inches. The ends of matting shall overlap at least 6 inches with the upgrade section on top.

C. The up-slope end of each strip of matting shall be staked and buried in a 6 inch-deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (one stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench.

D. ENGINEER may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner.

E. Check-slots shall be laced between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as up-slope ends. Check-slots must be placed so that one check-slot or one end occurs within each 50 feet of slope.

F. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting must be spread evenly and smoothly and in contact with the soil at all points.

G. Matting shall be held in place by approved wire staples, pins, spikes, or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in three rows for each strip of matting, with one row along each edge and one row alternately spaced in the middle. All ends of the matting and check-slots shall be fastened at 6 inch intervals across

their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil and driven flush with the finished grade.

3.5 Placing Clear Plastic Covering

A. Clear plastic covering shall be installed on erodible embankment slopes.

B. The clear plastic covering shall be installed immediately after completion of the application of roadside seeding. It is the intent of this specification that clear plastic covering will be in place before the fall rainfall begins.

C. Maintain the cover tightly in place by using sandbags or ties on slopes with a minimum of 10 foot grid spacing in all directions. All seams shall be taped or weighted down full length. There shall be at least a 12 inch overlap of all seams.

D. Immediately repair all damaged areas.

3.6 Existing Drainage Facilities

A. Should a storm sewer or culvert become blocked or have its capacity restricted due to siltation from CONTRACTOR's operations, the CONTRACTOR shall make arrangements with the jurisdictional agency for the cleaning of the facility at no additional expense to the OWNER.

B. CONTRACTOR shall install catch basin inserts in existing catch basins in the vicinity of, or adjacent to, clearing or construction activities to prevent sediment from entering the on-site stormwater conveyance system.

3.7 Drainage Diversion

A. CONTRACTOR may divert up-gradient surface runoff water around the site as required. CONTRACTOR will be responsible for routing diverted surface water to its original flow path downstream of the site, and providing energy dissipation and/or dispersion as needed to mimic pre-diverted flow characteristics, as required by the ENGINEER.

B. Drainage shall be restored to condition existing prior to construction unless otherwise shown on the drawings.

END OF SECTION

SECTION 02255

AGGREGATE PIER FOUNDATION SYSTEMS

PART 1 GENERAL

1.1 Description

Work shall consist of designing, furnishing and installing Aggregate Pier foundations to the lines and grades designated on the project foundation plan and as specified herein. The aggregate piers shall be constructed to the design elevations by vertically ramming lifts of aggregate using high-energy impact densification equipment to create the compacted aggregate pier. The Aggregate Pier elements shall be in a columnar-type configuration and shall be used to produce an intermediate foundation system for support of static foundation loads as well as meet the total and differential settlement requirements, and increase the apparent soil shear strength to improve global stability beneath the reservoir.

1.2 Work Included

A. Provision of all equipment, material, labor, and supervision to design and install Aggregate Pier elements. Design shall rely on subsurface information presented in the project geotechnical report. Layout of Aggregate Pier elements, spoil removal (as required), footing excavations, and subgrade preparation following aggregate pier installation is not included.

B. The Aggregate Pier design and installation shall adhere to all methods and standards described in this Specification.

C. Drawings and General Provisions of the Contract, including General and Supplemental Conditions, and Division 1 Specifications, apply to the work in this specification.

1.3 Approved Systems

Approved aggregate pier systems are the Impact® and Rampact® Rammed Aggregate Pier (RAP) System by Geopier Foundation Company; GeoRam® Engineered Aggregate Pier system by GeoTech Foundation Company - West; and Vibro Pier by Hayward Baker, Inc.

1.4 Aggregate Pier Installer Prequalification

Prequalification of the Aggregate Pier Installer (the Installer) applies to this project. Refer to Section 01100, SPECIAL PROVISIONS, for prequalification requirements.

1.5 Reference Standards

A. Design

1. "Control of Settlement and Uplift of Structures Using Short Aggregate Piers," by Evert C. Lawton (Assoc. Prof., Dept. of Civil Eng., Univ. of Utah), Nathaniel S. Fox (President, Geopier Foundation Co., Inc.), and Richard L. Handy (Distinguished Prof. Emeritus, Iowa State Univ., Dept. of Civil Eng.), reprinted from *IN-SITU DEEP SOIL IMPROVEMENT, Proceedings of sessions sponsored by the Geotechnical Engineering Division/ASCE in conjunction with the ASCE National Convention held October 9-13, 1994, Atlanta, Georgia*.

2. "Settlement of Structures Supported on Marginal or Inadequate Soils Stiffened with Short Aggregate Piers," by Evert C. Lawton and Nathaniel S. Fox. *Geotechnical Special Publication No. 40: Vertical and Horizontal Deformations of Foundations and Embankments,* ASCE, 2, 962-974.

B. Quality Control Testing

1. ASTM D 1143 - Pile Load Test Procedures
2. ASTM D 1194 - Spread Footing Load Test
3. ASTM D 5778 – Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils (e.g. Cone Penetration Test (CPT) probes)

C. Materials and Inspection

1. ASTM D 1241 - Aggregate Quality
2. ASTM D 422 - Gradation of Soils

D. Where specifications and reference documents conflict, the Aggregate Pier Designer shall make the final determination of the applicable document.

1.6 Certifications and Submittals

A. Design Calculations - The Installer shall submit detailed design calculations and construction drawings prepared by the Aggregate Pier Designer (the Designer) for review and approval by the ENGINEER. All plans shall be sealed by a Professional Engineer in the State in which the project is constructed.

B. Professional Liability Insurance - The Designer shall have Errors and Omissions design insurance for the work. The insurance policy should provide a minimum coverage of $3 million per occurrence.

C. Building Code Acceptance - The Installer shall demonstrate that the proposed aggregate pier system has been evaluated by the International Code Council (formerly ICBO).

D. Modulus Test Reports – A modulus test(s) is performed on a non-production aggregate pier element as required by the Designer to verify the design assumptions. The Installer shall furnish the CONTRACTOR a description of the installation equipment, installation records, complete test data, analysis of the test data, and verification of the design parameter values based on the modulus test results. The report shall be prepared under direction of a Registered Professional Engineer.

E. Daily Aggregate Pier Progress Reports – The Installer shall furnish a complete and accurate record of Aggregate Pier installation to the CONTRACTOR. The record shall indicate the pier location, length, volume of aggregate used or number of lifts, densification forces during installation, and final elevations or depths of the base and top of piers. The record shall also indicate the type and size of the installation equipment used, the type of aggregate used, and casing length, if used. The Installer shall immediately report any unusual conditions encountered during installation to the CONTRACTOR, to the Designer and to the ENGINEER.

F. Contingency Work Plan - The Installer shall furnish a Contingency Work Plan that details the manner in which Aggregate Pier installation shall continue in the event that unanticipated work conditions, including the detection of high frequency vibrations during installation as discussed in 02255-3.5.B.2, should occur.

1.7 Aggregate Pier Design

A. The design of the Aggregate Pier system shall be based on the service load bearing pressure and the allowable total and differential settlement (static and seismic) criteria for all footings and reservoir mat slab.

B. The design shall achieve the minimum composite aggregate pier treated soil mass friction angle indicated in the Specifications and as discussed in the Geotechnical Report for foundation support and slope stability by the aggregate pier system.

C. The Aggregate Pier system shall be designed in accordance with generally-accepted engineering practice and the methods described in Section 1 of these Specifications.

D. The Aggregate Pier installation area shall be square as shown on the Drawings and as discussed in the Geotechnical Report and shall extend at least 10 feet beyond the south, west, and east sides of the reservoir and 20 feet beyond the

north side of the reservoir. The north side of the square ground treatment area shall be essentially parallel to the general contour of the slope north of the reservoir as shown on the Drawings.

E. The Aggregate Pier system shall be installed to an elevation of at least 405 ft.

F. The composite effective friction angle of the aggregate pier treated soil mass shall be a minimum of 24.5 degrees based on an assumed existing (untreated) soil mass residual effective friction angle of 21 degrees.

G. The aggregate pier dimensions (spacing and diameter) shall be engineered by the aggregate pier contractor to meet the following performance criteria:

Minimum Static Allowable Soil Bearing Pressure following installation of Rammed Aggregate Piers	3,500 psf
Estimated Total Long-Term Static Settlement for Footings and Floor Slab at Center of Reservoir:	≤ 1.25-inch
Estimated Long-Term Differential Static Settlement (edge of footing to point on floor slab halfway between footings):	≤ 0.5-inch
Estimated Long-Term Coefficient of Subgrade Reaction, k:	75 pci

H. The aggregate pier elements shall be designed using an aggregate pier stiffness modulus to be verified by the results of the modulus test described in Section 3.4 of these Specifications.

1.8 Work Hour Limitations

A. All site work associated with the installation of the Aggregate Pier systems shall be conducted between the hours of 8:00 a.m. and 5:00 p.m. on weekdays only, unless otherwise approved by the OWNER. No weekend or holiday work will be allowed. Requests for variations in work hours shall be made in writing and shall be approved by the OWNER.

PART 2 MATERIALS

2.1 Aggregate

A. Aggregate used by the Installer for pier construction shall be pre-approved by the Designer and shall demonstrate suitable performance during modulus testing. Typical aggregate consists of Type 1 Grade B in accordance with

ASTM D-1241-68, No. 57 stone, recycled concrete or other graded aggregate approved by the Designer.

B. Potable water or other suitable source shall be used to increase aggregate moisture content where required. The CONTRACTOR shall provide such water to the Installer.

PART 3 EXECUTION

3.1 Approved Installation Procedures

The following sections provide general criteria for the construction of the Aggregate Pier elements. Unless otherwise approved by the Designer, the installation method used for Aggregate Pier construction shall be that as used in the construction of the successful modulus test.

A. Displacement Aggregate Piers

1. Displacement Aggregate Pier systems shall be constructed by advancing a specially designed mandrel with a minimum 10 ton static or dynamic force, augmented by dynamic vertical ramming energy, to the full design depth. The hollow shaft mandrel, filled with aggregate, is incrementally raised permitting the aggregate to be released into the shaft and then lowered by vertically advancing and/or ramming to densify the aggregate and force it laterally into the adjacent soil. The cycle of raising and lowering the mandrel/rammer is repeated to the top of pier elevation. The cycle distance shall be determined by the Designer.

2. Special high-energy impact densification apparatus shall be employed to vertically densify the Aggregate Pier elements during installation of each constructed lift of aggregate.

3. Densification shall be performed using a mandrel/tamper. The mandrel/tamper foot is required to adequately increase the lateral earth pressure in the matrix soil during installation. Compaction equipment that induces horizontal vibratory energy is not permitted.

4. Downward crowd pressure shall be applied to the mandrel during installation.

5. It is not acceptable to utilize air or water jetting to advance the aggregate pier equipment.

B. Augered Aggregate Piers

1. Augered Aggregate Pier system shall be pre-augered using mechanical drilling or excavation equipment.

2. If cave-ins exceeding 10 percent of the lift volume occur during excavation such that the sidewalls of the hole are deemed to be unstable by the ENGINEER and/or the Installer, or if in the opinion of the ENGINEER the sidewall instability of the excavations is not providing the required ground improvement detailed in the specifications, steel casing shall be used to stabilize the shaft at no additional cost to the OWNER. The Installer shall sufficient steel casing available for delivery to the project site as may be needed to complete the work without delays.

3. Aggregate shall be placed in the augered shaft in lift thicknesses as determined by the Designer.

4. A specially-designed beveled tamper and high-energy impact densification apparatus shall be employed to densify lifts of aggregate during installation. The apparatus shall apply direct downward impact energy to each lift of aggregate. Compaction equipment that induces horizontal vibratory energy is not permitted.

3.2 Plan Location and Elevation of Aggregate Pier Elements

The as-built center of each pier shall be within 6 inches of the locations indicated on the Designer's plans. Piers installed outside of the above tolerances and deemed not acceptable shall be rebuilt at no additional expense to the OWNER.

3.3 Rejected Aggregate Pier Elements

Aggregate Pier elements installed beyond the maximum allowable tolerances shall be abandoned and replaced with new piers, unless the Designer approves the condition or provides other remedial measures. All material and labor required to replace rejected piers shall be provided at no additional cost to the OWNER. It is the responsibility of the CONTRACTOR to determine if probable rejection may occur due to an obstruction or mislocation.

3.4 Quality Control

A. Control Technician

The Installer shall have a full-time, on-site Control Technician who is dedicated exclusively to Quality Control observation to verify and report all installation procedures. Equipment operators shall not have the dual role of Control Technician. The Installer shall immediately report any unusual

conditions encountered during installation to the Designer, the CONTRACTOR, and the ENGINEER.

B. Aggregate Pier Stiffness Modulus Testing

1. Aggregate Pier Stiffness Modulus Tests will be performed at locations agreed upon by the Designer and the ENGINEER to verify or modify Aggregate Pier designs.

2. Stiffness Modulus Test procedures shall utilize appropriate portions of ASTM D 1143 and ASTM D 1194, as outlined in the Aggregate Pier design submittal.

C. Bottom Stabilization Testing (BST) / Crowd Stabilization Testing (CST)

1. Bottom Stabilization Testing (BST) or Crowd Stabilization Testing (CST) shall be performed by the Control Technician during the installation of the modulus test pier.

2. Additional testing as required by the Designer shall be performed on selected production Aggregate Pier elements to compare results with the modulus test pier.

3.5 Quality Assurance

A. Responsibilities of the ENGINEER

1. ENGINEER shall monitor the modulus test pier installation and testing. The Installer shall provide and install all dial indicators and other measuring devices as may be necessary for the ENGINEER to monitor testing.

2. ENGINEER shall monitor the installation of Aggregate Pier elements to verify that the production installation practices are similar to those used during the installation of the modulus test elements.

3. ENGINEER shall report any discrepancies to the Installer and CONTRACTOR immediately.

4. ENGINEER shall observe the foundation preparation as described in Section 3.6.E.

B. The OWNER shall procure the services of an independent Testing Agency to survey and monitor adjacent properties during construction as outlined below:

1. Testing Agency shall conduct pre- and post-installation surveys of the surrounding properties. These pre- and post-installation surveys should include video and photographic documentation of the structures and detailed notes of existing damage and cracking

2. Testing Agency shall provide vibration monitoring. The maximum peak particle velocity (PPV) shall be less than 2 inches per second (ips) as measured at the property boundaries. Vibration monitoring shall be performed at the beginning of the project and be continuously monitored throughout Aggregate Pier installation to verify that the maximum PPV is not exceeded. If the maximum PPV is exceeded, the Installer shall suspend work until corrective measures are taken.

3.6 Responsibilities of the CONTRACTOR

A. Site Preparation and Protection

1. The CONTRACTOR shall locate and protect underground and aboveground utilities and other structures from damage during installation of the Aggregate Pier elements.

2. Site grades for Aggregate Pier installation shall be within 1 foot of the top of footing elevation or finished grade elevation to minimize Aggregate Pier installation depths. Ground elevations and bottom of footing elevations shall be provided to the Installer in sufficient detail to estimate installation depth elevations to within 3 inches.

3. The CONTRACTOR will provide site access to the Installer, after earthwork in the area has been completed. A working surface shall be established and maintained by the CONTRACTOR to provide wet weather protection of the subgrade and to provide access for efficient operation of the Aggregate Pier installation.

4. Prior to, during and following Aggregate Pier installation, the CONTRACTOR shall provide positive drainage to protect the site from wet weather and surface ponding of water.

5. If spoils are generated by Aggregate Pier installation, spoil removal from the Aggregate Pier work area in a timely manner to prevent interruption of Aggregate Pier installation is required.

B. Aggregate Pier Layout

The location of Aggregate Piers for this project, including layout of individual Aggregate Pier elements, shall be marked in the field using survey stakes or similar means at locations shown on the Designer's drawings.

C. Excavations of Obstructions

1. Should any obstruction be encountered during Aggregate Pier installation, the CONTRACTOR shall be responsible for promptly removing such obstruction, or the pier shall be relocated or abandoned. Obstructions include, but are not limited to, boulders, timbers, concrete,

bricks, utility lines, etc., which shall prevent placing the piers to the required depth, or shall cause the pier to drift from the required location.

2. Dense natural rock or weathered rock layers shall not be deemed obstructions, and piers may be terminated short of design lengths on such materials.

D. Utility Excavations

1. Protection of completed Aggregate Pier elements is the responsibility of the CONTRACTOR.

2. The CONTRACTOR shall coordinate all excavations made subsequent to Aggregate Pier installations so that excavations do not encroach on the piers as shown in the Aggregate Pier construction drawings. In the event that utility excavations are required in close proximity to the installed Aggregate Pier elements, the CONTRACTOR shall contact the Designer immediately to develop construction solutions to minimize impacts on the installed Aggregate Pier elements.

E. Foundation Preparation

1. Excavation and surface preparation of foundation subgrade and base aggregate shall be the responsibility of the CONTRACTOR.

2. Foundation excavations to expose the tops of Aggregate Pier elements, shall be made in a workman-like manner, and shall be protected until placement of foundation aggregate base, with procedures and equipment best suited to (1) avoid exposure to water, (2) prevent softening of the matrix soil between and around the Aggregate Pier elements before placing foundation aggregate base course, and (3) achieve direct and firm contact between the dense, undisturbed Aggregate Pier elements and the foundation aggregate base course.

3. All excavations for foundations supported by Aggregate Pier foundations shall be prepared in the following manner by the CONTRACTOR. Recommended procedures for achieving these goals are to:

a. Excavate to subgrade elevation using smooth-edged equipment buckets to minimize disturbance to aggregate pier and soil matrix. Excavation subgrade shall be evaluated and approved by ENGINEER.

b. Compaction of the top of Aggregate Pier elements shall be completed using a motorized impact compactor (“Wacker Packer,” “Jumping Jack,” or similar) if loose. Sled-type tamping devices shall only be used in granular soils and when approved

by the Designer. Loose or soft surficial soil over the entire footing bottom shall be re-compacted or removed, as directed by the ENGINEER. The surface of the aggregate pier shall be re-compacted prior to completing footing bottom preparation as directed by the ENGINEER.

c. Place foundation aggregate base immediately after subgrade is prepared and approved, preferably the same day as the excavation. Foundation aggregate base should be placed on the same day if moisture-sensitive soils are exposed. If same day placement of foundation aggregate is not possible, open excavations shall be protected from surface water accumulation. Any soft or loose soil, or water, that collects in foundation excavations shall be removed before placement of foundation aggregate base.

4. The following criteria shall apply, and a written Site Visit Report prepared by the ENGINEER shall be furnished to the Installer to confirm:

a. That water (which may soften the unconfined matrix soil between and around the Aggregate Pier elements, and may have detrimental effects on the supporting capability of the Aggregate Pier reinforced subgrade) has not been allowed to pond in the footing excavation at any time.

b. That all Aggregate Pier elements designed for each footing have been exposed in the footing excavation.

c. That immediately before footing construction, the tops of Aggregate Pier elements exposed in each footing excavation have been inspected and re-compacted as necessary with mechanical compaction equipment.

d. That no excavations have been made after installation of Aggregate Pier elements within the excavation limits described in the Aggregate Pier construction drawings, without the written approval of the Installer or Designer.

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 and the City of West Linn.

This Section pertains to work performed under Schedules A and C.

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 West Linn Public Works Design Standards.

1.3 Quality Assurance

A. All testing to determine compliance with the specifications shall be performed by an independent testing laboratory approved by the ENGINEER. All testing costs shall be borne by the CONTRACTOR.

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 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, ENGINEER and/or responsible roadway agency 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 3 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.

3.5 Concrete

A. Replace concrete driveways, sidewalks and curbs to the same section, width, depth, line and grade as that removed or damaged. Saw broken or jagged ends of existing concrete on a straight line and to a vertical plane. Place new concrete only on approved compacted trench.

B. Replace concrete driveways and sidewalks between scored joints and make replacement to prevent a patched appearance. Unless otherwise shown, provide a minimum 2-inch thick compacted leveling course of clean 3/4-inch minus crushed aggregate.

C. All replaced concrete driveways, sidewalks and curbs shall be constructed in accordance with City of West Linn Public Works Design Standards.

3.6 Rock Surfacing

Place rock surfacing only where shown on plans or directed on streets, driveways, parking areas, street shoulders, and other areas disturbed by the construction. Rock surfacing shall be 1 ½ inches – 0 inches, or ¾ inch – 0 inches crushed aggregate, as directed. Spread the rock surfacing to conform to adjacent existing grades and surfaces as directed. Compact as directed with mechanical vibratory or impact tamper.

3.7 Landscaping Restoration -- Restore all landscaped areas, yards and areas specifically identified on the drawings damaged as a result of construction as follows:

A. Place 12 inches of topsoil.

B. Removed landscaped material shall be replaced in-kind.

C. Yard areas shall be restored and replanted immediately upon completion of backfilling.

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.

3.9 Restoration of Permanent Pavement Striping and Marking

The CONTRACTOR shall restore all permanent pavement striping and marking that is removed or damaged during the project construction. The work shall include the removal of existing damaged markings where required, furnishing and installing thermoplastic and/or painted markings in accordance with the roadway owners' requirements and other incidental work as required to completely restore existing pavement striping and marking to the satisfaction of the roadway owners.

3.10 Cold Plane Pavement Removal

Cold plane pavement removal shall be conducted in accordance with the requirements of Section 00620 – Cold Plane Pavement Removal of the ODOT Standard Specifications.

3.11 Road Shoulder Dressing

Where shoulders are currently dressed with crushed aggregate, place road shoulder dressing material along all paved roadway shoulders where pipe laying operations have been conducted and after final paving. Road shoulder dressing material shall be ¾ inch – 0 inches crushed aggregate and shall be of the width and depth as shown on the Drawings. Compact the road shoulder dressing to a density of not less than 95 percent of the maximum density, as determined by AASHTO T-99.

END OF SECTION

SECTION 02510

ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 Scope

This section covers the construction of asphalt concrete pavement.

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 Specifications" 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 West Linn Public Works Design Standards.

1.3 Definitions

Maximum Density Test (MDT) is the theoretical maximum density of the bituminous mixture determined by multiplying the theoretical maximum specific gravity, determined by ASTM D2041 (Rice), by 62.4 pounds per cubic foot.

1.4 Submittals

A. Submit aggregate qualification tests in accordance with ODOT Section 00640 for aggregate used in aggregate base.

B. Submit aggregate qualification tests in accordance with ODOT Section 00745 for aggregate used in asphalt concrete.

C. Job mix formula shall be an approved job mix formula. Submit formula, supplier, and product identification to the ENGINEER 30 days prior to start.

1. Definite percentage for:

a. Each sieve fraction.

b. New asphalt cement.
c. Recycled asphalt pavement.

2. Temperature of completed mix when discharged from mixer.

3. Character and quantity of anti-strip and recycling agents.

1.5 Quality Assurance

A. All testing to be by an independent laboratory provided by the OWNER. Initial testing will be paid for by the OWNER. Where test results demonstrate that the material or workmanship does not meet the minimum requirements of the Contract Documents, additional testing shall be completed and shall be paid for by the CONTRACTOR with no reimbursement by the OWNER.

B. A minimum of five (5) nuclear densometer readings shall be taken in random locations within every test area. Each test area shall not exceed 200 tons of asphalt; however, smaller areas may be designated by the ENGINEER.

C. The surface smoothness of the new asphalt concrete pavement shall be such that when a 10-foot straightedge is laid longitudinally across the paved area in any direction, the new pavement shall not deviate from the straightedge more than 1/8 inch. Surface drainage shall be maintained. Additionally, paving must conform to the design grade and crown and contain no abrupt edges, low or high areas or any other imperfections as determined by the ENGINEER. Pavement construction not meeting these requirements will be repaired by grinding the existing pavement to a 1 1/2 inch depth and replacing with Level 3 ½ -inch dense graded Asphaltic Concrete the full width at no cost to OWNER.

1.6 Pre-Paving Conference

A. Any supervisory personnel of the CONTRACTOR and any subcontractors who are to be involved in the paving work shall meet with the ENGINEER, at a time mutually agreed upon, to discuss methods of accomplishing all phases of the paving work.

B. The CONTRACTOR shall be prepared to review the size and type of equipment to be used and the anticipated rate of placement to determine equipment needs.

PART 2 PRODUCTS

2.1 Aggregate Material

A. Aggregate Base for Dense Graded Asphalt Concrete: 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" minus aggregate.

B. Aggregate Base for Open Graded Asphalt Concrete-Aggregate base material shall be sizes and thicknesses as shown on drawings.

2.2 Asphalt Concrete Pavement

A. Dense Graded Hot Mix Asphalt Concrete

1. Use Level 3, ½ inch-dense graded, PG 70-22 HMAC. Conform to the requirements as specified in Section 00745 of the Standard Specifications. Conform to the requirements as specified in Section 00745 of the Oregon Standard Specification.

2. Asphaltic concrete pavement delivered to the site shall be accompanied by a ticket with the approved "job mix formula" number shown. Loads without tickets identifying the job mix formula will not be accepted.

3. Percent of recycled asphalt pavement used in new asphalt pavement shall not exceed 30 percent. Recycled asphalt pavement may not be used in top wearing course unless otherwise approved by the ENGINEER.

B. Open Graded Asphalt Concrete

1. Use Level 2, 3/4–inch open graded, PG 64-22 HMAC. Conform to the requirements as specified in Section 00745 of the Oregon Standard Specifications.

2. Recycled asphalt pavement may not be used in open graded HMAC.

3. Asphaltic concrete pavement delivered to the site shall be accompanied by a ticket with the approved "job mix formula" number shown. Loads without tickets identifying the job mix formula will not be accepted.

C. Tack Coat

In accordance with Oregon Standard Specifications. Use AR 4000, AC-20 asphalt or CSS-1 emulsified asphalt.

D. Seal and Cover Coat

Asphalt material shall be CRS-2 cationic emulsified asphalt. Cover stone shall conform to size ¼ -inch -#10 aggregate in the Standard Specifications.

E. Subgrade Geotextile

1. Dense Graded AC Mix-For subgrade separation using dense graded asphalt concrete, use subgrade geotextile with Certification Level B as specified in Section 02320 of the Oregon Standard Specifications.

2. Open Graded AC Mix-For subgrade separation using open graded asphalt concrete, use drainage geotextile type 2 with level B certification as specified in Section 02320 of the Oregon Standard Specifications.

F. Subgrade Stabilization

In the event that unstable materials are encountered during excavation, the additional excavation and installation of geotextile fabric and twelve (12) inches of rock substructure will be required, as directed. Conform to the requirements as specified in Section 00331 of the Oregon Standard Specification. For subgrade separation, use subgrade geotextile with Certification Level B as specified in Section 02320 of the Oregon Standard Specifications.

PART 3 EXECUTION

3.1 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.

C. Obtain the ENGINEER's acceptance of the subgrade before beginning construction of the aggregate base course.

D. When, in the judgment of the ENGINEER, the weather is such that satisfactory results cannot be secured, suspend operations. Place no aggregate base course in snow or in soft, muddy, or frozen subgrade.

E. If the required compacted depth of aggregate base course exceeds six (6) inches, construct in two or more lifts of approximately equal thickness. Maximum compacted thickness of any one lift shall not exceed six (6) inches. Compact each layer to the specified density before a succeeding lift is placed.

3.2 Asphalt Concrete Pavement

A. Construct asphalt concrete pavement in accordance with Section 00745 of the Oregon Standard Specifications.

B. CONTRACTOR shall conform to the requirements for prime coat and tack coat in the 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.

C. Obtain the ENGINEER's acceptance of the aggregate base course before beginning construction of the asphalt concrete wearing course.

D. Hot mix asphalt shall be placed on dry, prepared surfaces, when air temperature in the shade of 40^{o} F or warmer, unless otherwise authorized by the ENGINEER.

E. Placing asphalt pavement during rain or other adverse weather conditions will not be permitted unless otherwise authorized by the ENGINEER, except that asphalt mix in transit at the time these adverse conditions occur may be placed provided it is of proper temperature, the mix has been covered during transit, and it is placed on a foundation free from mud or free-standing water.

F. The CONTRACTOR shall correct any defects in material and workmanship, as directed, when determined detrimental by the ENGINEER. These include segregation of materials, non-uniform texture, and fouled surfaces preventing full bond between successive spreads of mixture. The corrections or replacement of defective material or workmanship shall be at the CONTRACTOR's expense.

G. Compact the bituminous mixture to at least 92 percent of the Theoretical Maximum Density.

H. The finished surface of each course of layer of mixture shall be of uniform texture, smooth, and free of defects and shall closely parallel that specified for

the top surface finished grade. Remove and replace boils and slicks immediately with suitable materials.

I. The surface of each layer when tested with a CONTRACTOR-furnished 10-foot straightedge shall not vary from the testing edge by more than 0.02-foot for underlying courses of pavements and 0.015-foot for finished top courses or wearing courses of pavements. At no point shall the finished top of the wearing course vary more than 0.03-foot from the specified finished grade.

J. Lift thickness shall be as shown on the drawings or specified, but not to exceed 3 inches.

K. Do not place asphalt concrete pavement on emulsified asphalt (tack coat) until the asphalt separates from the water (breaks) but before it loses its tackiness.

L. Asphalt and sand seal edges where new asphalt concrete meets existing pavement.

3.3 Job Mix Sampling and Testing

A. Job mix will be sampled immediately behind the paving machine.

B. Temperature of the mix will be measured immediately behind the paver.

C. The theoretical maximum specific gravity of the bituminous mixture will be determined in accordance with ASTM D2041.

D. Properties of the job mix will be measured using ASTM D2041.

E. Density of the compacted job mix will be measured in accordance with ASTM D2922.

3.4 Adjustment of Existing Manhole Covers and Valve Boxes

Prior to placing asphalt concrete pavement, the CONTRACTOR shall make all necessary adjustments to existing manhole frames and covers and valve box covers to ensure that the tops of the manhole covers or valve box lids are flush with the finished grade of the adjoining pavement or ground surface, and that valve boxes and PVC pipes are centered and plumb over operating nut valve.

END OF SECTION

SECTION 02620

DUCTILE IRON PIPE, FITTINGS AND SPECIAL ITEMS

PART 1 GENERAL

1.1 Description

Work under this Section applies to the furnishing and installation of ductile iron pipe, fittings and special items for buried service. The CONTRACTOR shall furnish and install ductile iron pipe, fittings, valves, special items and all appurtenant work, complete in place, all in accordance with the requirements of the Contract Documents.

1.2 Reference Specifications, Codes, and Standards

A. Comply with the provisions of the latest versions of the following Specifications, Codes, and Standards, except as otherwise shown or specified.

B. The following is a list of standards which may be referenced in this Section:

1. City of West Linn Design Standards.

2. American Society of Mechanical Engineers (ASME):

   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

   b. B16.5, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.

   c. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.

   d. B31.10, Standards of Pressure Piping.

3. ASTM International (ASTM):

   a. A36, Standard Specification for Carbon Structural Steel.

   b. A536, Standard Specification for Ductile Iron Castings.

   c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

d. D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

4. American Water Works Association (AWWA):

a. C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

b. C105, Polyethylene Encasement for Ductile-Iron Pipe Systems.

c. C110, Ductile-Iron and Gray-Iron Fittings.

d. C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

e. C115, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

f. C151, Ductile-Iron Pipe, Centrifugally Cast.

g. C153, Ductile-Iron Compact Fittings.

1.3 Submittals

A. See Section 01300, Submittals, for submittal procedures.

B. Product technical data and material data; including all pipe, fittings, restrained joint systems, and appurtenance information.

C. Lining and coating data.

D. Applicable material certifications and testing certificates.

E. Manufacturer's handling, delivery, storage and installation requirements.

1.4 Quality Assurance

A. 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.

B. All material of a like kind shall be provided from a single manufacturer unless otherwise approved by the ENGINEER.

C. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage and handling.

D. 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.

E. Markings:

1. Pipes and Fittings: Mark each pipe and fitting at plant. Include date of manufacture, manufacturer's identification, specification standard, inside diameter of pipe, dimension ratio as applicable, pipe class as applicable, pipe number for laying purposes as applicable, and other information required for type of pipe.

2. Bolting materials (washers, nuts and bolts) shall be marked with material type.

1.5 Material Delivery, Storage and Protection

A. In accordance with manufacturer's written recommendations and as specified in these Contract Documents.

B. Store and support pipe securely to prevent accidental rolling and to avoid contact with mud, water, or other deleterious materials.

C. Pipe and fittings shall not be stored on rocks or gravel, or other hard material that might damage pipe. This includes storage area and along pipe trench.

D. Pipe, specials, and fittings delivered to Project Site in damaged condition will not be accepted.

E. Gaskets:

1. In accordance with manufacturer's written recommendations.

2. Store gaskets in cool, well ventilated place, and do not expose to direct rays of sun.

3. Do not allow contact with oils, fuels, petroleum, or solvents.

F. Handling:

1. Pipe and appurtenances shall be handled in accordance with manufacturer's recommendations or requirements contained in this section or subsequent sections dealing with the specific pipe material, whichever is more stringent.

2. Pipe shall be handled with proper equipment in a manner to prevent distortion or damage. Use of hooks, chains, wire ropes, or clamps that

could damage pipe, damage coating or lining, or kink and bend pipe ends is not permitted.

3. Use heavy canvas, or nylon slings of suitable strength for lifting and supporting materials.

4. Lifting pipe during unloading or lifting into trench shall be done using two slings placed at quarter point of pipe section. Pipe may be lifted using one sling near center of pipe, provided pipe is guided to prevent uncontrolled swinging and no damage will result to pipe or harm to workers. Slings shall bear uniformly against pipe.

PART 2 PRODUCTS

2.1 General

A. Ductile iron piping materials and specials shall meet the specifications of this Section and of the appropriate AWWA Standard Specifications. In the case of conflict, the more stringent specifications shall apply.

B. Unless otherwise specified herein or shown on the Plans, the minimum working pressure rating of all water works materials specified herein shall be 250 or 350 psi.

C. All coatings and materials specified herein that come in contact with potable water shall be National Sanitation Foundation (NSF) approved.

2.2 Ductile Iron Pipe

A. Ductile iron pipe shall conform to AWWA Standard C151 and shall be the standard push-on joint type or restrained joint type as identified on the Plans.

B. Unless otherwise specified herein or shown on the Plans, ductile iron pipe shall be thickness Class 52.

1. The CONTRACTOR shall be aware ductile iron piping with thickness class greater than Class 52 may have long fabrication and supplier lead times. The CONTRACTOR shall be responsible for coordinating product submittal and delivery times accordingly such as not to delay construction.

C. Ductile iron pipe shall be factory lined with cement mortar and bituminous seal coat and coated outside with asphaltic seal coat. Interior and exterior sealed in accordance with AWWA C104.

D. Push-on type pipe joints shall conform to ANSI/AWWA C111/A21.11.

1. Manufacturers:

1) Tyton Joint by American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, McWane, and Pacific States Cast Iron Pipe.

2) Fastite Joint by American Cast Iron Pipe Company.

E. Restrained Joint:

1. Restrained joint ductile iron pipe and fittings shall be provided as identified on the Plans and required for the application.

2. Restrained joints for pipe shall be designed for a water working pressure as shown on the Plans.

3. Restraining components for pipe shall be ductile iron in accordance with applicable requirements of ANSI/AWWA C110/A21.10 and/or C153/A21.53, with the exception of the manufacturer's proprietary design dimensions. Mechanical joints, including accessory glands, gaskets and bolts, shall conform to the requirements of AWWA C111.

4. Joint restraint for pipe shall be accomplished with a mechanical joint system. Any such system shall be a manufacturer's standard proprietary design, shall be as recommended by the manufacturer for the application, and shall be performance proven.

5. Bolts: T-bolts of high-strength, low alloy steel.

6. Manufacturers:

a. The following is the approved list of restrained joint systems:

1) "MEGALUG", EBAA Iron, Inc.
2) "Field-Lok", United States Pipe and Foundry Company.

b. Where any restrained joint system requires the use of a wedge-type mechanical restraint gland for restraint, the glands shall be provided in quantities as may be required and shall be considered incidental to the joint restraint system.

7. Restrained joint for pipe shall be capable of being deflected after assembly as follows:

Size	Maximum Deflection
4	5.00°
6	5.00°

8	5.00°
10	5.00°
12	5.00°
14	3.25°
16	3.25°
18	3.00°
20	2.75°
24	2.25°
30	1.75°
36	1.50°
42	0.50°
48	0.50°
54	0.50°

F. Flanged Joints:

1. Flat faced, complying with ASME/ANSI B16.1, Class 125 and ANSI/AWWA C110/A21.11.

2. Bolts for assembly of flanged joints shall comply with AWWA C110.

   a. Bolts: Conform to ANSI B18.21, Square and Hex Bolts and Screws Inch Series, Including Hex Cap Screws and Lag Screws.

   b. Nuts: Conform to ANSI B18.2.2, Square and Hex Nuts.

   c. Threads: Conform to ANSI B1.1, Standard for Unified Inch Screw Threads (UN and UNR Thread Form), Class 2A, external and Class 2B, internal.

   d. Bolts and nuts: Low-carbon steel conforming to the requirements of ASTM A307, Grade B.

3. Bolt hole drilling according to ASME/ANSI B16.1, Class 125. Flanges shall be attached with bolt holes straddling the vertical axis of the pipe, unless otherwise shown.

4. The CONTRACTOR shall coordinate with pipe, valve and fitting suppliers to make certain that pipe, valve and fitting flanges match in bolt pattern.

5. Gaskets:

   a. Composed of synthetic rubber, full faced and 1/8-inch thick conforming to ANSI/AWWA C111/A21.1.

2) Ring gaskets will be permitted only where specifically noted in the Plans and Specifications.

G. Gauged Pipe:

1. All ductile iron pipe 24-inches in diameter or greater to be cut in the field shall be gauged full length, meeting the outside diameter standard dimensions and tolerances required for spigot ends along the full length of pipe to within 2 feet of the bell end.

2. In addition to pipe supplied for anticipated cutting, a minimum of 5% of each size of piping 24-inches in diameter or greater shall be provided gauged full length as described above.

3. Pipe shall be externally marked, in manufacturer's color, indicating gauged pipe.

2.3 Fittings and Specials

A. Fittings

1. Fittings used for joining ductile iron pipe shall be of the type, size and strength designated on the Plans, elsewhere in the specifications.

a. Fittings shall be mechanical joint, push-on type, flanged or plain-end as required and shown on the Plans.

b. All restraint systems and flanged fittings shall be provided with bolts and gaskets as specified herein.

2. All fittings used with ductile iron pipe shall be ductile iron, complying with AWWA C110.

3. Ductile iron (compact) fittings conforming to AWWA C153 may be substituted in lieu of AWWA C110 fittings.

4. Mechanical joints, including accessory glands, gaskets and bolts, shall conform to the requirements of AWWA C111.

5. Pressure ratings: All ductile iron fittings shall be Class 350.

6. Bolts: As specified for joint type detailed above.

7. Coating:

a. Asphaltic exterior coating in accordance with ANSI/AWWA C104/A21.4.

b. All buried units and bolts shall receive a protective coating of Koppers Super Tank Bitumastic product or approved equal.

1) Protective coating shall be dried and cured before fitting is placed and covered.

2) If coating is not dry, two layers of 8 mil plastic shall be wrapped around fitting and coated areas.

8. Pipe Mortar Lining:

a. Shop-applied NSF 61 cement mortar lining, smooth finished, complying with AWWA C104.

9. Fittings shall have the following information cast upon them:

a. Manufacturer's identification
b. County of manufacture
c. Pressure rating
d. Number of degrees or fractions of a circle (bends)

10. Manufacturers:

a. Griffin
b. Trinity Valley
c. Tyler
d. Union Foundry
e. U.S. Pipe

B. Flanged Spools

1. Threaded flanges shall meet the requirement of AWWA Standard C115.

2. Install only on pipe with a minimum Class 53 wall thickness.

3. Bolts and gaskets: As specified in Paragraph 2.2.F.

4. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown.

5. CONTRACTOR shall coordinate with pipe, valve and fitting suppliers to make certain that pipe, valve and fitting flanges match in bolt pattern.

C. Flexible (Transition) Couplings

1. All flexible couplings shall be of the bolted, sleeve-type and shall meet the requirements of AWWA C219.

2. Couplings may be straight, transition or reducing configuration as shown on the Plans.

3. Center rings and end rings shall be ductile iron meeting or exceeding the requirements of ASTM A536.

4. Gaskets shall be virgin styrene butadiene rubber (SBR) compounded for water or sewer service in accordance with ASTM D 2000 MBA 710.

5. Bolts and nuts shall be high strength low alloy steel conforming to AWWA C111.

6. All flexible couplings shall be constructed to diameters that properly fit the connecting pipes. CONTRACTOR is responsible for selecting sleeve lengths appropriate to the application, subject to review and approval of the ENGINEER, recognizing that longer sleeves allow for larger deflections and may ease installation.

7. Couplings shall be lined and coated with fusion bonded epoxy.

8. Flexible couplings shall be Style "501" as manufactured by Romac Industries, Inc. or approved equal.

9. Insulating flexible couplings shall meet the above specification and, in addition, shall include an insulating boot.

   a. The insulating boot shall be ethylene propylene diene methylene (EPDM) compounded for water and sewer service and insulating properties in accordance with ASTM D 2000 MBA 715.

   b. Insulating flexible couplings shall be Style "IC501" as manufactured by Romac Industries, Inc. or approved equal.

D. Flanged Coupling Adaptors

1. All flanged coupling adaptors shall meet the requirements of AWWA C219.

2. End rings and flanged bodies shall be ductile iron meeting or exceeding the requirements of ASTM A536.

3. Flange shall be compatible with ANSI Class 125 and 150 bolt circles.

4. Gaskets shall be virgin styrene butadiene rubber (SBR) compounded for water or sewer service in accordance with ASTM D 2000 MBA 710.

5. Bolts and nuts shall be high strength low alloy steel conforming to AWWA C111.

6. Couplings shall be lined and coated with fusion bonded epoxy. All flanged coupling adaptors shall be constructed to diameters that properly fit the connecting plain end pipe and the flanged fitting.

7. Flanged coupling adaptors shall be Style "FCA501" as manufactured by Romac Industries, Inc. or approved equal.

E. Restrained Flange Adapters

1. Restrained flange adapters shall be made of ductile iron conforming to ASTM A536

2. Flange bolt circles compatible with ANSI/AWWA C115/A21.15.

3. Restraint for the flange adapter shall consist of a plurality of individually actuated gripping wedges to maximize restraint capability.

4. Torque limiting actuating screws shall be used to insure proper initial set of the gripping wedges.

5. Flange adapters shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6-inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

6. Safety factor of 2:1, minimum.

7. Manufacturers:

   a. Series 2100 Megaflange, EBAA Iron.
   b. RFCA, Romac Industries.
   c. Approved equal.

F. Tapping Sleeves and Tapping Valves

Tapping sleeves shall have a stainless steel body and flanged outlet. Stainless steel to be thick gauge ASTM A240 Type 304/304L or equal. Bolts and nuts to be Type 304 stainless steel. Unit shall have a Type 304 stainless steel test plug. Outlet shall be SBR per ASTM D2000 and compounded for water and sewer service use. Flanges shall be stainless steel, ASTM A240 Type 304, per AWWA C228 Class D plate flange, ANSI Class 150 drilling, with proper recessing for tapping valves. Flanges shall accommodate tapping flanges per MSS SP-60 and meet the requirements of MSS SP-124 and AWWA C223.

Tapping sleeves shall be Model STS 420 as manufactured by Romac Industries, Inc. or approved equal.

Valves for tapping sleeves shall be resilient wedge tapping valves as specified in Section 15101.

G. Flexible Expansion Joints:

1. Installed in the locations indicated on the Plans.

2. End connections: As shown on the Plans.

3. Construction:

a. An expansion joint designed and cast as an integral part of a double ball and socket type flexible joint.

b. Manufactured of ductile iron, conforming to requirements of AWWA C153 and ASTM A536.

c. Deflection: Minimum of 15 degrees deflection per ball.

d. Expansion:

1) 12-inch diameter and under: 12 inches.
2) Greater than 12-inch diameter: 16 inches.

e. Each flexible expansion joint shall be hydrostatically tested to the manufacturer's published pressure rating prior to shipment.

f. Lining: All interior "wetted" parts shall be shop-lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213 and shall be holiday tested with a 1500-volt spark test conforming to said specification.

g. Coating: Coal tar epoxy.

h. All flexible expansion joints shall be encased in polyethylene material meeting the requirements of Section 264201, Pipeline Cathodic Protection Systems.

4. Manufacturer:

a. EBAA Iron, Flex-Tend or approved equal.

H. Polyethylene Encasement

1. All ductile iron and fittings and any appurtenances associated with the system including valves, couplings, insulating joints and all other buried metallic items shall be encased in polyethylene tubing. No polyethylene sheeting will be allowed.

2. Polyethylene film shall be 8-mil thick linear low-density polyethylene (LLDPE), meeting the requirements of AWWA C105 and ASTM D1248.

I. Insulated Flange Joints: See Section 15000-2.3.D.

PART 3 EXECUTION

3.1 General

A. Pipe shall be installed in accordance with good trade practice, true to line and be firmly bedded for the full length of the pipe.

B. The methods employed by the CONTRACTOR in the storage, handling, and installation of pipe, fittings, valves, hydrants, equipment and appurtenances shall be such as to insure that the material, after it is placed, tested and permanently covered by backfilling is in as good a condition as when it was shipped from the manufacturer's plant. Should any damage occur to the material, repairs or replacement shall be made to the satisfaction of the ENGINEER.

C. Ductile iron pipe shall be installed in accordance with AWWA Standard C600, except as modified elsewhere in these specifications.

D. Trench excavation and backfill of ductile iron piping system shall conform to the requirements of Section 02222, Excavating, Backfilling and Compacting for Utilities.

E. Pipe Cutting:

1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.

3. Grind edges smooth with beveled end for push-on connections.

F. 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.

1. Where possible, piping shall be sloped to permit complete drainage.

2. Where grades are not shown, pipe shall be laid to grade between control elevations shown on the Plans.

G. Provide special tools and devices, such as special jacks, chokers, and similar items, required for installation.

H. Sanitary Sewer Separation: The CONTRACTOR shall furnish all labor, equipment and materials required to replace sections of existing sanitary sewers or encase existing sanitary sewers in reinforced concrete as required to comply with Oregon Health Authority – Drinking Water Program requirements for minimum separation of water mains from sanitary sewers.

3.2 Handling and Storage of Pipe

A. It shall be the responsibility of the CONTRACTOR to locate an approved storage site for all equipment and materials.

B. 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 Owner's Representative.

C. Where pipe is placed in stockpiles, it shall be neatly piled and blocked with strips between tiers.

D. Distributing Materials: Place materials along top of excavations only as will be used each day, unless otherwise approved by Owner's Representative. Placement of materials shall not be hazardous to traffic or to general public, obstruct access to adjacent property, or obstruct others working in area nor shall it in any way pose a safety hazard.

3.3 Thrust Restraint

A. All tees, plugs, caps, bends, offsets, as well as other appurtenances which are subject to unbalanced thrust, shall be properly braced with concrete thrust blocks, unless otherwise directed by the ENGINEER.

B. Provide restraint systems at all fittings and on all piping joints within the specified or shown distance in the Plans.

C. Where shown on the Plans or as specified, the Contractor shall install concrete thrust blocks of the minimum size, configuration and minimum strength

necessary to resist thrust forces for the particular piping configuration shown or specified.

D. Concrete thrust blocks shall have a minimum 28-day compressive strength of 3,000 psi.

E. The concrete blocking shall bear against solid undisturbed earth at the side and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints of the pipe or fittings.

F. Wrap all ductile iron piping in polyethylene encasement prior to pouring concrete thrust blocks.

G. Thrust blocks shall be formed so that fitting joints remain accessible, and blocks that are to be removed in future waterline extensions shall be supplied with a rebar pulling loop and formed so that the block may be pulled off without disturbing the fitting.

3.4 Polyethylene Encasement

A. Polyethylene encasement of ductile iron pipe and fittings and buried metallic items shall be accomplished in accordance with AWWA C105, Method A, one length of polyethylene tube for each length of pipe.

B. Sand backfill shall be placed with the trench pipe zone and bedding area wherever polyethylene encasement is used.

3.5 Testing and Disinfection of Ductile Iron Pipe Mains

A. Testing and disinfection of ductile iron pipe mains shall be done in accordance with Section 01650, Pipeline Testing and Disinfection, AWWA Standard C600, and AWWA Standard C651.

B. All chlorinated water used in disinfection of water mains shall either be discharged through an approved connection to a public sanitary sewer system or shall be dechlorinated to limits acceptable by the Oregon State Department of Environmental Quality (DEQ) prior to discharge into any storm drainage system or open drainageway. No chlorinated water shall be discharged into a storm drainage system or an open drainageway without a dechlorination plan meeting DEQ's requirements.

END OF SECTION

SECTION 02641

HDPE PRESSURE PIPE

PART 1 GENERAL

1.1 Scope

This section covers high-density polyethylene (HDPE) pressure pipe, both buried and installed within reservoirs. HDPE pipe shall be furnished complete with all fittings, jointing materials, and appurtenances.

1.2 Reference Specification

Refer to the latest edition of ANSI/AWWA C906, AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution and Transmission.

1.3 Submittals

A. Complete layout drawings, details, and specifications covering all HDPE piping and accessories shall be submitted.

B. Certified copies of physical and chemical test results shall be submitted for the materials to be provided.

C. An affidavit of compliance and certification of special quality assurance testing shall be submitted.

PART 2 MATERIALS

2.1 General

The nominal diameter(s) of the pipe(s) are as shown on the Drawings.

2.2 Materials

A. Pipe

Pipe shall meet the requirements of ANSI/AWWA C906, Standard PE Code Designation - PE 3408, minimum cell classification - PE 334434C (ASTM D3350). Pipe may also be PE 4710 in accordance with the pending revisions to ANSI/AWWA C906-07. Pipe shall be iron pipe size (IPS) outside diameter

(OD) or ductile iron pipe size (DIPS) outside diameter (OD). All HDPE pipe and fittings shall be dimension ratio (DR) 17.

B. Joints and Fittings

Pipe shall be joined using thermal butt fusion method only per ASTM D3261. HDPE fittings shall be of the same class as the HDPE piping.

Reservoir hydraulic mixing system piping connections shall be flanged. Stainless steel hardware shall be used.

C. Connections with Other Pipe Types

Connections between HDPE pipe and other pipe types shall be made using pipe and fittings as shown on the plans.

PART 3 EXECUTION

3.1 Inspection

Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. All defective pipe and fittings shall be removed from the site of the work.

3.2 Preparation

The interior of all pipe and fittings shall be thoroughly cleared of all foreign matter prior to installation. Precautions shall be taken to prevent foreign material from entering the pipe during installation.

3.3 Handling

Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage or change the pipe and fittings. Hooks inserted in ends of pipe shall have broad well-padded contact surfaces. Pipe shall not be stored uncovered in direct sunlight.

3.4 Joining

A. Sections of polyethylene pipe shall be joined into continuous lengths on the job site above ground per ASTM D3261. The joining method shall be the thermal butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in

the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements for 400°F, alignment, and 75 psi interfacial fusion pressure.

B. Butt fusion joining shall be 100 percent efficient providing joint weld strength equal to or greater than the tensile strength of the pipe. Socket fusion will not be allowed. Extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications or in fabrications where shear or structural strength is important.

3.5 Testing and Disinfection

Disinfect all sections of HDPE pipe per the requirements of Section 01650 Pipeline Testing and Disinfection. Non-buried HDPE pipe shall be visually inspected by ENGINEER for leakage prior to final placement into service.

END OF SECTION

SECTION 02642

HDPE PIPE FOR STORM DRAINAGE

PART 1 GENERAL

1.1 Scope

A. This Section covers high-density polyethylene (HDPE) pipe for gravity storm drainage systems. HDPE pipe shall be furnished complete with all fittings, joint materials and appurtenances.

B. Materials to be furnished and installed includes, but is not limited to:

1. All pipe, fittings, bends, beveled pipe, adapters, bulkheads, stoppers, plugs, joints restraints, joints and jointing materials and pipe supports

2. Make connections to all existing and/or new facilities and provide temporary services

3. Test and clean pipelines

1.2 Delivery, Storage and Handling

A. Comply with requirements of these Specifications
B. Protect the pipe from the sun and provide adequate ventilation.

1.3 Submittals

A. Submit shop drawings in accordance with these Specifications showing: layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, pipe supports and any special provisions required for assembly.

B. Product Data -- Provide data on pipe, fittings and accessories.

C. Provide the pipe manufacturer's certificate stating that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification. An authorized agent of the manufacturer shall sign the certificate.

D. When requested by the ENGINEER, certified copies of physical and chemical test results shall be submitted for the materials to be provided.

PART 2 PRODUCTS

2.1 Materials

A. Polyethylene Pipe

Solid pipe, perforated pipe, and fittings shall meet the requirements of AASHTO M-252 for pipe 3 inches to 10 inches in diameter, and AASHTO M-294 for pipe 12 inches to 36 inches in diameter. Pipe shall also meet the requirements of ASTM F-405 and F-667.

B. Joints -- Pipe joints shall be integral bell push-on type.

C. Pipe shall be ADS N-12 with Pro Link joints, or approved equal.

PART 3 EXECUTION

3.1 Product Handling

A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.

B. Storage -- Store all pipe on a flat surface so as to support the barrel evenly. It is not recommended that pipe be stacked higher than four feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from the sunlight.

3.2 Inspection

A. All pipe sections, specials and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece installed shall be removed and replaced with a new pipe section in a manner satisfactory to the ENGINEER at the CONTRACTOR’s expense.

B. Defective material shall be marked with a lumber crayon and removed from the job site before the end of the day.

3.3 Preparation

A. Excavate trenches and prepare and maintain subgrade as described in these Specifications and shown on the Plans. Pipe base shall be inspected prior to placement of the pipe. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.

B. All pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the drawings.

C. Remove dirt and foreign material, inside and outside, from pipe and fitting materials before assembly.

D. Make straight-fired cuts without chipping or cracking pipe.

3.4 Installation

A. Install pipe and accessories in accordance with manufacturer's instructions.

B. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

C. Install pipe and fittings to the line and grade specified on the Drawings with bell end upstream, with joints centered, spigots home, pipe properly supported and restrained against movement, and all valve stems plumb.

D. Lay pipe from the low end toward the high point. Provide a continuous, smooth invert. Bell holes shall be dug where necessary and the pipe shall be placed and supported on bedding material the full length of the barrel.

E. All loose dirt shall be removed from the bottom and the trench backfilled with specified bedding material to pipe laying grade.

F. The maximum allowable tolerance for grade is 0.05 feet.

G. The open ends of all pipes and special castings shall be plugged or otherwise closed with a watertight plug before leaving the work for the night, and at other times of interruption of the work. All pipe ends, which are to be permanently closed, shall be plugged or capped and restrained against internal pressure.

H. Joints -- Install per the manufacturer's recommendations.

3.5 Pipeline Testing

A. General

Gravity pipelines shall be subject to acceptance tests. The CONTRACTOR shall provide necessary utilities, labor and facilities for testing and shall dispose of waste, including water.

B. Testing

1. Obstructions -- After backfilling and restoration of surfaces, gravity pipelines shall be inspected for obstructions and shall be cleaned. Pipes less than 24 inches in diameter shall be cleaned using the sewer ball method. Flushing may clean lines larger than 36 inches in diameter as long as it is first visually inspected to assure that no physical obstructions exist. Flushing shall be such that velocities are at least 2.5 feet per second.

2. Lamping and final inspection -- Before the system will be accepted by the OWNER after work is completed, but before flows are introduced into the new lines, after the CONTRACTOR has specifically checked all manholes and lines for unfinished work, then the CONTRACTOR may ask for final inspection and lamping of the lines. The CONTRACTOR shall correct any failure in the lines, misalignment, or the presence of problem causing foreign material. The lamping shall be done by using a bright portable light at one manhole or catch basin and viewing the inside of the pipe from another manhole or catch basin. The CONTRACTOR shall furnish staff and equipment to assist in this final inspection and lamping.

C. Special Testing -- Deflection of HDPE Pipe

1. Vertical Ring Deflection -- Before final acceptance of lines constructed of these materials, all sections of specified pipe eight inches and larger in diameter shall be measured for vertical ring deflection by the CONTRACTOR and witnessed by the ENGINEER. Maximum deflection under full load shall not exceed five percent of the average inside diameter as determined by the laboratory for the specified piping.

2. Failures -- Should any pipe exceed the allowable deflection, the CONTRACTOR shall replace those pipes and retest the section as directed by the ENGINEER.

3. Equipment -- Equipment used in testing shall be go/no go pull through gauges of a type approved by the ENGINEER. Each gauge must be checked and approved by the laboratory before using. A metal or plastic gauging ring of diameter equal to 95 percent of the specified average pipe diameter shall be furnished with each gauge required.

4. Testing Equipment and Personnel -- The CONTRACTOR shall provide Testing equipment and personnel to perform the required tests. The ENGINEER must witness the tests.

5. Use of mechanical pulling devices will not be permitted.

3.6 Pipe and Manhole Abandonment and Removal

Pipe to be removed shall be cut off at the berm intersection or where indicated on plans. Remaining cut end and abandoned pipe shall be properly plugged watertight with fittings or masonry plug. Manholes and structures to be abandoned shall be filled with suitable material as approved by OWNER and ENGINEER. Any removed salvageable items shall remain the property of the OWNER, and shall be stored as directed by the OWNER. The OWNER may refuse any items. The CONTRACTOR must properly dispose of such items free of charge to OWNER.

3.7 Field Testing

A. All materials, process of manufacturing and finished pipe shall be subject to inspection and approval.

B. The ENGINEER may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The CONTRACTOR shall furnish the first test piece or pipe core and any additional samples required because of failures. Should the sample fail to meet specifications, the laboratory in conformance with the specifications shall conduct retest.

3.8 Protection

A. Protect finished Work under provisions of these Specifications.

B. Protect pipes and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02644

PVC PIPE FOR STORM DRAINAGE & SANITARY SEWER

PART 1 GENERAL

1.1 Scope

A. This section covers polyvinyl chloride (PVC) for gravity storm drainage and sanitary sewer systems. PVC pipe shall be furnished complete with all fittings, joint materials and appurtenances.

B. Materials to be furnished and installed includes, but is not limited to:

1. All pipe, fittings, bends, beveled pipe, adapters, bulkheads, stoppers, plugs, joints restraints, joints and jointing materials, and pipe supports.

2. Make connections to all existing and/or new facilities and provide temporary services.

3. Test and clean pipelines.

1.2 References

A. ASTM F402: Practice for safe handling of solvent cements and primers used for joining thermoplastic pipe and fittings.

B. ASTM D1784: Specification for rigid Poly Vinyl Chloride (PVC) compounds and chlorinated Poly Vinyl Chloride (CPVC) compounds.

C. ASTM D2564: Solvent Cements for Poly Vinyl Chloride (PVC) plastic pipe and fittings.

D. ASTM D2855: Making Solvent-Cemented joints with Poly Vinyl Chloride (PVC) pipe and fittings.

1.3 Delivery, Storage and Handling

A. Comply with requirements of these Specifications.
B. Protect the pipe from the sun and provide adequate ventilation.

1.4 Submittals

A. Submit shop drawings in accordance with these Specifications showing: layout plan and dimensions, schedule of pipe fittings and specials, materials

and class for each size and type of pipe, joint details, pipe supports and any special provisions required for assembly.

B. Product Data: Provide data on pipe, fittings, and accessories.

C. Provide the pipe manufacturer's certificate stating that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification. The certificate shall be signed by an authorized agent of the manufacturer.

D. When requested by the ENGINEER, certified copies of physical and chemical test results shall be submitted for the materials to be provided.

PART 2 PRODUCTS

2.1 Materials

A. Pipe

1. In non-pressurized systems, PVC pipe shall be manufactured from rigid polyvinyl chloride compounds conforming to ASTM D-1784, Class 12454-B. PVC pipe and fittings 4 inches to 15 inches in diameter shall meet the requirements of ASTM D-3034, SDR 35. PVC pipe 18 inches and larger in diameter shall conform to ASTM F-679, PS-46. Pipe shall have a minimum stiffness of 46 psi.

2. At locations indicated on the plans, PVC pipe shall conform to the requirements of AWWA C900 and be manufactured from rigid polyvinyl chloride compounds conforming to ASTM D-1784, Class 12454-B. PVC pipe and fittings 4 inches to 12 inches in diameter shall meet the requirements of ASTM D-3139, DR 25. Pipe shall have a minimum stiffness of 149 psi.

B. Joints

1. Non pressurized PVC pipe joints shall be integral bell push-on type meeting the requirements of ASTM D-3212. Gaskets shall be rubber ring type meeting the requirements of ASTM F477. Rubber gaskets shall be factory installed.

2. Joints for PVC pipe meeting the requirements of AWWA C900 shall be integral bell push-on type meeting the requirements of ASTM D-3139. Gaskets shall be rubber ring type meeting the requirements of ASTM F477. Rubber gaskets shall be factory installed.

PART 3 EXECUTION

3.1 Product Handling

A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.

B. Storage: Store all pipe on a flat surface so as to support the barrel evenly. It is not recommended that pipe be stacked higher than four feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from the sunlight.

3.2 Inspection

A. All pipe sections, specials and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece installed shall be removed and replaced with a new pipe section in a manner satisfactory to the ENGINEER at the CONTRACTOR's expense.

B. Defective material shall be marked with a lumber crayon and removed from the job site before the end of the day.

3.3 Preparation

A. Excavate trenches and prepare and maintain subgrade as described in these Specifications and shown on the Plans. Pipe base shall be inspected prior to placement of the pipe. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

B. All pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the drawings.

C. Remove dirt and foreign material, inside and outside, from pipe and fitting materials before assembly.

D. Make straight field cuts without chipping or cracking pipe.

3.4 Installation

A. Install pipe and accessories in accordance with manufacturer's instructions.

B. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

C. Joints

1. Rubber-Ring and Chemically Welded Joints: Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain watertight joint. Trenches shall be kept water free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.

2. Gaskets: Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. Before the joint is fully "home," the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced. The pipe is then forced "home" firmly and fully. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

D. Install pipe and fittings to the line and grade specified on the Drawings with bell end upstream, with joints centered, spigots home, pipe properly supported and restrained against movement, and all valve stems plumb.

E. Lay pipe from the low end toward the high point. Provide a continuous, smooth invert. Bell holes shall be dug where necessary and the pipe shall be placed and supported on bedding material the full length of the barrel.

F. All loose dirt shall be removed from the bottom and the trench backfilled with specified bedding material to pipe laying grade.

G. Variance from the established line and grade shall not be greater than 1/32-inch per inch of pipe diameter and shall not exceed 1/2-inch for line and 1/4-inch for grade, providing that such variation does not result in a level or reverse-sloping invert. Variation in the invert elevation between adjoining ends of pipe, including fittings, shall not exceed 1/64-inch per inch of pipe diameter, or 1/2-inch maximum.

H. The open ends of all pipes and special castings shall be plugged or otherwise closed with a watertight plug before leaving the work for the night, and at

other times of interruption of the work. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.

3.5 Pipeline Testing

A. General: Gravity pipelines shall be subject to acceptance tests. The CONTRACTOR shall provide necessary utilities, labor and facilities for testing and shall dispose of waste, including water.

B. Testing

1. Obstructions: After backfilling and restoration of surfaces, gravity pipelines shall be inspected for obstructions and shall be cleaned. Pipes less than 24 inches in diameter shall be cleaned using the sewer ball method. Lines larger than 36 inches in diameter may be cleaned by flushing as long as they are first visually inspected to assure that no physical obstructions exist. Flushing shall be such that velocities are at least 2.5 feet per second.

2. Leakage: Gravity pipe drain lines including interior buried and encased lines shall be tested for leakage after backfilling. The program of testing shall fit the conditions as mutually determined by the ENGINEER and the CONTRACTOR. The CONTRACTOR shall take necessary precautions to prevent joints from separating while the piping or their appurtenances are being tested. The CONTRACTOR shall, at the CONTRACTOR's own expense, correct any excess leakage and repair any damage to the pipe and their appurtenances or to any structures resulting from or caused by these tests. No pipe sealant will be allowed in repair. Where required by the ENGINEER, the line shall be retested at the CONTRACTOR's expense to meet the Specifications.

a. Test method shall be either hydrostatic in accordance with APWA 303.3.09B or air in accordance with APWA 303.3.09C.

b. Where the actual leakage exceeds the APWA Standards, the CONTRACTOR shall determine the cause, and repair it before the pipe will be accepted. If the leakage is less than allowable and leaks are observed at a particular point. such leaks shall be repaired at the ENGINEER's direction. For the purpose of this subarticle, a section of pipe is defined as that length of pipe between successive special structures.

c. At any time during the construction period if there is any evidence to indicate excess infiltration or defect in any run of

pipe, then the run shall be rejected and the CONTRACTOR shall correct said leakage or defect at no expense to the OWNER.

3. Lamping and final inspection: Before the system will be accepted by the OWNER and after work is completed, but before flows are introduced into the new lines and after the CONTRACTOR has specifically checked all manholes and lines for unfinished work, then the CONTRACTOR may ask for final inspection and lamping of the lines. Any failure in the lines, misalignment, or the presence of problem causing foreign material, shall be corrected by the CONTRACTOR. The lamping shall be done by using a bright portable light at one manhole or catch basin and viewing the inside of the pipe from another manhole or catch basin. The CONTRACTOR shall furnish staff and equipment to assist in this final inspection and lamping.

C. Special Testing: Deflection of PVC Sewer Pipe.

1. Vertical Ring Deflection: Before final acceptance of sewer lines constructed of these materials, all sections of specified sewer pipe eight inches and larger in diameter, shall be measured for vertical ring deflection by the CONTRACTOR and witnessed by the ENGINEER. Maximum deflection under full load shall not exceed five percent of the average inside diameter as determined by the laboratory for the specified piping.

2. Failures: Should any pipe exceed the allowable deflection, the CONTRACTOR shall replace those pipes and retest the section as directed by the ENGINEER.

3. Equipment: Equipment used in testing shall be go/no go pull through gauges of a type approved by the ENGINEER. Each gauge must be checked and approved by the laboratory before using. A metal or plastic gauging ring of diameter equal to 95 percent of the specified average pipe diameter shall be furnished with each gauge required.

4. Testing Equipment and Personnel: Testing equipment and personnel to perform the required tests shall be provided by the CONTRACTOR. Tests must be witnessed by the ENGINEER.

5. Use of mechanical pulling devices will not be permitted.

D. Television Inspection: All sanitary sewer lines shall be video inspected by the CONTRACTOR per the APWA Specifications.

3.6 Pipe and Manhole Abandonment and Removal

Pipe to be removed shall be cut off at the berm intersection or where indicated on plans. Remaining cut end and abandoned pipe shall be properly plugged watertight with fittings or masonry plug. Manholes and structures to be abandoned shall be filled with suitable material as approved by OWNER and ENGINEER. Any removed salvageable items shall remain the property of the OWNER, and shall be stored as directed by the OWNER. The OWNER may refuse any items. The CONTRACTOR must properly dispose of such items free of charge to OWNER.

3.7 Field Testing

A. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.

B. The ENGINEER may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The CONTRACTOR shall furnish the first test piece or pipe core and any additional samples required because of failures. Should the sample fail to meet specifications, retests shall be conducted by the laboratory in conformance with the specifications.

3.8 Protection

A. Protect finished Work under provisions of these Specifications.

B. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02664

WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 Description

Work includes furnishing and installing service connections 2-inches in diameter and smaller from the main to the water meter. The water meter shall be furnished and installed by others unless specified otherwise elsewhere in the contract documents. Connection from new meter to existing plumbing to be made by City staff. All excavation and restoration to be made by Contractor.

1.2 Reference Specifications, Codes, and Standards

A. Comply with the provisions of the latest versions of the following Codes, Specifications and Standards, except as otherwise shown or specified.

B. The following is a list of standards which may be referenced in this Section:

1. American Society of Mechanical Engineers (ASME):

   a. B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
   b. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
   c. B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

2. ASTM International (ASTM):

   a. B43, Standard Specifications for Seamless Red Brass Pipe, Standard Sizes.

   b. B88, Standard Specification for Seamless Copper Water Tube.

   c. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.

   d. B601, Standard Classification for Temper Designations for Copper and Copper Alloys-Wrought and Cast.

   e. B687, Brass, Copper and Chromium-Plated Pipe Nipples.

3. American Water Works Association (AWWA):

   a. C600, Installation of Ductile-Iron Mains and Their Appurtenances.

   b. C700, Cold-Water Meters - Displacement Type, Bronze Main Case.

   c. C701, Cold-Water Meters - Turbine Type, for Customer Service.

   d. C702, Cold-Water Meters - Compound Type.

   e. C706, Direct-Reading, Remote-Registration Systems for Cold-Water Meters.

   f. C800, Underground Service Line Valves and Fittings.

   g. M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

4. National Sanitation Foundation (NSF):

   a. Standard 61, Drinking Water System Components - Health Effects.

   b. Standard 372, Drinking Water System Components - Lead Content.

5. Ductile Iron Pipe Research Association (DIPRA) Standards

1.3 Submittals

A. Product material data including all pipe, fittings and appurtenance information in accordance with Section 01300 Submittals.

B. Provide pipe manufacturers, certificates stating that the materials have been sampled and tested in accordance with the provisions of the designated specifications and meet the requirements of the designated specifications. An authorized agent of each manufacturer shall sign the certificate.

1.4 Quality Assurance

A. Unless otherwise noted, all water works materials provided shall be new, of first class quality and shall be made by reputable manufacturers.

B. All material of like kind shall be provided from a single manufacturer unless otherwise approved by the ENGINEER.

C. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage and handling.

D. 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 Delivery, Storage, and Handling

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store products and materials off ground and under protective coverings and away from walls.

C. Exercise care in handling products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 General

A. Service line materials shall conform to AWWA C800 and as follows:

1. Service line materials for normal pressure service applications shall be designed for a working pressure of 100 psig.

2. Where high pressure service materials are called for they shall be designed for a working pressure of 150 psig.

3. All materials in contact with potable water shall be NSF/ANSI Standard 61 certified and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.

2.2 Saddles

A. 1-inch services: Direct tap. Saddles not used.

B. 1 ½-inch to 2-inch services: 2-inch diameter female iron pipe thread outlet, double strap, stainless steel. Body of saddle shall be ductile iron coated with nylon, and straps, bolts, washers and nuts shall be Type 304 stainless steel.

2.3 Corporation Stops

A. 1-inch:

1. Brass construction. All wetted parts per ASTM B584.

2. Inlet: AWWA male iron pipe taper threading.

3. Outlet: Compression connection compatible with copper tubing.

4. Manufacturers:

a. Mueller, H-15008.
b. Ford, F1000 4Q.

B. 2-inch:

1. Brass construction. All wetted parts per ASTM B584.

2. Inlet: Compression connection compatible with copper tubing.

3. Outlet: Flange meter.

4. Manufacturers:

a. Mueller, H-14277
b. Ford FV23-777W

2.4 Service Fittings

A. General

1. All fittings shall meet or exceed the pressure rating of the pipe to which they are connected.

2. Comply with ASME B16.15.

B. Angle Meter Valves

1. Brass construction. All wetted parts per ASTM B584.

2. Inlet: Compression.

3. Outlet: Meter swivel nut with180-degeree turn check, lock wing.

a. For 2-inch services, meter flange is also allowed.

4. Manufacturers:

a. 1-inch:

1) Mueller, H-14258.
2) Ford, KV43-444W-Q.

b. 2-inch:

1) Muller, H-14277.
2) Ford, KV23-777W.
3) Mueller, H-14277 (meter flange outlet).

2.5 Service Pipe

A. Copper Tubing Service Pipe**:**

1. Copper tubing service pipe shall be annealed and seamless tubing and shall conform to the requirements of ASTM B 88M, Type K.

2. Sizes 1-inch diameter and below shall be soft drawn design, 0.065-inch wall thickness.

3. Sizes larger than 1-inch diameter shall be hard drawn design, 0.083-inch wall thickness.

4. Fittings: Conform to ASME 16.22, wrought copper.

5. Joints: Compression connection.

a. Straight couplings, copper to inside iron pipe: Mueller 110 compression or equal.

b. Copper couplings, copper to outside iron pipe threads: Mueller 110 compression union or equal.

2.6 Meter Boxes and Covers

A. Meter Boxes:

1. Construction: Reinforced concrete. Designed for AASHTO H-20 loading.

2. Manufacturers:

a. For 1-inch service:

1) Brooks, Body No. 37.

b. For 2-inch service:

1) Brooks, Body No. 65 (2”).

B. Covers:

1. Construction: Reinforced concrete. Designed for AASHTO H-20 loading.

2. Cast iron reading lid.

3. Manufacturers:

a. For 1-inch service:

1) Brooks, Body No. 37-S.

b. For 2-inch service:

1) Brooks, Body No. 65-S (2”).

PART 3 EXECUTION

3.1 General

A. All materials, workmanship and installation shall conform to referenced AWWA Standards, City of West Linn Standards and other requirements of these Specifications.

B. The methods employed by the CONTRACTOR in the storage, handling, and installation of pipe, fittings, valves and appurtenances shall be such as to insure that the material, after it is placed, tested and permanently covered by backfilling, is in as good a condition as when it was shipped from the manufacturer’s plant.

C. All new copper pipe and service fittings shall be kept clean and free of debris.

D. Should any damage occur to the material, repairs or replacement shall be made to the satisfaction of the ENGINEER at no expense to the OWNER.

3.2 Copper Service Installation

A. Where indicated on the drawings or as determined in the field, the contractor will be required to install copper water services. This will require the contractor to make all taps for the service, install new copper pipe or transfer existing copper pipe to new main and install either Corporation Stops or 2 in. gate valves. See Standard Drawing WL-402 and WL-403 for installation requirements.

B. Where new 1 in. copper service pipe is to be installed at the existing meter locations, the new Angle Meter Stop shall be set at the same elevation as the existing Angle Meter Stop with a maximum of 2 in. away from connection point on the existing meter. All new copper pipe and service fittings shall be kept clean and free of debris. City water crews will make connection of new Angle Meter Stop to existing meter. City water crews shall only have to remove the existing Angle Meter Stop, connect the new Angle Meter Stop, and flush the new service. Any extra time and materials required due to the Contractor's negligence shall be recorded and deducted from the Contractor's final payment.

C. Where new services are installed, new meter boxes shall be set with the top of the box at finish grade. The longest dimension of the box shall be set perpendicular to the centerline of the street. A new meter box shall be provided where, in the opinion of the City Engineer, an existing meter box is cracked, broken, or has missing parts. Where an existing meter must be relocated, Contractor shall provide and install the new copper service, Angle Meter Stop, and meter box complete and adjusted, to finished grade. City water crew will install the meter.

D. All copper and brass structures shall be bedded and covered with 3/4 in. minus crushed aggregate to a depth of 6 in. on all sides. However, the interior of the meter box shall be backfilled with soft earth free of gravel and organic matter.

E. Service lines shall be located in a direct line between the meter and a point on the main directly opposite the meter. Service lines shall have a minimum cover of 30 in. except where crossing road ditches where the cover may be reduced to 24 in. at said road ditch.

F. Where existing copper service is to be transferred to new main, and the existing main is to remain live, City crew shall disconnect corporation Stop from old main and install a brass plug. Contractor shall provide excavation down to old Corporation Stop, select backfill and compaction. Excavation and backfill shall be considered incidental to the project. Contractor shall perform surface restoration according to the bid item for that work.

G. All new services crossing existing metal gas lines shall have PVC sleeves as shown on Standard Drawing WL-402 and WL-403.

H. Corporation Stops shall be set at a 30° angle up from horizontal. Taps shall be a minimum distance of 18 in. from the bell or spigot end of the main or another service tap.

I. Where a new section of copper service is to be installed, it shall be type K, seamless soft annealed copper pipe conforming with ASTM B 88. There shall be no splicing of copper unless service is longer than 60 ft. or as approved by the City Engineer (unique conditions). When splicing is approved between two pieces of copper, it shall be done with a three piece copper to copper union. No more than one splice per service shall be made and splicing shall be made outside of the existing or proposed travel lane. Existing galvanized service lines encountered by the contractor shall be replaced with copper service pipe up to and through the Angle Meter Stop.

J. Where 1-1/2 in. and 2 in. services are to be installed, the new main shall be tapped 2 in., a double strap 2 in. I.P.T. service saddle, 2 in. x 6 in. brass I.P.T. nipple, 2 in. I.P.T. gate valve and 2 in. x 3 in. male I.P.T. x copper composite adapter. Two inch rigid copper tubing and 1-1/2 in. or 2 in. Angle Meter Stop shall then be installed to the new meter location.

K. Once the new copper services are installed by the Contractor and the new waterline facilities are pressure tested, chlorinated and accepted, City water crews shall relocate existing meters to their new locations and replumb the service. It shall be the responsibility of the Contractor to coordinate this with the City Construction Inspector. Placement of new sidewalks or other surface restoration shall not take place until meters have been installed.

3.3 Flushing, Testing and Disinfection

A. Flush, test and disinfect all service connections and appurtenances in accordance with Section 01650, Pipeline Testing and Disinfection.

END OF SECTION

SECTION 02700

STORM DRAINAGE FACILITIES

PART 1 GENERAL

1.1 Description of Work

Work under this Section includes all drainage related facilities shown on the plans.

1.2 Related Documents

The City of West Linn Public Works Design Standards shall apply except as modified herein.

PART 2 MATERIALS

2.1 Sumps, Manholes, Area Drains, and Catch Basins

All sumps, manholes, area drains, and catch basins shall be provided per above referenced City of West Linn standards. Connections of HDPE pipe to manholes and catchbasins to be made with Kor-N-Seal Boot or PVC sand collar and PVC and/or HDPE couplings as required per HDPE pipe manufacturer's requirements.

2.2 PVC Drainage Pipe (Gravity) - Polyvinyl chloride (PVC) pipe shall conform to ASTM D 3034, SDR 35, for pipe diameter 4-15" and ASTMF-679, SDR35 for pipe diameter 18-24" and shall have rubber gasket joints conforming to ASTM F477 and ASTM 3212.

2.3 High Density Polyethylene (HDPE) Double Wall, Ribbed Pipe With Smooth Interior- Double walled ribbed HDPE pipe with a smooth interior shall conform to ASTM 3350, ASTM 405, ASTM 667, AASHTO M252 and AASHTO M294 and shall have coupled joints with neoprene gaskets. The pipe shall be installed and coupled according to manufacturer’s requirements for installation of culvert and other heavy duty drainage applications. Pipe shall be N-12 as manufactured by ADS, Advanced Drainage System, Inc. or approved equal.

2.4 HDPE Perforated Drainage Pipe -- Polyethylene (PE) drainage pipe and fittings shall be heavy duty conforming to ASTM 405 and manufactured using virgin PE compounds. For perforated pipe perforations shall be cleanly cut so as not to restrict the inflow of water, and uniformly spaced along the length and circumference of the tubing. Circular perforations shall not exceed 3/16-inch diameter. Slots shall not exceed 1/8-inch in width nor 10 percent of the nominal inside circumference for pipe 4 to 8 inches in diameter.

Slots shall be centered in the valleys of the corrugations. The water inlet area shall be minimum of 1 square inch per linear foot of tubing. Corrugated polyethylene drainage tubing and fittings shall be N-12 as manufactured by Advance drainage Systems Inc., or approved equal. Where required by plans, provide geotextile fabric pipe wrap, "ADS Drain Guard Sock Filler" or approved equal.

2.5 ABS Pipe – Use ABS single wall pipe conforming to ASTM D 2751 and ABS composite pipe conforming to ASTM D 2680, with solvent-cemented or mechanical-seal joints as specified.

Perforated ABS pipe and fittings shall be virgin rigid ABS plastic and shall conform to ASTM D 2751, Type 1 and Type IV, except that the minimum heat deflection temperature (ASTM D 648) shall be 180° F. Wall thickness shall be not less than 0.140 inches for 4 inch diameter and 0.200 inches for 6 inch diameter. In addition, the pipe shall be perforated with 3/8 inch holes, 3 inches on center along the pipe. Four inch pipe shall have one row on each side approximately 45 degrees above bottom centerline. Six inch pipe shall have two rows on each side approximately 45 degrees above bottom centerline.

2.6 Concrete Pipe and Fittings: Concrete drain pipe shall conform to current provision of ASTM C76 and unless otherwise shown or specified shall be Class V. Pipe and fittings shall have rubber gasketed joints. Rubber gaskets shall be "O" ring or "D" ring conforming to current provisions of ASTM C443.

Fittings and specials for use with concrete pipe shall be of the same design as the pipe with which they are used. Fittings shall have internal reinforcement as may be required.

2.7 HDPE Fittings

Connections of HDPE pipe to HDPE pipe to be made by means of couplings designed for joining HDPE pipe, ADS N-12 coupler or approved equal. Lateral service connections to be made by ADS N-12 Saddle Tee, or approved equal.

2.8 PVC Fittings

Connections of HDPE pipe to manholes and catch basins to be made with PVC sand collar and PVC and/or HDPE couplings as required per HDPE pipe manufacturer's requirements.

2.9 PVC Liner Pipe Boots

Pipe penetrations through PVC liners shall be sealed using a pipe boot as recommended by the PVC liner manufacturer.

PART 3 EXECUTION

3.1 All construction and installation procedures to conform to above referenced City of West Linn Standards and other related sections herein.

END OF SECTION

SECTION 02800

CHAIN LINK STEEL FENCES AND GATES

PART 1 GENERAL

1.1 Description

This Section covers all work necessary to construct new chain link steel fencing and gates as shown on the Drawings or specified elsewhere. All fences and gates shall be furnished with top rails and knuckled periphery edges.

1.2 Submittals

Submit shop drawings for steel fences and gates, including plan layout and details illustrating fence height, location, and sizes of posts, rails, braces, gates and footings, appurtenances, hardware list and erection procedures.

1.3 Reference Specifications, Codes and Standards

Comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric", and "Industrial Steel Specifications for Fence-Posts, Gates and Accessories", and as specified herein. Requirements stated herein take precedence. Provide each type of steel fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.

PART 2 PRODUCTS

2.1 Materials

A. Fabric

Fabric shall be continuous chain link fence, height as shown on the plans, having a 2-inch mesh, #9 gauge steel core wire. Top and bottom selvage shall be knuckled finish. It shall be galvanized after weaving and the zinc coating shall not be less than 0.9 ounces per square foot. Fabric shall be covered with a minimum 6 mils of fusion-bonded PVC coating, colored black. All mesh shall have knuckled periphery to eliminate sharp appendages.

B. Line Posts

Line posts shall be hot dipped galvanized 2.375" O.D. hot dipped galvanized pipe, weighing 3.12 pounds per lineal foot, and powder coated with color to match finished fence fabric. Line posts shall be spaced not further than 10-foot on-center.

C. Terminal Posts

End, corner and pull posts shall be hot dipped galvanized pipe 2.875 inches O.D. and weighing not less than 4.64 pounds per lineal foot and powder coated to match finished fence fabric.

D. Top Rail

Top rail shall be hot dipped galvanized 1.660 inch O.D. pipe, weighing 1.83 pounds per lineal foot powder coated to match finished fence fabric and shall be furnished in random lengths of approximately 20 feet. They shall be jointed using a pressed steel or malleable sleeve, not only allowing for expansion and contraction, but also providing a continuous brace from end to end of each stretch of fence.

E. Tension Wire

Bottom tension wire shall be #6 gauge heavy galvanized high carbon steel coil spring wire, vinyl coated with color to match the finished fence fabric, securely fixed to the fabric, line posts and terminal posts.

F. Braces

All terminal posts shall be braced with 1.660 inch O.D. horizontal pipe bracing of the same material as the top rail, securely attached to the terminal and first line post with malleable iron fittings. They shall be truss braced from the first line post to the bottom of the terminal post, with a 3/8-inch galvanized truss rod assembly. Corner posts shall be braced in both directions.

G. Fittings

Hot dip galvanized, powder coated with color to match finished fence fabric. All fittings to be malleable, cast iron or pressed steel

H. Fabric Ties

#11 gauge galvanized wire ties shall be used to tie the fabric to the line posts and rails. Space ties at 14 inches on-center (O.C.).

I. Gates

Gate frames to be made of heavy galvanized 1.90 inch O.D. pipe, weighing 2.28 pounds per lineal foot. Gate frames shall be either welded or assembled with corner fittings. Gate frames and all associated fittings shall be powder coated with color to match finished fence fabric. Corner fittings, ball and socket hinges, catch stops and center rest to be heavy galvanized malleable iron. Hinges as required. Provide diagonal cross-bracing. Gates shall have 3-inch clearance above ground surface and sized for the application shown

J. Gate Posts

Posts shall be hot dipped galvanized pipe 2.875-inch O.D. weighing 4.64 pounds per lineal foot, and powder coated with color to match finished fence fabric.

K. Framework Material

All posts, rails and braces to be heavy galvanized and powder coated with color to match finished fence fabric.

L. Lock Assembly and Gate Stop

Provide for each gate one (1) double-hasp drive gate drop rod lock assembly set in concrete and one (1) gate stop set in concrete. All lock assemblies and gate stops shall be fabricated from heavy galvanized malleable iron. Provide one vandal-proof keyed lock and 3 keys for each gate assembly.

PART 3 EXECUTION

3.1 Installation

A. All materials and workmanship shall be first class in all respects and shall be done in a neat and workmanlike manner. Installation shall be conducted in accordance with the requirements of the Chain Link Fence Manufacturers Institute and these plans and specifications.

B. All line, terminal, gate stops, gate drop, and gate posts shall be fixed with a minimum of 3-foot embedment in concrete poured into a 1-foot diameter hole and plumb upon curing of the concrete.

END OF SECTION

SECTION 03210

REINFORCING STEEL

PART 1 GENERAL

1.1 Description

This section covers the work necessary to furnish, install and complete the reinforcing steel.

1.2 Submittals

The CONTRACTOR shall submit shop drawings of detailed placing and bending lists for the ENGINEER's approval before the reinforcement is fabricated.

1.3 Quality Control

A. Mill test certificates shall be submitted to the ENGINEER to certify that the reinforcing steel meets the specified requirements. Mill test certificates shall be furnished and paid for by the CONTRACTOR.

B. In addition, the ENGINEER may require that test samples be taken and test certificates be furnished by a reputable material testing laboratory at the OWNER's expense.

PART 2 PRODUCTS

2.1 Deformed Reinforcing Bars

A. Unless otherwise specified, reinforcing steel shall be Grade 60 billet steel conforming to ASTM A615.

B. Varying grades shall not be used interchangeably in structures.

C. All such reinforcing shall be deformed steel bars with deformations conforming to the requirements set forth in ASTM Specification A615.

D. Steel bending processes shall conform to the requirements of ACI 318.

E. Bending or straightening shall be accomplished so that the steel will not be damaged.

F. Kinked bars shall not be used.

G. Spiral reinforcement and steel wire shall be cold-drawn steel wire conforming to the requirements of ASTM A82 unless shown otherwise on the Drawings.

2.2 Plain Reinforcing Bars

Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A82 unless shown otherwise on the Drawings.

2.3 Supports

A. Bar supports shall conform to ACI 315.

B. Bar supports shall consist of approved high density "adobes", stainless steel chairs, plastic spacers or plastic shim plates.

1. Brick, broken concrete masonry units, spalls, rocks or similar materials shall not be used for support of reinforcing steel.

2. Steel chairs shall be furnished with plastic tips when incorporated into concrete exposed to view, such as in the roof slab.

3. Plastic spacers shall be PRECO BARSPAN WHEELS, as manufactured by the PRECO CORPORATION or equal.

4. Plastic shim plates may be used to support the plastic spacers and shall be used to support the vertical reinforcing in the corewall, unless shown otherwise on the Drawings.

C. Hot-dipped Galvanized Reinforcing Bars

When reinforcing bars are indicated on the Drawings to be hot-dipped galvanized, they shall be galvanized in accordance with ASTM A767 and ASTM A143. The grade of reinforcing bars shall be as specified under Section 03210-2.1. The bars shall be galvanized in conformance with a Class 1 coating and shall be galvanized after fabrication and shearing.

D. Welded Wire Fabric Reinforcement

If specified on the Drawings, welded wire fabric shall be manufactured in accordance with ASTM A185. It shall be of new stock and free from rust when placed in the work.

E. Steel Tie Wire

Annealed steel tie wire shall be used to fasten the reinforcing steel in place.

PART 3 EXECUTION

3.1 Reinforcing Bars

Comply with the specified codes and standards and Concrete Reinforcing Steel Institutes recommended practice for "placing reinforcing bars," for details and methods of reinforcement placement and supports, and as herein specified.

A. General

1. Mild steel reinforcing bars shall be furnished, cut, bent and placed as indicated on the Drawings.

2. At the time of placing concrete, all reinforcement shall be free from loose mill scale, rust, grease or other coating which might destroy or reduce its bond with concrete.

3. Steel reinforcement which is to be placed in the work shall be stored under cover to prevent rusting, and shall be placed on blocking such that no steel touches any ground surface.

4. All reinforcing steel placed in the work shall be tied together and supported in such a manner that displacement during placing of concrete and shotcrete will not occur.

5. When there is a delay in depositing concrete, reinforcement shall be reinspected and cleaned when necessary.

B. Cutting and Bending

1. Steel reinforcement shall be cut and bent in accordance with ACI 318 and with approved practices and machine methods, either at the shop or in the field.

2. Reinforcement shall be accurately formed to the dimensions indicated on the Drawings and on the bending schedule.

3. Bends for hooks on bars shall be made around a pin having a diameter not less than six times the minimum thickness of the bar.

4. All bars shall be bent cold.

C. Minimum Bar Spacing

The clear distance between parallel bars shall not be less than one and one-half times the diameter of the bars and, unless specifically authorized, shall in no case be less than one inch, nor less than the maximum size of coarse aggregate specified.

D. Concrete Cover (Minimum)

1. On all formed surfaces which will be exposed to water, ground or the elements, there shall be a nominal cover over the steel of 2 inches for bars number 6 through number 18 and 1.5 inches for bars number 5 and smaller, with an installation tolerance of + 1/4 inch. When crossing bars of different diameter are encountered in one face, one shall consider the bar size and location that will provide the largest cover over the nearest steel to the outside surface.

2. Unless otherwise specified in these specifications or shown on the Drawings, all reinforcing steel facing subgrades in footing and floors for concrete construction of the tank shall be given a nominal protective cover of 3.0-inch minimum. The largest cover shall be used when different size bars are encountered in one face.

3. The minimum cover over reinforcing steel for concrete construction of other facilities shall be as shown on the Drawings.

4. No "bury" or "carrier" bars will be allowed unless specifically approved by the ENGINEER.

E. Splicing

1. Except as shown or specified on the Drawings, reinforcing steel shall not be spliced at any location without specific approval by the ENGINEER. Splices in adjacent bars shall be staggered.

2. Where permitted or required, splices in reinforcing steel shall have sufficient lap to transfer full strength of the bar by bond and shear. Unless specified or shown otherwise on the Drawings, the bars at a lap

splice shall be in contact with each other. In no event shall the lap be less than 40 diameters of the spliced bars.

3. Unless specified or shown otherwise on the Drawings, bars shall be lap spliced in accordance with ACI 318 and shall be fastened together with steel tie wire.

4. Unless shown otherwise on the Drawings, where bars are to be lapped spliced at joints in the concrete, all bars shall project from the concrete first placed, a minimum length equal to the lap splice length indicated on the Drawings. All concrete or other deleterious coating shall be removed from dowels and other projecting bars by wire brushing or sandblasting before the bars are embedded in a subsequent concrete placement.

F. Supports

1. All reinforcement shall be retained in place, true to indicated lines and grades, by the use of approved bar supports. The CONTRACTOR shall submit for ENGINEER's approval, samples of all bar supports he proposes to use along with a written description of where each bar support will be used.

2. The supports shall be of sufficient quantity, strength and stability to maintain the reinforcement in place throughout the concreting operations. Bar supports shall be placed no further than 4 feet apart in each direction. Supports must be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete. The CONTRACTOR shall be held responsible for providing the appropriate quantity and type of bar supports.

3. Do not place reinforcing bars more than two inches beyond the last leg on continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

G. Bar Tying

1. Bars shall be tied sufficiently often to prevent shifting. There shall be at least three ties in each bar length (this shall not apply to dowel laps or to bars shorter than 4 feet, unless necessary for rigidity).

2. Slab bars shall be tied at every intersection around the periphery of the slab. Wall bars and slab bar intersections shall be tied at not less than

every fourth intersection, but at not greater than the following maximum spacings:

	Slab Bars (inches)	Wall Bars (inches)
Bars No. 5 and smaller	60	48
Bars No. 6 through No. 9	96	60
Bars No. 10 through No. 11	120	96

H. Reinforcement Around Openings -- Where reinforcing steel has to be cut to permit passage of pipe or to create openings, and should no detail be shown for extra reinforcing in such areas, the area of steel removed by the creation of the opening must be replaced by placing at least double the area of steel removed by the opening equally around the openings. The steel shall be placed such that it extends 5 feet beyond the opening on each side to provide for sufficient bond.

3.2 Welded Wire Fabric Reinforcement

A. General

1. All necessary tie wiring, spacing chairs, or supports shall be installed to keep the welded wire fabric in place while concrete is being placed.

2. The welded wire fabric shall be bent as shown or required on the Drawings to fit the work. Welded wire fabric shall be rolled or otherwise straightened to make a perfectly flat sheet before placing in the Work.

B. Splicing

1. Welded wire fabric shall be lap spliced as indicated on the Drawings. If the lap splice length is not indicated on the Drawings, the welded wire fabric shall be spliced in accordance with ACI 318 and no less than a minimum of 40 wire diameters of the lapped wire, or 12 inches, whichever is greater.

2. Offset end laps in adjacent widths to prevent continuous laps in either direction.

END OF SECTION

SECTION 03230

EARTHQUAKE CABLES

PART 1 GENERAL

1.1 Description

This section covers the work necessary to furnish, install and complete the tank earthquake cables.

1.2 Submittals

The CONTRACTOR shall submit five copies of the quantity, location and details for the ENGINEER's approval before the earthquake cables are fabricated.

PART 2 PRODUCTS

2.1 Earthquake Cables

A. Where called for on the Drawings, earthquake cables consisting of 7 wire galvanized strands, meeting the minimum strength requirements on the Drawings and these Specifications, shall be installed to connect wall and wall footing. If no strength requirements are shown on the Drawings, the minimum ultimate strength for 3/8", 1/2" and 0.6” strand shall be 21,400 lbs., 38,200 lbs. and 53,750 lbs., respectively.

B. The strands shall be hot-dipped galvanized before stranding with a minimum zinc coating of 0.85 oz./ft².

C. Galvanized strands for earthquake cables shall meet the quantity and spacing outlined on the Drawings.

2.2 Closed Cell Neoprene Seismic Cable Sleeves

A. Closed cell neoprene pads, shall be used as a filler material in the flexible joints between the wall and wall-footing and between the wall and roof connection in the areas not taken up by the solid neoprene bearing pads and waterstops.

B. The material shall be medium grade closed cell neoprene conforming to 2A3 of ASTM D 1056 and as further specified herein and on the Drawings.

1. Compression deflection	9-13 PSI
2. Shore 00 durometer	60 (±5) PCF
3. Density	9 (±2) PCF
4. Water absorption by weight	< 10%
5. Temperature range:	
• low (flex without cracking)	-40° F
• high continuous	200° F
• high intermittent	250° F
6. Heat aging (7 days @ 158° F)	
• Flexibility (180° Bend)	PASS
• Appearance change	NONE
• Change in Compression Deflection	±30%
7. Tensile strength	100 PSI min.
8. Elongation	125% min.
9. Resilience (bayshore-% rebound average	
1/2" thickness @ 72° F)	20%

10. Armacell Monarch #5013 (Black), or approved equal, are acceptable materials.

2.3 Mild Steel Reinforcing Bars

The mild steel reinforcing bars for the support of the earthquake cable anchors shall conform to the requirements of Section 03210, REINFORCING STEEL.

PART 3 EXECUTION

3.1 Earthquake Cables

A. The cables may be cut to length with a burning torch.

B. Where necessary, the strands shall be pre-bent before placing the units in wall and wall footings, as called for on the Drawings.

C. The strands shall be tied to circumferential reinforcing as required and as shown on the Drawings.

D. In the footing, the strands shall be tied to the radial footing bars.

END OF SECTION

SECTION 03251

EXPANSION AND CONSTRUCTION JOINTS

PART 1 GENERAL

1.1 Description

This section covers the work necessary to furnish, install and complete the tank expansion and construction joints.

1.2 Submittals

Furnish certified mill certificates showing that the material meets all of the requirements specified herein. The ENGINEER, at his option, may take samples of any materials and have them tested by an independent testing laboratory to verify their compliance with these Specifications. All such costs shall be borne by the OWNER. If any materials should fail to meet these Specifications, all costs for further testing of the replacement material shall be borne by the CONTRACTOR.

1.3 Obstructions

CONTRACTOR shall pay particular attention to removing all obstructions such as concrete, nails, etc., from joints when movements of floor, wall and roof sections can be expected under prestressing, temperature and other conditions.

PART 2 PRODUCTS

2.1 Waterstops

A. Waterstops shall be of an approved type, supplied by an approved manufacturer and shall be plastic made of virgin polyvinylchloride compound, shall be ribbed, uniform in dimensions, dense, homogeneous, free from porosity, and as detailed on the Drawings.

B. No reclaimed PVC shall be used in the compound.

C. The finished waterstop material shall meet the following minimum requirements:

1.	Tensile strength	2,000 psi	(ASTM D412)
2.	Ultimate elongation	350%	(ASTM D412)
3.	Shore hardness	75 ±5	(ASTM D2240)
4.	Specific gravity	1.3	(ASTM D792)

5.	Stiffness in flexure	600 psi	(ASTM D747)
6.	Cold brittleness	-35° F	(ASTM D746)
7.	Water absorption: 48 hrs	0.320% max.	(ASTM D570)
8.	Tear resistance	290 lb./in.	(ASTM D624)

D. VINYLEX CORPORATION and GREENSTREAK PLASTIC PRODUCTS are two of several suppliers who can furnish waterstops meeting these requirements. Approved equal materials may also be used.

2.2. Joint Sealers

A. Joints, not requiring waterstops or when so indicated on the Drawings, shall be sealed with a mastic joint sealer material of uniform, stiff consistency that does not contain solvents.

B. The mastic shall tenaciously adhere to primed concrete surfaces, shall remain permanently mastic and shall not contaminate potable water.

C. The material shall be of a type that will effectively and permanently seal joints subject to movements in concrete.

D. The mastic joint sealer shall be an acceptable two-part, self-leveling (or gun grade), non-staining, polyurethane elastomeric sealant which cures at ambient temperature. Acceptable sealants shall conform to ASTM C920 or Federal Specification TT-S-00227E.

E. For sloping joints, vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ANSI/ASTM C920 Class 12-1/2, or Federal Specification TT-S-0027 E(3), Type II.

F. For plane horizontal joints, the self-leveling compounds which meet the requirements of ANSI/ASTM C920 Class 25, or Federal Specification TT-S-0027 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 25 to 35, shall be used.

G. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.

H. Acceptable polyurethane materials are PSI-270 RESERVOIR SEALANT, as manufactured by POLYMERIC SYSTEMS, INC., SIKAFLEX/2C POLYURETHANE ELASTOMERIC SEALANT, as manufactured by SIKA CHEMICAL CORP., and SELECT SEAL U-227 RESERVOIR GRADE, as manufactured by SPC, or approved equal.

2.3 Preformed Joint Filler

Preformed joint filler material shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D1752 for Type I, except as otherwise specified herein.

2.4 Backing Rod

Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.5 Bond Breaker

Bond breaker shall be SUPER BOND BREAKER WATER BASE as manufactured by Burke Company, SELECT EMULSION CURE 309, as distributed by Select Products Co., (clear or white pigmented) or equivalent. Fugitive dye may be used in bondbreakers if recommended by manufacturer.

PART 3 EXECUTION

3.1 Installation of Waterstops

A. The waterstop shall be correctly positioned in the forms so that the center of the waterstop is centered on the joint.

B. In cases where preformed expansion joint material is used in conjunction with the waterstop, allowance shall be made for equal waterstop embedment on each side in the concrete.

C. Waterstop shall be held in place in the forms by use of a split form or other approved method that will positively hold the waterstop in the correct position and to the correct alignment.

D. Horizontal waterstops shall be bent up during placing of concrete until the concrete has been brought to the level of the waterstop; additional concrete shall then be placed over the waterstop, after which the concrete shall be thoroughly vibrated.

E. All horizontal and vertical waterstops, which are not accessible during pouring, shall be tied off in two directions every 12 inches in such a manner that bending over one way or another is prevented.

F. A hog-ring or nail may be driven through both ends of the waterstop to facilitate placing and tying of waterstops to reinforcing steel forms or form-ties.

G. All waterstops shall be properly spliced and joints shall be checked for strength and pinholes after splicing.

H. Splices shall be strong enough to develop a pulling force of 75 percent of the strength of the waterstop, and shall be watertight.

I. Connect the ends of the radial waterstop in the wall footing joints to the circumferential waterstop in the wall to wall-footing joint and to the circumferential waterstops in the floor to wall-footing joints if they should exist.

3.2 Joint Sealers

A. Joint sealed areas shall be sandblasted or roughened and blown clean of dust and sand with compressed air before the material may be applied.

B. Joints shall be primed (if required) and the sealant shall be applied in accordance with the manufacturer's recommendations.

3.3 Construction 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.

C. Isolation Joints in Slabs-on-Ground - Construct isolation joints where shown on plans 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.

D. Control Joints in Slab-on-Ground - Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4 inch wide x 1/5 to 1/4 of the slab depth, unless otherwise shown. 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.

END OF SECTION

SECTION 03255

TANK WALL BASE AND TOP JOINT

PART 1 GENERAL

1.1 Description

This section covers the work necessary to furnish, install and complete the tank wall base and top joint (if shown on the Drawings).

1.2 Submittals

A. The CONTRACTOR shall provide the ENGINEER a 2-foot minimum length of each of the closed cell neoprene pads and the neoprene bearing pads in order that the ENGINEER can test the pads for compliance with these Specifications.

B. Furnish certified mill certificates showing that the material meets all of the requirements specified herein. The ENGINEER, at his option, may take samples of any materials and have them tested by an independent testing laboratory to verify their compliance with these Specifications. All such costs shall be borne by the OWNER. If any materials should fail to meet these Specifications, all costs for further testing of the replacement material shall be borne by the CONTRACTOR.

PART 2 PRODUCTS

2.1 PVC Waterstops

PVC waterstops shall conform to requirements in Section 03251, EXPANSION AND CONSTRUCTION JOINTS. The size and location of the waterstop shall be as shown.

2.2 Neoprene Bearing Pads

A. Neoprene pads shall be of dimensions and hardness shown on the Drawings and shall be made by an approved manufacturer.

B. The material for 40 durometer neoprene pads shall conform to ASTM D2000 M2BC414A14C12F17 and the material for 30 durometer neoprene pads shall conform to ASTM D2000 M2BC310A14C12F17.

C. Unless otherwise specified on the Drawings, neoprene pads shall be of 40 durometer.

D. KIRKHILL RUBBER CO. and WEST AMERICAN RUBBER COMPANY, INC. are two of several suppliers who can furnish neoprene pads meeting these requirements. Approved equal materials may be used.

2.3 Closed Cell Neoprene Pads

A. Closed cell neoprene pads, shall be used as a filler material in the flexible joints between the wall and wall-footing and between the wall and roof connection in the areas not taken up by the solid neoprene bearing pads and waterstops.

B. The materials shall be medium grade closed cell neoprene conforming to 2A3 of ASTM D1056 and as further specified here-in and on the Drawings.

1. Compression deflection 9-13 PSI

2. Shore 00 durometer 60 (±5) PCF

3. Density 9 (±2) PCF

4. Water absorption by weight < 10%

5.Temperature range:

- low (flex without cracking) -40° F
- high continuous 200° F
- high intermittent 250° F

6. Heat aging (7 days @ 158° F)

- Flexibility (180° Bend) PASS
- Appearance change NONE
- Change in Compression Deflection ±30%

7. Tensile strength 100 PSI min.

8. Elongation 125% min.

9. Resilience 20%

10. Armacell Monarch #5013 (Black), or approved equal, are acceptable materials.

2.4 Soft Mastic

A. Soft mastic shall be installed in all voids and cavities around bearing pads, waterstops and seismic cable sleeves. Such material shall be installed with a consistency that will not adversely affect the quality of PVC and neoprene materials.

B. SIKAFLEX 1A, as manufactured by Sika Corporation or SELECT SEAL U-230, as manufactured by Select Products Company, or approved equal, are acceptable materials.

PART 3 EXECUTION

3.1 Installation of PVC Waterstop

PVC waterstops shall be continuous and shall be installed where shown. The method of installation shall be as specified in Section 03251.

3.2 Bearing and Filler Pads

A. Bearing and filler pads shall be installed as indicated on the Drawings.

B. Bearing and filler pads shall be glued to the concrete with an approved rubber cement material to prevent uplift of the pads during concrete pouring.

C. In addition, all pads shall be held down with approved plastic shim plates placed under the reinforcing steel.

D. Nailing down pads will not be permitted

E. All voids and cavities between bearing and filler pads, waterstop and seismic cable sleeves, irrespective of whether these voids are large or small, shall be filled with a soft mastic in accordance with the requirements of Section 03255-2.4.

F. Closed-cell neoprene shall be ordered at least l/4 inch wider than theoretically required to facilitate placing and to reduce development of voids between filler pads, bearing pads and waterstops.

G. CONTRACTOR's workmanship shall be such that no cement grout or concrete seepage will occur through the bearing and filler pad area resulting in a restraint of radial wall-movements.

H. A continuous neoprene pad and one or more sponge filler pads are required between the top of the wall and the underside of the roof. Any void areas between such pads shall be caulked and sealed to prevent any mortar from the roof pour to come in contact with the wall top.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 Description

The extent of concrete work is shown on the Drawings. This section covers cast-in - place concrete including framework, shoring for concrete and installation into formwork of items such as anchor bolts, setting plates, bearing plates, anchorages, inserts, reveals, frames, nosings, sleeves and other items to be embedded in concrete.

1.2 Submittals and Meetings

A. The following shall be submitted:

1. Shop Drawings shall show complete details and arrangement and bending of reinforcing and embedded items. Comply with the ACI 315 "Details and Detailing of Concrete Reinforcement," showing bar schedules, stirrup spacing, diagrams of bent bars and arrangements of concrete reinforcement. Include special reinforcement required and openings through concrete structures.

2. A sufficient quantity of the proposed aggregate, sand, air-entraining admixtures, cement and water for testing of materials and concrete mix designs referred to under Section 03300-1.4.

3. Certification of aggregate compliance with these Contract Documents, and source of supply and location of all materials and cement.

4. The CONTRACTOR shall schedule and attend a Concrete Placement meeting at least one week prior to placing concrete. The meeting shall be attended by the OWNER, ENGINEER, CONTRACTOR, Testing Laboratory Representative and the Concrete Supplier. The following shall be discussed at the meeting: Safety, Batching and Delivery, Adjustments to Mix; Site Dosing, Placement Rates and Anticipated Schedule of Placing and Finishing, Site Layout –Holding Area; Pump Truck Location; Truck Wash-out Area; Parking area, Equipment – Pumps and Appurtenances; Vibrators; Spare Equipment, Concrete Testing Procedures and Curing.

1.3 Quality Assurance

A. Codes and Standards - Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

B. American Society for Testing and Materials (ASTM)

1. C31 “Standard Practice for Making and Curing Concrete Test Specimens in the Field”

2. C33 “Standard Specification for Concrete Aggregate”

3. C39 “Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens”

4. C40 “Standard Test Method for Organic Impurities in Fine Aggregate for Concrete”

5. C1084 “Standard Test Method for Portland-Cement Content of Hardened Hydraulic-Cement Concrete”

6. C88 “Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate”

7. C94 “Standard Specification for Ready-Mixed Concrete”

8. C131 “Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine”

9. C136 “Standard Test Method for Sieve Analysis to Fine and Coarse Aggregate”

10. C143 “Standard Test Method for Slump of Hydraulic Cement Concrete”

11. C150 “Standard Specification for Portland Cement”

12. C156 “Standard Test Method for Water Loss Through Liquid Membrane Forming Curing Compounds for Concrete”

13. C173 “Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method”

14. C231 “Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method”

15. C233 “Standard Test Method for Air-Entraining Admixtures for Concrete”

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

17. C289 “Standard Test Method for Potential Alkali Silica Reactivity of Aggregates (Chemical Method)”

18. C441 “Standard Test Method for Effectiveness of Pozzolans or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to the Alkali-Silica Reaction”

19. C457 “Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete”

20. C494 “Standard Specification for Chemical Admixtures for Concrete”

21. C670 “Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials”

22. C803 “Standard Test Method for Penetration Resistance of Hardened Concrete”

C. American Concrete Institute (ACI)

1. “Specifications for Structural Concrete,” ACI 301 as supplemented and modified herein.

2. “Standard Practice for Selecting Proportions for Normal Heavyweight, and Mass Concrete,” ACI 211.1.

D. Forming

1. 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.

2. Forming, shoring and bracing designs for footings, walls and roofs shall be designed by the CONTRACTOR to meet all requirements specified here-in.

3. If requested by the ENGINEER, drawings and calculations shall be submitted verifying the selection of form ties, horizontal and vertical stiff-backs or braces for wall panels, forming and form openings, shoring of roof forms, or any other part of forming, shoring or bracing which may be considered critical by the ENGINEER.

4. All falsework and forming requirements for roof support systems must be designed by an ENGINEER registered in the same state as the reservoir will be built in. The drawings, with supporting calculations, must each be signed and sealed by the designer. No work shall be started until the roof support and form design has been reviewed by the ENGINEER. The falsework design ENGINEER must visit the site and approve the erection of all shoring prior to the placement of any concrete.

5. The CONTRACTOR shall be solely responsible for the adequacy of the forming, shoring and bracing design.

6. The turn-around time of the ENGINEER's review will be 2 weeks from date of receipt of each written submittal.

7. Any formwork installed by CONTRACTOR shall be solely at CONTRACTOR's risk. The ENGINEER's review will not lessen or diminish the CONTRACTOR's liability.

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 2, 4, and 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 C94. In case of conflict, ACI 301 shall govern.

PART 2 PRODUCTS

2.1 Concrete Composition

Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water, and specified additives so proportioned and mixed as to produce a plastic workable mixture in accordance with requirements of this section of the specification and suitable to the specific conditions of placement.

2.2 Portland Cement

A. Portland cement shall be from an approved source and shall conform to the requirements of the current ASTM Specification C150, for Type II cement. Only one brand of cement from one manufacturing plant may be used. The use of ground granulated blast furnace slag is not allowed.

B. Cement may be delivered in paper sacks or in bulk.

C. If cement is delivered in sacks, each sack shall contain not less than 94 pounds of cement, and if delivered in bulk, one barrel of cement shall be considered to weigh 376 pounds.

D. In order that the cement may not become unduly aged after delivery, the CONTRACTOR shall use cement that has been stored on the jobsite before using cement direct from freighting, hauling or transporting operations.

E. Storage bins for bulk cement shall be watertight and constructed so that there will be no dead storage.

F. If there is reason to believe that dead storage exists, the bins shall be emptied completely at least once every four months.

G. Cement bins at the mixing plant, and cement storage silos shall be provided with effective dust collectors at the vent to prevent loss of cement.

H. The CONTRACTOR shall designate the source and quantity of cement required for his needs at least 30 days prior to its use, so that appropriate tests, inspection and certification can be made.

I. Certified mill certificates shall be furnished by the cement company with every shipment, giving proof that the above requirements have been met.

J. In addition, the OWNER may conduct, at its own expense, any tests it considers necessary, to insure that the cement furnished meets the specified requirements.

K. Any cement not meeting the Specifications will be rejected.

L. The OWNER may direct the use of Portland cement of a type other than that above specified, in which case it will pay the additional cost, if any, for the cement required over the cost of that specified, or shall receive appropriate credit for any cement required of a lesser cost than specified.

2.3 Fine and Coarse Aggregates

A. Aggregates shall conform to ASTM C33 and as herein specified. Provide aggregates from a single source for all exposed concrete.

B. Fine aggregates shall be clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances and consisting of hard, strong, durable and uncoated particles.

C. Material removable by decantation from fine aggregate shall not exceed five percent (5%) by weight.

D. The moisture content of fine aggregate shall not exceed eight (8%) by weight at the time the aggregate is used for the concrete.

E. Fine aggregate shall be subjected to careful, thorough analysis to determine conformity with all requirements of these specifications.

F. Mortar specimens made with the fine aggregate shall have a compressive strength after seven (7) days of at least ninety percent (90%) of the strength of similar specimens made with Ottowa sand having a fineness modulus of 2.40 ± 0.10.

G. Coarse aggregate shall be washed gravel or crushed stone consisting of hard, tough, durable particles free from adherent coating. Use of pit or bankrun gravel is not permitted.

H. It shall contain no vegetable matter of soft, friable, thin, flat or elongated particles in quantities considered deleterious.

I. A thin, flat or elongated particle is defined as a particle having a maximum dimension in excess of five times its minimum dimension.

J. Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered in the work under consideration shall not be used.

K. When crushed stone is used, the crusher shall be equipped with a screening system which will entirely separate the dust from the stone and convey it to a separate bin.

L. The substances designated shall not be present in excess of the following amounts:

1.	Soft fragments	5%
2.	Clay lumps	1.4%
3.	Material removed by decantation	1%

M. When the material removed by decantation consists essentially of crushed dirt, the maximum amount permitted may be raised to one and one-half percent (1-1/2%).

N. Coarse aggregate shall be subjected to a careful, thorough analysis to determine conformity with all requirements of these Specifications.

O. The maximum size aggregate shall be 1½" inch and the aggregate shall be uniformly well graded from coarse through fine in accordance with the following schedule.

Sieve Size	Percent Passing
1	90 - 100
3/4	70 - 90
3/8	45 - 65
N0. 4	31 - 47
No. 8	23 - 40
No. 16	17 - 35
No. 30	10 - 23
No. 50	2 - 10
No 100	0 - 3
No. 200	0 - 2

P. Corrective measures to remedy deficiencies in aggregate grading may be used only with the written approval of the ENGINEER.

Q. The CONTRACTOR shall furnish satisfactory evidence to the ENGINEER that all aggregate used in the work meets the requirements specified herein. Tests shall be performed by a reputable independent testing laboratory and the cost of testing be borne by the CONTRACTOR.

R. If the ENGINEER deems that additional testing of aggregate is necessary, he may select samples from any of the aggregate delivered to the ready-mix plant or jobsite and have them tested by a laboratory of his choice. Such material shall not be used in the work until test reports are available. If in such tests the material fails to meet the specified requirements, the aggregate will be rejected and the expense of testing shall be borne by the CONTRACTOR. If such tests show the aggregate to be satisfactory, the cost of additional testing will be paid by the OWNER but the CONTRACTOR shall have no claim for costs due to delays caused by testing.

S. When tested in accordance with "Standard Test Method for Organic Impurities in Fine Aggregate for Concrete," (ASTM C40), the fine aggregate shall provide a color in the supernatant liquid no darker than the reference standard color solution.

T. When tested in accordance with "Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate," (ASTM C88), the loss resulting after five cycles shall not exceed 10% for fine aggregate and 12% for coarse aggregate when using sodium sulfate.

U. When tested in accordance with ""Standard Test Method for Resistance to Abrasion of Small Size Coarse Aggregate by use of the Los Angeles Machine," (ASTM C131), the coarse aggregate shall show a loss not exceeding 50% after 500 revolutions or 10% after 100 revolutions.

V. When tested in accordance with "Standard Test Method for Potential Alkali Silica Reactivity of Aggregates (Chemical Method)," (ASTM C289), the aggregates should be represented by points lying to the left side of the solid line of Figure 2 therein.

2.4 Water

Water for mixing shall be clean, fresh and free from injurious amounts of oil, acid, chlorides, sulfates, alkali or organic matter. Water shall conform to ACI 301.

2.5 Admixtures - General

All admixtures used in any mix design shall be manufactured and supplied by the same admixtures company to insure compatibility.

2.6 Retarding Densifiers

A. All Class "A" concrete (as defined in Section 03300-2.9) used for wall construction shall also contain DARATARD-17, as manufactured by Grace Construction Products or approved equal in the amounts recommended by the additive manufacturer whenever the air temperature during the pour exceeds 85° F.

B. 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.

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

2.7 Air-Entraining Agents

A. Unless specifically required by OWNER, Class "A" concrete shall not be air-entrained. Unless otherwise specified, all other concrete may be air-entrained at the option of the CONTRACTOR.

B. Air-entraining agents shall meet ASTM C260, ASTM C233 and ASTM C457.

C. The maximum total volumetric air content of the concrete before placement shall be 6 percent plus or minus one percent as determined by ASTM C173 or ASTM 231.

D. Subject to these Specifications, consideration will be given to the following products: PROTEX "AES," GRACE "DAREX AEA," MASTER BUILDERS "MB-AE90," or SIKA CHEMICAL "AER."

2.8 Water Reducing Admixtures

A. 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 C494, Type A or D.

B. 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.

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

D. Superplasticizers, if allowed by the ENGINEER, shall conform to ASTM C494, Type F or G, batch plant added using second or third generation only.

E. Set control admixtures if allowed by the ENGINEER, shall conform to ASTM C494, Type B (retarding) or Type C (accelerating).

2.9 Proportioning Normal Concrete

Unless indicated otherwise on the Drawings, concrete shall be of the following classes, each meeting the mix and compressive strength requirements as specified hereafter, and shall be used as follows:

1. Class "A" Prestressed concrete reservoir walls.

2. Class "B" Roof slabs and drop panels, floor slabs, wall footings. Pump station floor slabs and footings

3. Class "C" Pipe blocks and appurtenances, columns and column footings

At the CONTRACTOR's option, Class "A" concrete may be substituted for Class "B" and "C" concrete. Likewise, Class "B" concrete may be used in lieu of Class "C" concrete. If Class "A" concrete is substituted for Class "B" or Class "C" concrete, such concrete shall be air-entrained if the Class "B" or "C" concrete is required to be air-entrained.

2.10 Measurement

A. All measurements shall be by weight. However, CONTRACTOR, at his own expense, may increase the cement content at a corresponding reduction in weight of aggregate and sand, whenever he is concerned that the minimum strength and mix ratio requirements under these specifications can not be met. The amount of water to be used shall be the amount necessary to produce a plastic mixture of the specified slump.

B. The slump shall be between two inches and four inches when tested in accordance with ASTM Specifications C143. 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.

2.11 Compressive Strength, Water and Cement Content

A. Not withstanding what has been stated here-before, and unless shown otherwise on the Drawings, the concrete shall meet the following requirements:

	Class A	**Class B**	**Class C**
1. Min. Compressive Strength	5,000 psi	4,000 psi	3,500 psi
2. Max. Water Content (gallon per 94 lb. sack of cement)	4.5 gal.	4.5 gal.	4.5 gal.
3. Min. Cement Content (94 lb. sack of cement per cubic yard of solid concrete)	7.0 sacks	5.5 sacks	6.0 sacks
4. The cement content is required irrespective of strength. Up to a maximum of 15% of cementatious material may be fly ash in accordance with ASTM C618. The use ground granulated blast furnace slag is not allowed.			
5. The total chloride ion content of hardened concrete shall be less than 0.06 percent by weight of cement.			

2.12 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. A plastic shotcrete reglet shall be incorporated into the top of the reservoir corewall as shown on the Drawings.

B. Ties

1. Form ties which remain in the corewall of water-retaining structures 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.

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. Form Size

1. BURKE, ECONOMY, SYMONS, ALUMA, and overlaid plywood complying with U.S. Product Standard PS-1 "B-B High Density Overlaid Concrete Form," Class 1, forms may be used for forming of circular walls, as long as there are no straight sections longer than 36 inches at any place around the outside circumference of such walls.

2. The height of such wall panels shall not exceed 8 feet unless built-in pouring openings are incorporated in such walls.

D. 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.

2.13 Roof Forms

A. Forms and falsework supports for the roof shall be sufficiently rigid and strong to support the wet concrete and the men and equipment necessary for its placement without appreciable deflections. A minimum of 40 PSF for live-load shall be allowed in the design.

B. Allowable deflections and required form camber in roof forms shall be regulated per ACI 347.

C. Forms shall be sloped equal to the prescribed roof slope to avoid exceeding the design roof slab thickness.

2.14 Form Oil:

Form oil compounds shall be NSF-61 approved for use in potable water and shall be provided which will not adversely affect finished concrete surfaces by bonding or staining. Selected form coating shall not adversely affect application of curing compounds or future application of bonding or adhesive products.

2.15 Epoxy Adhesive:

An approved non-sag epoxy adhesive shall be applied over all dry-packed holes on the inside surface of the corewall. An acceptable material is SELECT BOND GP-3000, as manufactured by SELECT PRODUCTS CO. or LV EPOXY as manufactured by SIKA CORPORATION. Approved equal materials may be used.

2.16 Curing Compound

A. All horizontal, screeded and floated surfaces, exposed to drying winds and sunlight, shall be sprayed with ATLAS QUANTUM-CURE as manufactured by Atlas Construction Supply, Inc. (application rate: 200 sf/gallon). Application of the curing compound shall conform to the requirements of 03300 3.11.

B. Alternate curing compounds will be accepted if they are pigmented or colored, such as white, at the time of application and are non-toxic to potable water. Regardless of the type of curing compound used, CONTRACTOR shall assume complete responsibility for its adequacy.

PART 3 EXECUTION

3.1 Concrete Quality

A. Concrete shall conform to the requirements of Section 03300-2.1. The required proportions shall be assembled, well mixed, transported, placed, consolidated, finished and cured as here-in-after specified. Concrete shall be uniformly dense and sound, free from faults, cracks, voids, honeycomb and other imperfections.

B. If not called for specifically, and unless specified otherwise hereunder, concrete requirements shall follow ACI 301 where applicable.

3.2 Mixing

A. Concrete shall be batched in fully automatic or semi-automatic stationary plants or approved portable batch type plants, and mixed in stationary or truck mixers. Mixing equipment and mixing procedures shall be subject to the approval of the ENGINEER.

B. Site-Mixed Concrete

1. Conform to ACI 304 except as modified by these Specifications.

2. Use a batch type mixer capable of combining the aggregates, cement, and water within the specified time into a thoroughly mixed and uniform mass and discharging the mixture without segregation.

3. Use supporting equipment that can accurately proportion the cement, the coarse and fine aggregates, the admixtures, and the water which enters the mixing drum. Proportion the cement and aggregate by weight.

4. Discharge each entire batch before recharging. Do not allow the volume of the mixed materials per batch to exceed the manufacturer's rate capacity of the mixer.

5. Mixing time shall be as follows:

a. For mixer of capacity of 1 cubic yard or less, one and one-half minutes after batching is completed.

b. For mixers of capacities larger than 1 cubic yard, one and one-half minutes plus one-half minute for each additional 1/2 cubic yard capacity or fraction thereof in excess of 1 cubic yard.

c. The mixer shall revolve at a uniform rate as specified by the manufacturer for the mixing equipment.

C. Ready-mixed Concrete

1. Provide central-mixed concrete conforming to ASTM C94 except as modified by these Specifications.

2. Limit the haul time of central-mixed concrete so that the specified slump is attained without the onsite addition of water which will cause the mix design water-cement ratio to be exceeded. In no event shall the time exceed 90 minutes from the batch plant to the completion of the pour, unless specifically approved by the ENGINEER.

3. Use truck-transported, dry-batched concrete or mix on the jobsite when haul time is excessive. Do not retemper partially hardened concrete.

3.3 Protection from Abrasion or Fire

A. Every reasonable precaution shall be taken to protect finished surfaces from abrasion or other damage. Concrete surfaces or edges likely to be injured during the construction period shall be protected by leaving the forms in place or by erecting satisfactory covers. No fire shall be permitted in direct contact with concrete at any time.

3.4 Placement of Concrete

A. Placement shall conform to ACI 304 except as modified by these Specifications.

B. Notify the ENGINEER of readiness, not just intention, to place concrete in any portion of the work. This notification shall be made a minimum of 48 normal working day hours prior to proposed concrete placing. All forms, steel, anchors, ties, inserts, and other embedded items shall be in place before the CONTRACTOR's notification of readiness is given to the ENGINEER.

C. Schedule sufficient equipment for continuous concrete placing, program backup equipment, and the actions to be taken in case of an interruption in placing. Provide extra concrete vibrators. Test the concrete vibrators the day before placing concrete.

D. Concrete in walls shall not be placed in layers thicker than 24 inches (vertical dimension) at any one time except that the bottom layer shall be no thicker than 12 inches.

E. Concrete in circular spirally-tied columns, having no horizontal reinforcement crossing into the region bounded by the vertical reinforcement, may be deposited from the top of the column form at CONTRACTOR's option such that no separation of the coarse aggregate from the mortar takes place. All concrete shall be vibrated as required here-in. The final quality of the poured concrete column shall be the responsibility of the CONTRACTOR. If the quality of the column is found to be unacceptable, the ENGINEER, at the CONTRACTOR's expense, may require the complete removal of the column and may require that an alternate placement method by used.

F. Each layer of concrete in walls and columns shall be vibrated thoroughly before the next layer may be placed thereon. Vibrators shall be taken through the top layer down through the full layer thickness below to insure proper integration of the concrete and to avoid the development of cold joints and honeycomb

between the layers. In other words, each layer of concrete shall be vibrated at least twice.

G. Each wall footing, wall section, column footing (if any) and column pour (if any) shall immediately be preceded with a cement/sand slurry mix consisting of equal parts cement and sand in combination with 4.5 gallons of water per sack of cement. The thickness of the slurry shall be 1 inch average for the wall and columns and 1/2 inch average for the wall and column footings.

H. Unforeseen cold joints in walls shall be roughened and then covered with a pure mixture of cement and water of approximately 1 inch thickness, before the pour may be continued.

I. Horizontal waterstops in floor and roof decks, if shown on the Drawings, shall be lifted up, then the concrete shall be placed under the waterstop, the waterstop shall then be laid down on that concrete, additional concrete shall be placed on top of that waterstop to the approximate finish level of the concrete, where upon the concrete shall be thoroughly vibrated in one continuous motion from one end of the waterstop to the other end without skipping any areas. Visual observation shall be performed by the CONTRACTOR to certify that voids under waterstops do not exist.

J. Cold joints in floor, roof slabs and in wall-footings shall be avoided at all costs. Joints shall be continuously covered with new concrete, and shall be thoroughly integrated through vibration, even if it means that horizontal passes of only 6 inches in width be made until additional concrete and equipment becomes available to permit wider passes in concrete placement.

K The following minimum equipment, which must be in excellent working condition, shall be available on the site for every concrete placement operation on floor, wall and roof:

1. Conveying: 2 pumps, or 2 cranes, or 1 pump and 1 crane (for floor and roof decks only).

2. Vibrating: 3 vibrators of 14,000 vibrations per minute (minimum).

3. Trowelling: 2 power-operated trowelling machines (for floor and roof decks only).

The ENGINEER shall be the sole judge as to the acceptability of the equipment and as to its condition and capacity. The CONTRACTOR shall assume complete responsibility for having adequate equipment.

L. Use mechanical vibration in placing concrete to eliminate rock pockets and voids, to consolidate each layer with that previously placed, to completely

embed reinforcing bars and fixtures, and to bring just enough fine material to exposed surfaces to produce a smooth, dense, and even texture. Vibrators shall be of the high-frequency internal type, and the number in use shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least three (3) operable vibrators shall be available at the site. Use external vibrators for consolidating concrete when the concrete is otherwise inaccessible for adequate consolidating, provided the forms are constructed rigidly enough to resist displacement or damage from external vibration.

M. Not used.

N. If avoidable, do not place concrete during rainstorms. Protect concrete placed immediately before rain to prevent rainwater from coming in contact with it. Keep sufficient protective covering on hand at all times for this purpose.

O. Concrete placed for encasement shall not be backfilled until the concrete has reached at least 50% of its 28-day compressive strength confirmed by concrete cylinder tests. The CONTRACTOR may mold and cure additional concrete cylinders as specified here-in to verify that the 50% strength has been achieved, prior to the required 7-day test. The CONTRACTOR shall keep the trench dewatered until that time. The CONTRACTOR may use type III cement (High Early Strength) in lieu of type II cement in the same batch quantities as specified, but there will be no additional reimbursement to the CONTRACTOR for costs incurred using such concrete.

3.5 Pumping Concrete

A. Base pump size on the rate of concrete placement, length of delivery pipe or hose, aggregate size, mix proportions, vertical lifts, and slump of concrete. The minimum inside diameter of pipe or hose shall be based on the maximum aggregate size as follows:

- 1½-inch maximum aggregate: 4 inches minimum I.D.
- 1-inch maximum aggregate: 3 inches minimum I.D.

B. Do not use aluminum pipes for delivery of concrete to forms.

C. Before pumping is started, prime the delivery pipe or hose by pumping mortar through the line using 5 gallons of mortar for each 50 feet of delivery line. Do not deposit mortar in the forms.

3.6 General Forming

A. Purpose

1. Forms shall be used, whenever necessary, to confine the concrete, to shape the concrete to the required lines and grades, and to obtain a thoroughly compacted dense concrete through proper vibrating. Construct forms complying with ACI 347.

2. The forms shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration, without deflection from the prescribed lines.

B. Design

1. The surfaces of all forms in contact with the concrete shall be clean, rigid, tight and smooth.

2. Openings sufficient in size and number to permit convenient access to properly clean, inspect and place concrete within the forms shall be provided.

3. Exposed sharp edges shall be eliminated from finished concrete work by means of 3/4 inch triangular fillets or chamfer strips placed in the forms.

C Removal

1. All forms shall be removed before backfilling is placed.

2. Forms shall be so constructed that they can be removed without hammering on, or prying against, the concrete and shall be removed in such a manner as to prevent damage to the concrete and to ensure the complete safety of all parts of the structure.

D. Form-Ties and Seepage

1. Form-ties may be loosened temporarily to permit the removal of bulkheads.

2. All forms, whether prefabricated or custom made, shall be assembled and connected in such a manner that only minor mortar seepage through the joints will occur during vibration of the concrete, which shall be small enough that no honeycomb areas will develop.

E. Clean and Oil

1. All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas, before any concrete is deposited therein.

2. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused.

3. Before concrete is deposited within the forms, all inside surfaces of steel and plywood form surfaces shall be thoroughly, but not excessively, coated with an approved nonstaining bond releasing form oil.

3.7 Wall, Wall Footing and Column Footing Forms

A. All vertical wall and column footing sides shall be formed by methods acceptable to the ENGINEER and to the correct elevations and location shown on the Drawings.

B. Pouring Openings

1. Pouring of walls may be done only through pouring openings on one of the wall sides, and may not be pumped or poured from the top through the use of "elephant trunks" or tremies.

2. CONTRACTOR shall either erect the complete form on one side of the wall and then erect the form panels on the other side of the wall while the concrete pour is in progress or remove form panels from either the inside or outside form assembly before concrete pouring starts.

3. The horizontal centerline distance between such openings shall not exceed 96 inches nor shall the distance between the nearest opening and the bulkhead for the vertical joint exceed 36 inches.

4. The vertical centerline distance between horizontal rows of openings shall not exceed 96 inches.

5. The minimum pouring opening size shall be 18" x 18".

6. The bottom of the lower openings shall be no more than 48 inches from the top of the wall-footing.

7. Under no circumstances shall forming be such that the drop of concrete in the forms will exceed 8 feet in any one place.

C. Blockouts

There shall be no blockouts or other types of wall-openings other than those shown on the Drawings.

D. Remove Wood Splinters

1. CONTRACTOR shall remove all wood splinters on concrete surfaces after stripping of wood forms.

2. Such work shall be completed before sandblasting of exterior wall surfaces may be started.

E. Bulkheads

1. Bulkheads to form vertical wall joints shall be strong enough to withstand concrete pressures during pouring and vibrating, and shall be properly placed between the forms and against the waterstop to avoid mortar seepage.

2. Holes shall be provided in the bulkheads to permit passage of horizontal mild steel reinforcing where required by the Drawings.

3. Unless these are specifically called for on the Drawings, no chamfer strips shall be placed in the corners of vertical construction joints of reservoir walls.

F. Form Removal

1. Forms may be removed as soon as the concrete has developed sufficient strength to prevent sagging, excess deflection, misalignment, spalling, cracking, breaking of edges and surfaces and any other damage to the concrete.

2. Removal of wall and column forms shall not be started any sooner than 12 hours of accumulated time with the ambient air temperature above 50° after completion of the wall or column pour, respectively.

   Hammering or prying against concrete surfaces to remove forms is prohibited.

G. Alignment and Tolerances

1. Every precaution shall be taken to see that all forms are in the proper alignment, plumb, placed to correct radius and that all form supports are secure and tight.

2. Form sills shall be used to contain or hold down neoprene pads and facilitate proper alignment of forms. The maximum permissible variation in the horizontal and vertical location of the waterstops, neoprene pads and seismic cables (if required) is plus or minus 1/4 of an inch.

3. The maximum permissible variation in reservoir radius, as measured from the center of the reservoir to the inside wall surface at the bottom, is plus or minus 3/8 of an inch.

4. The out-of-round tolerance is: 3/4 of an inch in 50 feet, 3/8 of an inch in 10 feet, and 3/16 of an inch in 24 inches from the true curvature specified at any point on the wall.

5. The maximum permissible variation in the vertical alignment, from the bottom to the top of the wall, is plus or minus 3/8 of an inch.

6. The allowable tolerance in the average wall thickness for poured walls shall not vary more than 1/8 inch either way. All transitions from plus to minus shall be gradual, even and smooth, and without abrupt changes in the surfaces.

7. Adequate time and cooperation shall be provided to the Inspector to verify the compliance of these requirements prior to closing up the forms or pouring concrete.

H. Slipform

The use of slipform construction on liquid-retaining walls will not be permitted on any part of the reservoir.

I. Gaps between Wall and Wrapped Wire

Irrespective of what has been stated elsewhere in this section, the forming and bracing method shall be such that no gaps between the wrapped wire and the corewall will develop which exceed 3/8 of an inch at any place on the wall.

3.8 Roof Forms

A. Form Finish and Alignment

The finished form surface shall be smooth, true to elevation and alignment and all joints between boards, plywood sheets or form panels shall be mortar-tight, or be made mortar-tight by taping or other means as the situation calls for, before any concrete pour may be started.

B. Form Removal

1. Removal of the forms will be permitted only when the concrete has attained 90% of its design strength (verified by cylinder tests) and no sooner than 7 days (168 hours) of cumulative time above 50° F after concrete installation.

2. As soon as the forms have been removed, the CONTRACTOR will carefully examine the top and bottom surface of the concrete for any defects in the concrete or irregularities in the surface which shall be repaired as required.

3. Hammering or prying against concrete surfaces to remove forms is prohibited.

C. Form Adjust and Release

The CONTRACTOR shall provide either wedges under timber posts, screw jacks under shoring, or provide other means to adjust the forms and relieve the load.

D. Tolerance

1. Unless stated otherwise on the Drawings, the permissible tolerance at any point for flat or dome-roof form-surfaces shall not exceed plus or minus 1/4 inch from the specified elevation or thickness. The finished roof surface shall be capable of completely draining. CONTRACTOR shall camber or provide necessary forming supports to prevent low spots and to ensure drainage. If low spots should occur, CONTRACTOR shall submit a corrective procedure to the ENGINEER for approval.

2. Any transition between high and low points shall be gradual, smooth and even, and shall be to the satisfaction of the ENGINEER.

3.9 Bulkheads and Screeds for Floors and Roofs

A. Unless free-spanning vibrating and finishing screeds are used, sufficient floor and roof screeds shall be installed to ensure that the finished concrete surface will conform to the slopes, elevations and tolerances specified in these documents.

B. Screeds and bulkheads shall be set to specified alignment and elevations permitting a maximum tolerance of 1/4 inch plus or minus.

C. All transitions between high and low points shall be gradual, smooth and even, and shall be to the satisfaction of the ENGINEER.

3.10 Surface Finishes

A Smooth Form Finish

1. 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, dampproofing, painting or other similar system.

2. 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.

3. 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.

B. Wood-Float Finish

1. This requires an integral finish by wood-float after screeding, to compact the surface evenly.

2. Any excess surface water shall be removed before floating and no mortar shall be used for leveling.

3. 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.

4. 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

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.

C. Steel Trowel Finish

1. This shall be an integral finish obtained by trowelling with a steel trowel after the surface has been floated and allowed to stand until all water-sheen has disappeared.

2. Final trowelling shall be done after the concrete has hardened sufficiently to prevent drawing moisture and fine materials to the surface and when the concrete is sufficiently hard that no mortar accumulates on the trowel.

3. Cement or mixture of cement and sand, shall not be spread on surfaces to absorb excess water or to stiffen the concrete.

4. Trowelling shall produce a dense, smooth, impervious surface free from defects and blemishes.

5. All finished top surfaces of wall and wall-corbel (if required), column-footings (if required) and floors shall receive a smooth, even, level and hard (so called "burnt") steel trowel finish. The entire wall footing surface, particularly along each side of the circumferential waterstop in the area to receive neoprene pads, shall also receive a hard steel trowel finish.

D. Non-Slip Broom Finish:

1. Apply non-slip broom finish to exterior and interior 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. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the ENGINEER before application.

E. Unformed Surfaces

1. Unformed surfaces which will not be exposed in the completed work shall be brought to required finished elevations and left true and regular.

F. Screeds

1. Sufficient screeds, unaffected by form deflections under concrete loads, shall be installed to ensure an even concrete surface, true to grade and elevation, without unacceptable local depressions of any sort.

2. Screeds shall be set to the required levels and be approved by the ENGINEER before any concrete may be placed.

G. Form Tie Holes

1. Tie holes shall be thoroughly sandblasted or roughened. After the taper tie holes have been cleaned, plugs, as specified in Section 03300 - 2.12 B.3, shall be installed in the middle third of the corewall. The tie holes shall then be coated with a water insensitive epoxy or an acceptable bonding agent and properly filled through damp-packing with a mortar of dry consistency and a mix of one part of cement to one part sand. The amount of water to be added to the cement-sand mix shall be such that the mortar can be driven into the voids and will compact properly. The outside of the tie hole shall be drypacked no sooner than 7 days after the inside has been drypacked.

2. Embeco or other fast-setting cements/additives shall not be used for damp-packing such cavities.

3. Interior reservoir wall surfaces which have been damp-packed shall be covered with an approved 10 mil. thick water insensitive non-sag epoxy coating, which shall conform to the requirements of Section 03300 - 2.15. Finished surfaces shall be free from sand streaks or other voids.

H. Abrasive Blasting

1. The exterior surface of poured concrete wall areas, which will receive wire-wrapped prestressing/shotcrete or paint, if any, shall be abrasive blasted, regardless of the forming method used, by a mechanical etching or shot blast system combined with a vacuum recovery system, or a self-contained waterblasting system.

2. The surface shall be blasted sufficiently to remove all laitance, form oil or other type coatings.

3. The surface shall be cut sufficiently to provide a good mechanical bond between the shotcrete covercoat and the concrete wall. The surface shall be cut to a minimum CSP5 profile, was established by the International Concrete Repair Institute (ICRI), over a minimum 90% of the area as measured over any one foot square area.

4. Systems that have not been used in the past to prepare circular tank wall surfaces for shotcreting and strandwrapping or systems which rely on sandblasting or steel shot without a vacuum system will not be allowed.

5. All abrasive blasting shall be done to the satisfaction of the ENGINEER, and this work shall not be started before the completion date of the curing period or before all the tie-holes have been drypacked.

I. Honeycombed areas

1. Unless the removal of one or more defective panels is required by the ENGINEER, defective surfaces, such as honeycomb, shall be cut out entirely until homogeneous concrete is met, even if it means going through the entire wall, floor or roof slab. Removal of defective areas must be performed in a way as to avoid damage to all embedded items such as reinforcing steel, vertical threadbars, waterstops or any other items.

2. Such areas shall be coated with an approved epoxy or adhesive bonding material, which shall be applied in accordance with the manufacturer's instructions, before damp-packing the area with a mix consisting of one part of Portland cement and two parts of sand and fine gravel, epoxy and sand mix, or any combination of materials and mixes as the situation dictates in the opinion of the ENGINEER.

3. The water content of the damp-pack material shall be such that a ball of the mix may be squeezed in the hand without bringing free water to the surface.

4. Damp-pack material shall be tamped into place and finished to match adjacent concrete surfaces.

5. Particular care shall be taken that no sagging of the material will occur.

6. The bond between any two layers of damp-pack shall be improved through the use of an approved epoxy bonding agent.

7. Surfaces which have been damp-packed shall be kept continuously damp during, and for a period of not less than seven days after completing the damp-pack operation, by the curing procedure described below in Section 03300 - 3.11.

8. Under no circumstances shall CONTRACTOR apply a plaster coat over the honeycomb areas to conceal the existence of the honeycomb in the concrete.

9. Neither Embeco, calcium chloride nor fast-setting cements/additives shall be used for filling honeycomb areas, nor shall they be mixed with damppack material. CONTRACTOR shall provide certification that any material placed on or in the corewall shall be free of chlorides and other materials corrosive to prestressing steel.

10. Determination of defective areas is at the discretion of the ENGINEER.

J. Miscellaneous Surfaces

1. Miscellaneous surfaces that are not covered herein and not specifically designated on the Drawings shall be finished as directed by the ENGINEER.

K. Schedule of Finishes

Surface Description	Finish Required
Reservoir:	
Reservoir Floor	Steel Trowel Finish
Top of Footings	Steel Trowel Finish
Interior of Wall	Smooth Form Finish
Exterior of Wall	Sandblasted
Underside of Roof	Smooth Form Finish
Surface of Roof	Non-Slip Broom Finish
Columns	Smooth Form Finish
Vault:	
Interior Floor	Steel Trowel Finish
Interior of Wall	Smooth Form Finish
Exterior of Wall	Steel Trowel Finish
Underside of Roof	Smooth Form Finish
Surface of Roof	Steel Trowel Finish

3.11 Curing

A. The Contractor shall begin curing immediately after initial concrete set has occurred. Exposed concrete surfaces shall be kept moist during finishing operations prior to initiating specified curing procedures.

B. Curing of the roof and floor slabs shall be made by covering the slab with curing blankets, which incorporate a water containing felt or burlap element and a white plastic cover, and kept continuously wet for a period of no less than 7 days (168 hours). After removal of curing blankets the slab shall be sprayed with a curing compound as specified in Section 03300 2.16.

C. All other horizontal, screeded and floated surfaces, exposed to drying winds and sunlight, shall be sprayed with a curing compound as specified in Section 03300.2.16 at an application rate of 200 sf per gallon or more as recommended by the manufacturer.

D. Water for curing shall be generally clean and free from any elements which might cause staining or discoloration of the concrete.

E. All formed concrete surfaces shall be sprayed with a concrete curing compound as specified in Section 03300 - 2.16 at an application rate of 200 sf per gallon, or as recommended by the product manufacturer, whichever provides the most coverage. This requirement will be waived if the forms have been left in place for at least 7 days.

3.12 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 ½-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. Repair methods not specified above may be used subject to the acceptance of the ENGINEER. Alternate repair methods must be submitted and approved by the Engineer prior to installation.

3.13 Concrete Tests

A. Compression tests shall conform to ASTM C39, ASTM C670and ASTM C803.

B. Proportioning (or chemical analysis) tests shall conform to ASTM C1084.

C. Air content: ASTM C231, pressure method; one for each set of compressive strength test specimens. If air content is found to be out of conformance during site concrete testing, air content will be checked for every 9cy truck delivered to the site until 3 consecutive trucks are found to have air content meeting the specification. Testing will then return to rate outlined in 03300-3.13.E

D. Slump Test: ASTM 143; one test for each concrete load at point of discharge; and one for each set of compressive test specimens.

E. At least one slump test and five test cylinders shall be made, under the supervision of the ENGINEER, by an approved testing lab for every 40 cubic yards of ready-mixed concrete delivered to the jobsite. Each cylinder shall be coded to identify the date of delivery, the truck number, the location where the concrete has been used and the slump measured upon discharge. For each

reservoir wall section, two sets of five cylinders shall be made. When the frequency of testing will provide less than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

F. The specimens shall be standard test cylinders, six inches in diameter, twelve inches in length, and they shall be prepared in accordance with ASTM Standard C31.

G. Molds for the standard test cylinders shall be furnished by the independent testing laboratory contracted by the OWNER at the expense of the OWNER.

H. All costs for making and testing of concrete and materials, by an approved recognized reputable testing laboratory, will be borne by the OWNER.

I. Making and testing of cylinders shall be performed by an approved testing laboratory that normally engages in the preparation of concrete mix designs and testing of concrete materials.

J. A compression test may be made on one cylinder from each group of five after 7 and/or 14 days, at the ENGINEER's option. A strength test shall be made using two cylinders from each group of five at 28 days for use in evaluating the concrete strength in accordance with the current editions of the IBC and ACI 318.

K. As requested by the ENGINEER, proportioning tests for each class of concrete delivered to the jobsite, shall be made from test cylinders designated by the ENGINEER.

L. In addition to the test cylinders referred to in Section 03300 - 3.12.E, an additional 3 test cylinders shall be made for each day's pour, or for every 4,000 square feet of wall and roof surface, whichever provides the largest number of cylinders.

They shall be cured in the same manner, and in the same location of the concrete area to be investigated. Before walls may be prestressed, or before roof-forms may be stripped, at least one cylinder, of each batch of 3 cylinders, must be tested to verify whether the in-place concrete strength meets the minimum specified design strength.

M. The method of determining the standard deviation of compressive concrete strengths from previously utilized mix designs having previously recorded test results and the minimum allowable average compressive strengths of mix designs not having any previously recorded test results shall comply with the

requirements of the code and commentary sections in the current edition of ACI 318.

N. The compressive test results of the cylinders referred to in Section 03300 - 3.12.J above will be compared against the strength-versus-slump relationship curves referred to in Section 03300 - 1.4 B. Proportioning tests may then be made, at the discretion of the ENGINEER, on those groups of cylinders which have shown low readings.

O. Any concrete not meeting the minimum specified design strength and any concrete showing a cement content less than the ratio by weight established in the original mix design will be subjected to further testing of concrete cores complying with ASTM C42 taken from the concrete in question. Should these tests confirm that the specified requirements have not been met, the extra costs involved in such testing shall be borne by CONTRACTOR; and the concrete, at the ENGINEER's option, and at CONTRACTOR's sole expense, may be rejected and must then be removed from the site or may be strengthened with additional shotcrete or concrete as the situation warrants it. Should the core tests indicate that the strength requirement has been met or if the low strength concrete is deemed acceptable to the ENGINEER, the extra costs involved in such testing shall still be borne by the CONTRACTOR.

END OF SECTION

SECTION 03301

COLD WEATHER CONCRETING PROCEDURES

PART 1 GENERAL

1.1 Description

This section covers requirements for placement and preparation for cast in place concrete and appurtenances under cold weather conditions. Cold weather conditions are defined as any period when for more than 3 successive days the mean daily temperature falls below 40° F or any day when the temperature is expected to fall or falls below freezing.

1.2 Submittals

Not less than 30 days prior to expected placement of concrete under cold weather conditions, a complete procedure shall be submitted for review covering all aspects of protection of concrete and its ingredients from the detrimental effects of cold weather. Concrete placement during cold weather shall not commence prior to return of the procedure marked "Reviewed".

1.3 Product Delivery, Handling and Storage

The concrete temperature, during placement in cold weather, shall not be less than 50° F. Temperature measurements of the concrete as delivered to the jobsite shall confirm this requirement.

PART 2 PRODUCTS

2.1 Materials

Water and aggregates may be preheated for cold weather placement; however, their temperature shall not exceed 150° F. All methods and equipment for heating of water and aggregate shall be subject to the approval of the ENGINEER and shall conform to ACI 306.

PART 3 EXECUTION

3.1 Concrete Placement

A. No concrete shall be placed on frozen ground.

B. The ground, against which concrete is to be poured, must be protected against freezing after its preparation, or the concrete placement shall be delayed until the ground has fully thawed out.

C. When temperatures are expected to be below 32^{o} F the night before the concrete is placed, then all reinforcing steel, forms and the ground shall be preheated, for a minimum of 12 hours, under a minimum temperature of 50^{o} F.

D. When temperatures are expected to be below 40^{o} F any time before the concrete has reached a strength of 1000 psi, the concrete must be adequately protected against frost damage by heating blankets, straw or insulation materials for a minimum of 7 days or until at least 1000 psi concrete strength has been reached. Provide adequate means to maintain the temperature in the area where concrete is being placed at either 70°F for 3 days or 50°F for 5 days after placing. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. The concrete temperature shall at no time fall below 40^{o} F based on recording temperature monitors placed at a maximum of 50 feet on centers, each way, and around the circumference of the floor, wall, roof slab and wall-footing. CONTRACTOR shall provide heat as required to keep the concrete temperature as specified throughout the entire curing period of 7 days.

E. Weather prediction made by the nearest NOAA station, and corrected for the local elevation and environmental conditions, may be used to determine whether cold weather protection shall be required. Thermometers will be used by the ENGINEER and these readings shall determine whether cold weather protection shall be required and whether cold weather protection is adequate.

F. When combustion type heaters are used to maintain concrete temperatures within an enclosure, the exhaust gases shall be vented from the heater to the outside atmosphere so that the concrete is not exposed to the products of combustion.

G. 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.

H. 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.

I. 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.

END OF SECTION

SECTION 03302

HOT WEATHER CONCRETING PROCEDURES

PART 1 GENERAL

1.1 General

This section covers requirements for placement and preparation for cast in place concrete and appurtenances under hot weather conditions. Hot weather conditions are defined as any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise resulting in abnormal concrete properties. During hot weather conditions, any or all of the methods specified herein for temperature control of concrete shall be used as required to maintain the concrete temperature below the limits specified.

1.2 Submittals

Not less than 30 days prior to expected placement of concrete under hot weather conditions, a complete procedure shall be submitted for review covering the aspects of protection of concrete and its ingredients from the detrimental effects of hot weather. Concrete placement during hot weather shall not commence prior to the return of the procedure marked "Reviewed".

1.3 Product Delivery, Handling and Storage

A. Aggregate piles, cement bins and batch plant bins shall be shaded from the direct rays of the sun.

B. Aggregate piles shall be cooled by wetting and evaporation. Aggregate wetting shall be performed in such a manner that it will not cause wide variations in moisture content impairing slump uniformity.

1.4 Quality Assurance

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

- American Concrete Institute - ACI 305

PART 2 PRODUCTS

2.1 Materials

A. Batching and Mixing

1. Concrete mix water shall be refrigerated or ice shall be added to the mix up to 100 percent of the water requirement. Ice, when introduced into the mixer, shall be in such form that it will be completely melted and dispersed throughout the mix at the completion of the mixing time. Ice may be used provided the water equivalent of the ice is calculated to the total amount of mixing water. The mixing time shall be held to the minimum practicable consistent with producing concrete meeting the specified requirements.

2. All methods and equipment for cooling of water and aggregate shall be subject to the approval of the ENGINEER and shall conform to ACI 305.

PART 3 EXECUTION

3.1 Temperature Control of Concrete

A. General Practices and Measures

The following list of practices and measures, as described in ACI 305, may be used to reduce or avoid the potential problems of hot weather concreting:

1. Use concrete materials and proportions with satisfactory records in field use under hot weather conditions.

2. Use cool concrete.

3. Use a concrete consistency that permits rapid placement and effective consolidation.

4. Transport, place, consolidate, and finish the concrete with least delay.

5. Plan the job to avoid adverse exposure of the concrete to the environment; schedule placing operations during times of the day or night when weather conditions are favorable.

6. Protect the concrete against moisture loss at all times during placing and during its curing period.

B. Concrete Temperature

The temperature of concrete, as delivered at the time and location of placement, shall not exceed 90° F under any conditions. The temperature of concrete as delivered at the time and location of placement under the following combined ambient conditions, except concrete that will be deposited within wall or column forms, shall not exceed the following temperatures:

Relative humidity		Ambient temperature		Maximum concrete temperature
less than:	80%	greater than:	90°F	100°F
	70%		90°F	95°F
	60%		90°F	90°F
	50%		90°F	85°F
	40%		90°F	80°F
	30%		80°F	75°F
	20%		75°F	70°F

3.2 Delivery

Concrete shall be placed in the Construction within 90 minutes after the completion of mixing.

3.3 Preparation for Placing

A. Elevated forms and reinforcing steel for beams and similar members shall be cooled by fog spraying and evaporation immediately prior to placing concrete. Forms shall be free of standing water when concrete is placed herein.

B. Cover reinforcing with water soaked burlap such that the steel temperature does not exceed the ambient air temperature immediately before embedment in concrete.

C. Wet form thoroughly before placing concrete.

3.4 Placing

A. Concrete shall be placed in shallower layers than under normal weather conditions if necessary to assure coverage of the previous layer while it will respond readily to vibration.

B. Do not use retarding admixtures unless otherwise accepted in mix design. Wet forms thoroughly before placing concrete.

3.5 Finishing

Fog spray shall be used during finishing operations whenever necessary to avoid surface plastic-shrinkage cracking. Fog spray shall also be used after finishing and before the specified curing is commenced to avoid surface plastic-shrinkage cracking.

3.6 Protection and Curing

Forms shall be kept covered and continuously moist. Once forms are loosened and during form removal, concrete surfaces shall be protected from drying and shall be kept continuously wet by fog spraying or other approved means.

END OF SECTION

SECTION 03400

PRECAST CONCRETE

PART 1 GENERAL

1.1 Description

A. This Section covers the furnishing and installation of precast vaults, manholes and wet wells.

B. The drawings identify precast vaults by manufacturer and model number. This information is provided for dimensional information only; the CONTRACTOR shall provide precast items in accordance with these specifications.

C. The CONTRACTOR shall construct all precast items as required in the Contract Documents, including all appurtenances necessary to make a complete installation.

D. This section does not include prestressed or cast-in-place concrete items.

1.2 Codes and Standards

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

A. General -- The latest edition of all specifications, codes, and standards listed herein shall be used.

B. Codes -- All design and construction shall meet the requirements of the Uniform Building Code except where local codes or the Contract Documents are more restrictive.

C. Commercial Standards

ACI 301	Specifications for Structural Concrete for Buildings
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete
ASTM C150	Specification for Portland Cement
ASTM A 48	Specification for Gray Iron Castings
ASTM C 478	Precast Reinforced Concrete Manhole Sections
ASTM C 923	Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes

CRD-C 621 Corps of ENGINEERs Specification for Non-shrink Grout

1.3 Submittals

A. The CONTRACTOR shall submit design calculation and shop drawings for all precast concrete items. Submitted drawings shall show all dimensions, location and type of lifting inserts, details of reinforcement, connection embeds, joints, covers or hatches, ladders and grating in accordance with the Contract requirements.

B. CONTRACTOR shall submit design calculations stamped by a registered professional engineer for the wet well topslab design.

C. For all precast items which are manufactured, the CONTRACTOR shall also submit a list of the design criteria used by the manufacturer.

1.4 Quality Assurance

Quality assurance shall be in accordance with the standards identified in 1.2 C of this section.

PART 2 PRODUCTS

2.1 General

The design and construction of all precast items shall be in accordance with the recommendations and requirements of ACI 301, ACI 315 and ACI 318.

2.2 Precast Vaults

A. Vaults covered by this section include, but are not limited to, valve vaults, meter vaults, electrical manholes and pull boxes.

B. Size -- Vault dimensions shall be as required by the Drawings.

C. Material -- Concrete used for manufactured vaults shall have a minimum 3000 psi compressive strength at 28 days. Cement used shall be ASTM C150, Type II Concrete shall have a maximum water-cement ratio of 0.50 and an air content of four (4) to six (6) percent.

D. Construction -- The vaults may be formed with separate top and bottom slabs. Walls shall be cast so that all sides are continuous at corners and their full length with no blockouts or knockouts. Horizontal joints may be provided so that walls can be placed in horizontal segments. All horizontal joints shall be keyed to prevent offsets and shall be provided with a watertight gasket.

E. Finish -- Formed surfaces shall be smooth and uniform with no fins, bulges, or other irregularities. Any void greater in width than 1/2-inch or deeper than 3/8-inch shall be repaired. Unformed interior slab surfaces shall have a smooth steel trowel finish. Unformed exterior slab surfaces shall have a light broom finish applied to a steel trowel finish.

F. Access Hatch and Lid -- Unless noted otherwise on the Contract Documents, vaults shall have concrete top slabs with access openings as shown on the Drawings. The vault manufacturer shall provide the access hatch per requirements in Section 05500. Lids shall have lifting holes. When leveling bolts are used to set the vault top sections, the CONTRACTOR shall ensure that the load from the top slab is transferred through grout to the vault walls, and will not be carried by the leveling bolts.

G. Loading

1. Vertical -- Vaults shall be designed for H-20 traffic loading. Where the vault is below grade, a dead load of 125PCF shall be added for the soil.

2. Lateral -- Lateral loads on all vault walls shall be as follows:

Static 105 x H (PSF) triangular equivalent fluid pressure plus a surcharge of an additional three (3) feet of soil depth in areas designated for vehicular traffic.

Where H = depth of fill

Seismic acceleration -- IBC site specific requirements, where importance factor, I, is equal to 1.5, but not less than 0.20 g acting on structure mass. Seismic loading need not be considered simultaneously with traffic surcharge.

H. Mechanical Details -- Piping, electrical, and other details shall be as required by the Contract Documents. No blockouts or knockouts shall be cast into vault walls. All pipe penetrations shall be preformed or core drilled at the required locations.

I. Accessories -- Accessories such as ladders, floor grates at sumps, etc. shall be provided as shown on the drawings.

J. Precast concrete vaults shall be by Utility Vault Company or approved equal.

2.3 Precast Concrete Manholes

A. Precast concrete pipe manhole sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to ASTM C-478. Minimum wall thickness shall be four (4) inches. Cones shall have the same wall

thickness and reinforcement as riser sections. Reinforcing in transition sections shall be equal to that specified for wall sections of the larger diameter.

B. Precast manhole sections shall consist of circular sections in standard nominal inside diameters of 42, 48, 54, 60, 72, 84 or 96 inches. Heights of sections shall be in multiples of 12 inches. Diameter and type shall be as specified on the plans.

C. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be preformed or cored by the manufacturer. All rigid non-reinforced pipe entering or leaving the manhole (new or existing manhole) shall be provided with flexible joints within 1-foot of the manhole structure

D. Precast integral base sections shall be of monolithic construction, conforming to ASTM C-478.

E. Specified manhole steps shall be factory installed to provide a continuous ladder of 12-inch C/C rung spacing. Steps shall be placed in the forms and cast in pipe wall or placed immediately after the pipe is removed from casting and carefully mortared in place with non-shrink mortar to ensure a watertight joint. If the outer surface of the pipe wall is pierced, the patch shall be completely covered with a bituminous sealer.

F. Where pressure tight manhole frames and covers are called for, threaded inserts shall be cast in eccentric cones or flat slab tops and holes formed or cored in adjusting rings to match bolt size and spacing specified for manhole casting.

G. Manhole Steps -- Manhole steps shall be of polypropylene plastic reinforced with a 1/2-inch No. 60 grade reinforcing rod as specified elsewhere in this document.

H. Manhole Frames and Covers

1. Manhole covers shall be designed so they may be secured to the frames. Matching surfaces of covers and frames shall be flat to prevent any movement of covers within the frames. Covers and frames shall be interchangeable.

2. Manhole cover and frame shall conform to ASTM A-48, Class 30B Cast Iron Construction, machined flat bearing surface, removable lid with air vent, closed lid design. Rated for H20 loading and in accordance with manufacturer's specifications. The foundry shall certify as to the tensile and transverse properties and the Brinell Hardness.

2.4 Precast Panel Vault

A. This section includes the precast panel vault to as specified for the Transfer Pump Station.

B. Pump Station Responsibility and Coordination

1. The CONTRACTOR shall cause all material and vault structure elements specified under this section to be furnished by the precast panel vault manufacturer, who shall be responsible for the adequacy and compatibility of all vault elements with the package pump station supplied by others. Any component of the complete vault structure not provided by the manufacturer should be designed, fabricated, tested, and installed by factory-authorized representatives experienced in the design and manufacture of the pump station equipment or components specified herein. This requirement, however, shall not be construed as relieving the CONTRACTOR of the overall responsibility for this portion of the work.

2. The CONTRACTOR shall cause the precast concrete vault manufacturer and its suppliers to coordinate design of the vault structure such that all components are compatible and capable of achieving the performance requirements specified herein.

C. Design Requirements

The vault structure size and arrangement shown on the mechanical drawings is based upon the best information available to the ENGINEER at the time of design and is not intended to show exact dimensions relative to any specific equipment unless otherwise shown or specified. It is anticipated that the vault openings, hatches and/or vault dimensions, in part or in whole, may have to be modified in order to accommodate the specific pump station furnished. No additional payment will be made for such modifications. All necessary calculations and drawings for any related design shall be submitted to the ENGINEER for approval prior to beginning the work.

D. Warranty

The CONTRACTOR shall warrant the package pump station vault structure to be of quality construction, free from defects in material and factory workmanship. The vault structure, cover and components shall be warranted for a period of one (1) year to be free from defects, cracks, resistant to rusting of components, corrosion, or physical failures occurring in normal service, when installed in accordance with the manufacturer’s recommendations.

Major components which fail to perform as specified by the ENGINEER or prove defective in service during the warranty period shall be replaced, repaired, or satisfactorily modified by the CONTRACTOR without cost of parts or labor to the OWNER. Such components, parts, or repairs determined to have failed because of defects in workmanship or materials will be replaced or repaired F.O.B. factory or other designated location.

E. Size – Panel vault dimensions shall be as required by the Drawings.

F. Material -- Concrete used for manufactured vaults shall have a minimum 5000 psi compressive strength at 28 days. Cement used shall be ASTM C150, Type II Concrete shall have a maximum water-cement ratio of 0.50 and an air content of 4 to 6 percent.

G. Construction -- The vault shall be formed with separate top and bottom slabs. Walls shall be cast so that all sides are continuous at corners and their full length with no knockouts. Horizontal and vertical joints may be provided so that walls and top and bottom slabs can be placed in sections. All horizontal joints and vertical shall be keyed to prevent offsets and shall be provided with a watertight gasket. Separate sections shall be connected using mechanical connectors specifically designed for the application.

H. Finish -- Formed surfaces shall be smooth and uniform with no fins, bulges, or other irregularities. Any void greater in width than ½-inch or deeper than 3/8-inch shall be repaired. Unformed interior slab surfaces and exposed exterior slab surfaces shall have a smooth steel trowel finish. Unformed exterior slab surfaces which will not be exposed shall have a light broom finish applied to a steel trowel finish.

Exposed exterior surfaces shall have additional architectural details as shown on the Drawings, formed into the slab at manufacture.

I. Waterproofing – All buried exterior surfaces shall be coated with Crystalseal waterproofing material or approved equal.

J. Blockouts -- Panel vault rough openings (blockouts) for doors, exhaust fan, piping, sump pump and handrails shall be cast in vault panels during manufacture in the sizes and locations shown. No cutting of vault will be allowed. Contractor to coordinate dimensions and locations of rough openings with equipment requirements and incorporate into vault design for ENGINEER prior to manufacture.

K. Loading

1. Vertical -- Vaults shall be designed for pedestrian loading. Where the vault is below grade, a dead load of 125PCF shall be added for the soil.

2. Lateral -- Lateral loads on all vault walls shall be as follows:

   Static 105 x H (PSF) triangular equivalent fluid pressure plus a surcharge of an additional 3 feet of soil depth in areas designated for vehicular traffic.

   Where H = depth of fill

   Seismic acceleration -- IBC site specific requirements, where importance factor, I, is equal to 1.5, but not less than 0.20 g acting on structure mass. Seismic loading need not be considered simultaneously with traffic surcharge.

3. Live Load – A live load of 1,500 pounds per square foot shall be included in the design to account for a pump and motor system being moved on the roof -mounted davit crane.

L. Mechanical Details -- Piping, electrical, and other details shall be as required by the Contract Documents. No knockouts shall be cast into vault walls. All blockouts and pipe penetrations shall be performed at the required locations.

M. Accessories -- Accessories shall be provided as shown on the Drawings and coordinated with the CONTRACTOR and package pump station manufacturer.

N. Access Hatches -- Per Section 05500-2.10 of the Specifications.

O. Precast panel vault shall be by Oldcastle Precast or approved equal.

2.5 Joint Materials

A. Mortar used for the structures herein specified shall conform to ASTM C-387. Admixtures may be used not exceeding the following percentages of weight of cement: hydrated lime, 10 percent; diatomaceous earth or other inert materials, five (5) percent. The consistency of the mortar shall be such that it will readily adhere to the precast concrete if using the standard tongue and groove type joint. Mortar mixed for longer than 30 minutes shall not be used.

B. Non Shrinking Grout -- Non-shrink grout shall be Sika 212, Euco N-S, Five-Star, or approved equal non-metallic cementitious commercial grout exhibiting zero shrinkage per ASTM C-827 and CRD-C-621. Grout shall not be amended with cement or sand and shall not be reconditioned with water after initial mixing. Unused grout shall be discarded after 20 minutes and shall not be used.

C. Non-shrink grout shall be placed or packed only with the use of an approved commercial concrete bonding agent applied to all cured concrete surfaces being grouted. The bonding agent shall be compatible with the brand of grout

used. Water shall not be used as a substitute for the commercial bonding agent.

D. Rubber gaskets shall conform to ASTM C 443.

E. Preformed mastic gaskets for vault, manhole and wet well joints shall meet Federal Specification SS-S-00210 (210-A) and AASHTO M-198B.

F. Waterproof sealant for vault pipe penetrations shall be Vulkem 921 or approved equal.

PART 3 EXECUTION

3.1 General

A. The CONTRACTOR shall design the method of placement for all precast items and shall add all reinforcing steel, embeds, bracing, and other items necessary for such placement. All portions of embeds which remain embedded in the concrete shall be made of stainless steel.

B. The CONTRACTOR shall safely install all precast items with no damage to the precast item or any other structure, piece of equipment, or appurtenance.

C. Precast structures shall be installed in accordance with the manufacturer's recommendations, unless otherwise required by the Contract Documents.

D. Subgrade Preparation -- Subgrade shall be compacted to 95 percent of maximum density and covered with a minimum of six (6) inches of aggregate base which is also compacted to 95 percent of maximum density. The aggregate base shall be graded to a uniform, level surface to fully support the structure and to an elevation that will assure proper positioning of the top slab or lid.

E. Joints -- All joints for vaults, manholes and wet wells shall be sealed watertight by the use of rubber gaskets or preformed sealant. All joints shall then be filled with non-shrink grout inside and out to produce smooth interior and exterior surfaces.

3.2 Precast Vaults

Pipe Penetrations -- Pipe penetrations shall be located and sealed as shown on the drawings. All pipe penetrations shall be preformed or core drilled to produce a smooth hole to allow for the installation of the specified sealing device. Where specified, pipe penetrations shall be sealed with a Link Seal as manufactured by Thunderline or approved equal. All such connections shall be watertight.

3.3 Precast Concrete Manholes

A. All rigid non-reinforced pipe entering or leaving the manhole (new or existing manhole) shall be provided with flexible joints within one foot of the structure and shall be placed on compacted bedding. Concrete pipe and ribbed HDPE pipe connections to manholes shall be grouted watertight with non-shrink grout. PVC pipe shall be connected to manholes using an approved adapter specifically manufactured for the intended service. Adapters shall be Fernco, Kor-N-Seal, or approved equal

B. Concrete Base Installation

1. Bases shall be set at the proper grade to allow pipe openings to match the grades for connecting pipes. The invert shall be constructed to a section identical with that of the sewer pipe. Where the size of sewer pipe is changed at the manhole, the invert shall be constructed to form a smooth transition without abrupt breaks or unevenness of the invert surfaces. Where a full section of concrete sewer pipe is laid through the manhole, the top shall be broken out to the spring line of the pipe for the full width of the manhole, and the exposed edge of the pipe completely covered with mortar. During construction, the CONTRACTOR shall prevent sewage or water from contacting the new concrete or mortar surfaces to prevent damage to the fresh concrete or mortar until the initial set has been achieved.

2. Manhole bases shall be set level so that base gravel fully and uniformly supports them in true alignment with uniform bearing throughout full circumference. Do not level the base sections by wedging gravel under the edges.

3. Flexible connectors shall be installed in the base section to form a permanently watertight seal.

C. Manhole Riser Sections

1. Precast manhole components may be used to construct standard, drop and carry-through manholes. Manholes less than four (4) feet in depth measured from the springline of the pipe to the bottom of the lower riser ring shall be flat-top manholes.

2. Install manhole riser sections at the location shown on the plans. All sanitary sewer and pollution control manholes joints shall be watertight and shall use rubber gaskets or a preformed sealant. All joints shall ten be filled with non-shrink grout inside and out so as to produce smooth interior and exterior surfaces. All manhole penetrations shall be

watertight. Complete manholes shall be rigid. Compact backfill in accordance with the provisions stated elsewhere in this document.

3. All lift holes shall be thoroughly wetted, completely filled with mortar, and smoothed and pointed both inside and out to ensure watertightness.

4. The shortest length of riser section to be incorporated into the manhole shall be installed immediately below the flat slab top or cone.

5. Properly locate and plumb each manhole riser section.

6. Install manhole extensions and top slabs in accordance with manufacturer's specifications and as shown on the plans. Lay section risers with sides plumb and tops level. Make joints and penetrations watertight.

D. Grates, Frames, and Covers

1. Manhole frames, grates and covers shall be installed in such a manner as to prevent infiltration of surface or groundwater between the frame and the concrete of the manhole section. Use preformed rubber ring to form a watertight seal.

2. Manhole frames and covers shall be installed to grades shown on the drawings or as directed.

3. Adjustment of manhole castings shall be made using specified precast grade rings and approved rubber ring joints.

4. The maximum depth of adjustment below any manhole casting shall be 16 inches, and a minimum depth of adjustment shall be four (4) inches.

E. Manhole Hydrostatic Test

The hydrostatic test shall consist of plugging all inlets and outlets and filling the manhole with water. The manhole shall be filled to the rim at the start of the test. Leakage in the manhole shall not exceed 0.2 gallons per foot of head above the invert after a one-hour test period. Leakage shall be determined by refilling to the rim using a calibrated known-volume container. The manhole may be filled 24 hours prior to the time of testing to permit normal absorption into the walls.

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 03300, CAST-IN-PLACE CONCRETE and as referred to herein.

B. Commercial Standards

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

2. ASTM C109 “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)”

3. ASTM C531 ”Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”

4. ASTM C579 ”Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”

5. ASTM C827 “Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens 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 C827; 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 03740

EPOXY ADHESIVE INJECTION OF CONCRETE MEMBERS

PART 1 GENERAL

1.1 Description

The CONTRACTOR or his SUBCONTRACTOR shall furnish all materials, tools, equipment, appliances, transportation, labor and supervision required to repair cracks by the injection of an epoxy resin adhesive.

1.2 Qualifications

A. Epoxy injection shall be performed by a certified applicator.

B. CONTRACTOR'S/SUBCONTRACTOR'S OPERATOR engaged in the epoxy injection process shall have satisfactory operator experience in the methods of restoring concrete structures utilizing the specific epoxy injection process indicated. OPERATOR'S experience shall include previous repairs of cracked or damaged concrete structures, the technical knowledge of correct material selection and use, and the operation, maintenance and trouble shooting of equipment.

PART 2 MATERIALS & EQUIPMENT

2.1 Epoxy Resin Adhesive for Injection

Epoxy adhesive grout shall be a 100% solids 2-part water insensitive low-viscosity epoxy resin system. Epoxy shall be suitable for grouting both dry and damp cracks. Epoxy shall develop a minimum tensile strength (ASTM D695) of 6,000 psi and a minimum compressive strength of 8,000 psi. Epoxy shall be SELECT BOND GP-4440, as manufactured by SPC, or equivalent.

2.2 Surface Seal

A. The surface seal material is that material used to confine the injection adhesive in the fissure during injection and cure.

B. The surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.

2.3 Equipment for Injection

A. The equipment used to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide positive ratio control of exact proportions of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in-line metering and mixing.

B. The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 200 psi plus or minus 5 psi and shall be equipped with a manual pressure control override.

C. The injection equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of plus or minus 5 percent by volume at any discharge pressure up to 200 psi.

PART 3 EXECUTION OF WORK

3.1 Preparation

A. Surface adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil, efflorescence or other foreign matter which may be detrimental to the integrity of the bond between the epoxy and the injection surface. Acids and corrosives shall not be permitted.

B. Entry ports shall be provided along the crack at intervals of not less than the thickness of the concrete at that location.

C. Surface seal material shall be applied to the face of the crack between the entry ports. For through cracks, surface seal shall be applied to both faces.

D. Enough time for the surface seal material to gain adequate strength shall pass before proceeding with the injection.

3.2 Epoxy Injection

A. Injection of epoxy adhesive shall begin at lower entry port and continue until there is an appearance of epoxy adhesive at the next entry port adjacent to the entry port being pumped.

B. When epoxy adhesive travel is indicated by appearance at the next adjacent port, injection shall be discontinued on the entry port being pumped, and epoxy injection shall be transferred to the next adjacent port where epoxy adhesive has appeared.

C. Epoxy adhesive injection shall be performed continuously until cracks are completely filled.

D. If port to port travel of epoxy adhesive is not indicated, the work shall immediately be stopped and the ENGINEER notified.

3.3 Finishing

A. When cracks are completely filled, epoxy adhesive shall be cured to sufficient time to allow removal of surface seal without any draining or runback of epoxy material from cracks.

B. Surface seal material and injection adhesive runs or spills shall be removed from concrete surfaces.

C. The face of the crack shall be finished flush to the adjacent concrete showing no indentations or protrusions caused by the placement of entry ports.

3.4 Pressure Test

A. The mixing head of the injection equipment shall be connected and the equipment run until clear uniformly mixed material flows into the purge pail. The OPERATOR shall engage the equipment shut-off nozzle valve and subsequently bump the on-off switch while monitoring pressure on psi gauge until the pressure reaches 200 psi. Pressure gauge shall be monitored for one minute. If pressure is maintained between 190-200 psi, check valves shall be considered to be functioning properly and the injection may proceed. If pressure drops below 190 psi, CONTRACTOR shall be required to have new seals installed on the check valves and the equipment shall be subsequently retested.

B. The pressure test shall be run for each injection unit at the beginning and after meal break of every shift that the unit is used in the work of crack repair.

C. The adequacy and accuracy of the equipment shall be solely the responsibility of the CONTRACTOR.

3.5 Ratio Test

A. The epoxy mixture ratio shall be monitored continuously while injecting by placing a strip of masking tape on the sides of the A & B reservoirs full height. After filling reservoirs, the A & B levels shall be marked and monitored while running injection machine into purge pail for a period of one minute.

B. The ratio test shall be run for each injection unit at the beginning and after meal break of every shift that the unit is used in the work of crack repair.

3.6 Proof of Ratio and Pressure Test

A. At all times during the course of the work the CONTRACTOR shall keep complete and accurate records available to the ENGINEER of the pressure and ratio tests specified above.

B. In addition, the ENGINEER at any time without prior notification of the CONTRACTOR, may request the CONTRACTOR to conduct the tests specified above in the presence of the ENGINEER.

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

5. SSINA – “Stainless Steel Fabrication”

B. Qualification for Welding Work -- Qualify welding processes and welding operators in accordance with AWS D1.1 “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. Stainless Steel, General – Grade 304 or 316

L. Stainless Steel Plate, Sheet, Strip (chromium-nickel) -- ASTM A 167

M. Stainless Steel Pipe (austentic) – ASTM A 312

N. Structural Aluminum Shapes and Plates -- ASTM B 308, Alloy 6061-T6, Anodic Coating Class I, AA-C22-A41, anodized after fabrication

O. 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.

2.13 Concrete Vault Hatches

The vault hatches shall be BILCO J-AL or JD-AL or approved equal and conform to the following minimum requirements:

A. Size as shown on drawings.

B. Flush grip handle.

C. Comp. spring lifting mechanism assembly.

D. Heavy duty forged brass hinges with stainless steel pins.

E. Heavy duty automatic lock open arm with red vinyl release grip.

F. Heavy duty check chain.

G. Plate cover reinforced for H20 Loading

H. 1-1/2 inch drain coupling.

I. Channel frame with anchor flange.

J. Stainless steel slamlock with brass spoon handle.

K. All steel plate, sheeting and hardware galvanized or cadium plated except as noted above.

L. Shop finish of cover and frame: Mill finish.

M. Recessed hasp for pad lock.

N. Aluminum in contact with concrete or grout to be coated with epoxy as specified herein.

2.13 Reservoir Roof Access Hatches

The vault hatches shall be U.S.F Fabrication Inc. model FPS Potable Water compliant or approved equal and conform to the following minimum requirements:

A. Size as shown on drawings.

B. All hardware and components shall be 316 stainless steel (nuts, bolts, washers).

C. ¼" aluminum shall consist of 6061 T6 & 5058 grade aluminum

D. Cover: aluminum diamond plate cover shall be reinforced for a 625 psf live load rating. Provide 2" lip on door leaf (shoe box) over top of frame extrusion. Door leaf shall include neoprene gasket affixed to underside of door leaf and hatch shall be capable of holding up to 10 ft head of water without leakage.

E. Frame: Minimum 4" high frame and suitable for embedment in a cast-in-place concrete curb. Mill finished with a bituminous coating where the frame is in contact with concrete.

F. Lock Devises: 316 Stainless steel pressure locks on each non hinged side of door leaf. Hatch frame shall include a tamperproof exterior padlock shroud for padlock staple.

G. Lift Assist: 316 Stainless steel lift assist mechanism for one handed operation of door leaf. Door leaf lifting weight must not exceed 30 lbs to lift at any point within the 90 degree open position.

H. Door leaf must include a 316 stainless steel Heavy duty hold open arm with secondary latch mechanism.

I. Door leaf finish: glare reducing acid wash finish.

J. Lift Handle: Aluminum lift handle welded to the cover leaf.

K. Aluminum in contact with concrete or grout to be coated with epoxy as specified herein.

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, Pre-painted 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 Buildings.

PART 2 PRODUCTS

2.1 Rough Carpentry Hardware

Rough carpentry hardware used in building construction shall conform to the latest provisions of the Oregon State Structural Specialty Code, the International Building Code (IBC), 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. Use stainless steel nails at locations where stainless steel hardware is specified in the Contract Documents, do not mix dissimilar materials without approval of the ENGINEER. Hot-dipped galvanized or stainless steel nails are required at all locations where they are in contact with treated wood. The number and size of nails connecting wood members shall be per the Contract Documents but shall not be less than that set forth in Table 2304.9.1 of the IBC for any members.

2.3 Bolts and Screws

Conforming to ASTM A307, appropriately sized for the materials being joined. Use galvanized bolts and screws where exposed or in contact with treated wood or embedded into concrete.

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. Post hot-dip galvanize all connection hardware in contact with pressure treated wood, or use stainless steel connectors.

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 OWNER.

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

A. The CONTRACTOR shall submit a complete list of products, product information, type and grade for OWNER approval prior to beginning building construction.

B. The design of the roof truss system shall be a deferred submittal for the building permit prepared by the CONTRACTOR.

1.3 Quality Assurance

A. All work specified herein shall conform to the latest provisions of the International Building Code (IBC), the Plastic Lumber National Evaluation Service, NER-508, and the local Codes and Ordinances of all Governmental agencies having jurisdiction over the Project.

B. 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.

C. Where special inspection of wood structural elements is required in the Contract Documents, an independent testing agency or laboratory shall perform special inspection of the elements indicated in the Contract Documents. The OWNER or and agent of the OWNER will engage a testing

laboratory acceptable to the ENGINEER to perform the required Special Inspections and/or Material Tests.

D. 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 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 Delivery, Handling and Storage

Immediately upon delivery to job site, place materials in an area protected from weather. Store materials a minimum of six (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 the latest edition of U.S. Department of Commerce, National Institute of Standards and Technology, Product Standard DOC PS 20 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 2012 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 the latest edition of U.S. Product Standards PS 1 and PS 2, and be Engineered Wood Association (APA) rated Exposure 1.

C. Lap siding, soffit panels and trim shall be as specified in Section 07460, Fiber Cement Siding of these Specifications.

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 the latest edition of U.S. Product Standard DOC PS 20.

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	Douglas Fir-Larch No. 2
Structural light framing, two (2) inches to four (4) inches thick, two (2) inches to six (6) inches wide	Douglas Fir-Larch No. 2
Structural joists, rafters and planks, two (2) inches to four (4) inches thick, five (5) inches and wider and headers	Douglas Fir-Larch No. 2
Beams, stringers, posts, timber	Douglas Fir-Larch No. 1
Fascia Board	Fiber cement board manufactured by James Hardie or approved equal
Sills and Plates	Douglas Fir-Larch No. 2, Treated in accordance with IBC 2303.1.8

2.4 Plywood

A. Roof sheathing shall conform to APA rated sheathing and shall be identified with the appropriate trademark. Minimum sheathing shall be, Exposure 1, 1/2-inch or greater, grade CDX. Span rated 32/16 per APA.

B. MDO -- APA rated Medium Density Overlay exterior glue.

2.5 Building Paper

Asphalt-saturated felt conforming to ASTM D 226 or D 250, Type I, plain non-perforated.

2.6 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.

B. Stud Framing

1. Plates and Stud Members

Unless shown otherwise in the Contract Documents, provide single pressure treated bottom plates for the tops of all concrete or masonry unit walls, 1-1/2 inches thick by 5-1/2 inches wide (2 x 6). Provide double top plates for the tops of the wood framed interior partition wall, 1-1/2 inches thick by 5-1/2 inches wide (2 x 6). Splice top plates at corners and intersections with an appropriate framing anchor as specified in Section 06050.

Provide studs in continuous lengths without splice.

End nail studs to bottom plate and end nail to lower top plate where required.

Facenail upper top plate to lower top plate.

Anchor plates to concrete or CMU walls as shown on Drawings.

2. Blocking

Install continuous, staggered horizontal row where shown on Drawings or required by code.

Locate blocking to facilitate installation of finishing materials, fixtures, specialty items, hardware, and trim.

C. Engineered Trusses -- See drawings for requirements and Section 06175-3

D. Roof Sheathing

Install plywood with face grain perpendicular to supports, using panel with continuous end joints over two or more spans staggered between panels and locate over supports.

Allow minimum space 1/16-inch (1.6 mm) between end joints and 1/8-inch (3.2 mm) at edge joints for expansion and contraction of panels.

Support edge joints by use of ply clips or lumber blocking, unless noted otherwise on Drawings.

E. Ceiling Plywood -- Install ceiling plywood where shown on drawings with joints transverse to the members they attach to. Attach plywood sheets to wood framing using finish nails. Countersink nails. Spackle and sand joints, knot holes, and nail holes as required to provide a smooth uniform surface prior to application of paint coating system as specified in Section 09800.

F. Install horizontal lap siding as required by manufacturer recommendations.

G. Fastener Requirements – Connections for wood members shall be in accordance with the Contract Drawings and Section 06050. The number and size of nails connecting wood members shall not be less than that set forth in Table 2304.9.1 of the IBC.

END OF SECTION

SECTION 06175

SHOP FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 Description

Design, manufacture, and supply wood trusses as shown on the Construction Documents and as specified.

1.2 Definitions

A. *BCSI:* Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses jointly produced by the Structural Building Components Association and the Truss Plate Institute.

B. *Building Designer:* Owner of the Building or the person that contracts with the Owner for the design of the Framing Structural System and/or who is responsible for the preparation of the Construction Documents.

C. *Building:* Structure used or intended for supporting or sheltering any use or occupancy.

D. *Building Code:* As it applies to a Building, any set of standards set forth and enforced by a Jurisdiction for the protection of public safety.

E. *Building Official:* Officer or other designated authority charged with the administration and enforcement of the Building Code, or a duly authorized representative.

F. *Construction Documents*: Written, graphic and pictorial documents prepared or assembled for describing the design (including the Framing Structural System), location and physical characteristics of the elements of a Building necessary to obtain a Building Permit and construct a Building.

G. *Contractor:* Owner of a Building, or the person who contracts with the Owner, who constructs the Building in accordance with the Construction Documents and the Truss Submittal Package. The term "Contractor" shall include those subcontractors who have a direct contract with the Contractor to construct all or a portion of the construction.

H. *Cover/Truss Index Sheet:* Sheet that is signed and sealed by an Oregon licensed Professional Engineer, by the Truss Design Engineer, and shall contain the following information: (1) identification of the Building, including

Building name and address, lot, block, subdivision, and city or county; (2) identification of Construction Documents by drawing number(s) with revision date; (3) specified Building Code; (4) computer program used; (5) roof dead and live loads; (6) floor dead and live loads; (7) wind load criteria from a specifically defined code (e.g., *ASCE 7*) and any other design loads (such as ponding, mechanical loads, etc.); ; (8) a listing of the individual identification numbers and dates of each Truss Design Drawing referenced by the Cover/Truss Index Sheet; and (9) name, address, date of drawing and license number of Truss Design Engineer.

I. *Framing Structural System:* Completed combination of Structural Elements, Trusses, connections and other systems, which serve to support the Building's self-weight and the specified loads.

J. *Jurisdiction:* Governmental unit that is responsible for adopting and enforcing the Building Code.

K. *Legal Requirements:* Any applicable provisions of all statutes, laws, rules, regulations, ordinances, codes, or orders of the governing Jurisdiction.

L. *Owner:* Person having a legal or equitable interest in the property upon which a Building is to be constructed, and: (1) either prepares, or retains the Building Designer or Registered Design Professional to prepare the Construction Documents; and (2) either constructs, or retains the Contractor to construct the Building.

M. *Registered Design Professional:* Engineer, who is licensed to practice their respective design profession as defined by the Legal Requirements of the Jurisdiction in which the Building is to be constructed.

N. *Standard:* National Design Standard for Metal Plate Connected Wood Truss Construction *(ANSI/TPI 1)*.

O. *Structural Element:* Single structural member (other than a Truss) that is specified in the Construction Documents.

P. *Truss*: Individual metal-plate-connected wood component manufactured for the construction of a Building.

Q. *Truss Design Drawing*: Written, graphic and pictorial depiction of an individual Truss that includes the information required in the Standard.

R. *Truss Design Engineer:* Person who is licensed to practice engineering as defined by the Legal Requirements of the Jurisdiction in which the Building is to be constructed and who supervises the preparation of the Truss Design Drawings.

S. *Truss Designer*: Person responsible for the preparation of the Truss Design Drawings.

T. *Truss Manufacturer*: Person engaged in the fabrication of Trusses.

U. *Truss Placement Diagram*: Illustration identifying the assumed location of each Truss.

V. *Truss Submittal Package:* Package consisting of each individual Truss Design Drawing, and, as applicable, the Truss Placement Diagram, the Cover/Truss Index Sheet, Lateral Restraint and Diagonal Bracing details designed in accordance with generally accepted engineering practice, applicable *BCSI* defined lateral restraint and diagonal bracing details, and any other structural details germane to the Trusses.

1.3 Design

A. Trusses shall be designed in accordance with the Standard and where any applicable design feature is not specifically covered herein, design shall be in accordance with the applicable provisions of the latest edition of the American Forest & Paper Association's (AF&PA's) *National Design Specification® (NDS®) for Wood Construction* and all applicable Legal Requirements.

B. Truss Manufacturer shall furnish Truss Design Drawings and Calculations prepared in accordance with all applicable Legal Requirements, and signed and stamped by an Oregon licensed Professional Engineer.

C. The Truss Manufacturer shall furnish a Truss Placement Diagram which shall provide at a minimum the location assumed for each Truss based on the Truss Manufacturer's interpretation of the Construction Documents.

D. The Truss Manufacturer shall submit the Truss Submittal Package to the Building Designer and/or the local Building Official for review and approval prior to the manufacturing of the Trusses.

E. The Truss Design Drawings shall include, at a minimum, the information specified below (per the Standard):

1. Building Code used for Design, unless specified on Cover/Truss Index Sheet.

2. Slope or depth, span and spacing.

3. Location of all joints and support locations.

4. Number of plies if greater than one.

5. Required bearing widths.

6. Design loads as applicable, including:

   - Top Chord live load (for roof Trusses, this shall be the controlling case of live load or snow load);
   - Top chord dead load;
   - Bottom chord live load;
   - Bottom chord dead load;
   - Additional loads and locations;
   - Environmental Load Design Criteria (wind speed, snow, seismic, and all applicable factors as required to calculate the Truss loads); and
   - Other lateral loads, including drag strut loads.

7. Adjustments to Wood Member and Metal Connector Plate design values for conditions of use.

8. Maximum reaction force and direction, including maximum uplift reaction forces where applicable.

9. Metal Connector Plate type, manufacturer, size, and thickness or gauge, and the dimensioned location of each Metal Connector Plate except where symmetrically located relative to the joint interface.

10. Size, species and grade for each Wood Member.

11. Truss-to-Truss connection and Truss field assembly requirements.

12. Calculated span to deflection ratio and/or maximum vertical and horizontal deflection for live and total load and K_{CR} (creep factor) as applicable.

13. Maximum axial tension and compression forces in the Truss members.

14. Fabrication tolerance per the Standard.

15. Required Permanent Individual Truss Member Restraint location and the method of Restraint/Bracing to be used per the Standard.

PART 2 PRODUCTS

2.1 Materials

A. Lumber:

1. Lumber used shall be identified by grade mark of a lumber inspection bureau or agency approved by the American Lumber Standards Committee, and shall be the size, species, and grade as shown on the Truss Design Drawings, or equivalent as approved by the Truss Design Engineer/ Truss Designer and shall be in accordance with Specification Section 06100 Part 2.1.

2. Adjustment of value for duration of load or conditions of use shall be in accordance with the latest edition of the National Design Specification for Wood Construction (*NDS)*.

3. Fire retardant treated lumber, if applicable, shall meet the specifications of the fire retardant chemical manufacturer, the Truss design and the Standard and shall be re-dried after treatment in accordance with the American Wood-Preservers' Association (AWPA) Standard *C20 Structural Lumber – Fire Retardant Treatment by Pressure Processes*. Allowable values must be adjusted in accordance with *NDS*. Lumber treater shall supply certificate of compliance.

B. Metal Connector Plates:

1. Metal connector plates shall be manufactured by a Truss Plate Institute (TPI) member plate manufacturer and shall not be less than 0.036 in. thick (20 gauge) and shall meet or exceed *ASTM A653/A653M* grade 33, and galvanized coating shall meet or exceed *ASTM A924/924M*, coating designation G60. Working stresses in steel are to be applied to effectiveness ratios for plates as determined by test and in accordance with the Standard.

2. In highly corrosive environments, special applied coatings or stainless steel may be required as noted on the Contract Documents.

3. At the request of the Building Designer, a TPI member plate manufacturer shall furnish a certified record that materials comply with steel specifications.

2.2 Manufacturing

Trusses shall be manufactured to meet the quality requirements of the Standard and in accordance with the information provided in the final approved Truss Design Drawings.

PART 3 EXECUTION

3.1 Handling, Installing, Restraining and Bracing

A. Trusses shall be handled during manufacturing, delivery and by the Contractor at the job site so as not to be subjected to excessive bending.

B. Trusses shall be unloaded in a manner so as to minimize lateral strain. Trusses shall be protected from damage that might result from on-site activities and environmental conditions. Trusses shall be handled in such a way so as to prevent toppling when banding is removed.

C. Contractor shall be responsible for the handling, installation, and temporary restraint/ bracing of the Trusses in a good workmanlike manner and in accordance with the recommendations set forth in the latest edition of *BCSI*.

D. Apparent damage to Trusses, if any, shall be reported to Truss Manufacturer prior to erection.

E. Trusses shall be set and secured level and plumb, and in correct location. Each Truss shall be held in correct alignment until specified permanent restraint and bracing is installed.

F. Cutting and altering of Trusses is not permitted. If any Truss should become broken, damaged, or altered, written concurrence and approval by a Registered Design Professional is required.

G. Concentrated loads shall not be placed on top of Trusses until all specified restraint and bracing has been installed and decking is permanently nailed in place. Specifically avoid stacking full bundles of plywood or other concentrated loads on top of Trusses.

H. Truss Submittals and any supplementary information provided by the Truss Manufacturer shall be provided by the Contractor to the individual or organization responsible for the installation of the Trusses.

I. Trusses shall be permanently restrained and braced in a manner consistent with good building practices as outlined in *BCSI* and in accordance with the requirements of the Construction Documents. Trusses shall furthermore be

anchored or restrained to prevent out-of-plane movement so as to keep all Truss members from simultaneously buckling together in the same direction. Such permanent lateral restraint shall be accomplished by: (a) anchorage to solid end walls; (b) permanent diagonal bracing in the plane of the web members; or (c) other suitable means.

J. Materials used in temporary and permanent restraint and bracing shall be furnished by Contractor.

END OF SECTION

SECTION 07200

BUILDING INSULATION

PART 1 GENERAL

1.1 Description

A. The extent of insulation work is shown on drawings and indicated by provisions of this section.

B. Applications of insulation specified in this section include rigid foam board and loose-fill type systems.

1.2 Submittals

The CONTRACTOR shall submit a complete list of products, product information, types and grades for approval by the ENGINEER 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. Light Shafts and Vent Ducts

1. Insulation in framed skylight light shafts and vent ducts in attic spaces shall be rigid cellular polyurethane, polystyrene or polyisocyanurate foam board insulation.
2. Thickness and minimum R value shall be as shown in drawings or as required by current Oregon Energy Efficiency Specialty Code.

B. Loose-Fill Insulation

1. Perlite insulation shall conform to ASTM C549.
2. Cellulose fiber loose-fill insulation shall conform to ASTM C739.

3. Thickness and minimum R value shall be as shown in drawings or as required by current Oregon Energy Efficiency Specialty Code.

PART 3 EXECUTION

3.1 Installation, General

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. Install insulation system in accordance with manufacturer's recommendations or requirements.

C. Set vapor barrier faced units with vapor barrier to warm side (winter) of construction. Do not obstruct ventilation spaces, except for firestopping.

END OF SECTION

SECTION 07400

METAL ROOFING

PART 1 GENERAL

1.1 Scope

Work includes furnishing and installing a standing seam interlocking panel metal roof system with concealed fasteners where shown on the drawings and as specified herein.

1.2 Submittals

A. Product data and materials list of items proposed to be provided under this Section.

B. Sufficient technical data to demonstrate compliance with the specified requirements.

C. Samples, to include preformed panel, seam, fastener, base sheet, finish sheet, ridge, and trims.

1.3 Quality Assurance

A. Use 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.

B. In addition to complying with requirements of governmental agencies having jurisdiction, comply with:

1. Underwriters' Laboratories, Inc., Class 90 wind uplift

2. Underwriters' Laboratories, Inc., UL 790, Class A roof assembly a fire rating

3. SMACNA -- Pertinent recommendations contained in the "Architectural Sheet Metal Manual"

C. Warranty -- Installer and manufacturer shall furnish a written 5 year warranty stating that they will be responsible for replacement at their cost of any portion of the roof system that leaks due to defects in material or installation.

1.4 Delivery, Handling and Storage

Comply with manufacturer's requirements for product delivery, handling and storage.

PART 2 PRODUCTS

2.1 Materials

A. Panels -- 13 1/2-inch maximum width continuous length interlocking hot-dip zinc coated steel sheets, minimum 26 GA thickness, ASTM A-446, Grade C ASTM A-792-83 zinc coating, surface treated for maximum coating performance.

B. Metal Finish -- Polyvinylidene fluoride resin (min 70% resin) finish coat applied over baked-on compatible prime coat. 1 mil minimum total coating system thickness, in manufacturer's standard color as selected by OWNER.

C. Roofing Membrane -- Comply with ASTM D2626, Type 1, 30 pound.

D. Slip sheet -- Rosin-surfaced building paper weighing not less than 3 pounds. per 100 square foot, W.R. Meadows Red Rosin Paper or equal.

E. Anchors -- 1-inch long, large head galvanized wood screws.

2.2 Fabrication

Shop fabricate to the maximum extent practicable. Brake-form to the indicated profiles, length and width.

2.3 Acceptable Manufacturers

A. Bruce & Dana, Inc., Salem, Oregon
B. ASC Pacific, Inc., Tacoma, Washington
C. Ray F. Becker, Co., Portland, Oregon

PART 3 EXECUTION

3.1 Installation

A. General

1. Do not allow the installed work of this Section to be used as a storage space for other materials.

2. Do not permit unnecessary walking on the finished roof. Require all personnel to wear rubber-soled shoes when installing or walking on the finished surfaces.

3. Install per approved submittal drawings only.

4. Discrepancies between job site conditions and drawings as approved shall be brought to the attention of the Engineer for resolution.

B. Apply the specified roofing membrane over the entire area to be covered by sheet metal roofing.

1. Start at the low edge, and place succeeding courses shingle fashion, lapping edges 2-inch minimum.

2. Lap the membrane with flashings as necessary to provide a positive barrier against penetration of water.

C. Apply the specified slip sheet over the entire assembly, scatter nail to sheathing as required to hold in position prior to application of metal panels.

D. Install concealed anchor cleats at minimum 18-inch centers into roof sheathing.

E. Install preformed metal panels in strict accordance with manufacturer's approved written installation instructions.

1. Do not drive fasteners through panels or seams.

2. Do not use tools or methods that scratch or mar the finish on exposed surfaces.

3.2 Cleaning and Protection

A. Damaged Units -- Replace panels and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Cleaning -- Remove protective coverings and strippable films (if any) at time in project construction sequence which will afford greatest protection of work. Clean finished surfaces upon completion of work as recommended by panel manufacturer.

C. Protection -- Installer shall advise the CONTRACTOR of protection and surveillance procedures, as required to ensure that work of this Section will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 07460

FIBER CEMENT SIDING

PART 1 GENERAL

1.1 Scope

Furnish all necessary labor, material and equipment for complete installation of fiber cement siding, fascia, molding and related work as shown on Drawings or specified herein.

1.2 References Specifications, Codes and Standards

A.	Section 06100	Rough Carpentry: Wood framing and bracing.
B.	Codes	BOCA, ICBO, SBCCI, Report No. NER-405
C.	ASTM C1185	Flexural Strength 1850 psi along direction of sheet, 2000 psi across direction of sheet
D.	ASTM E-136	Product is non-combustible
E.	ASTM E-84	Flame Spread = 0, Fuel Contribution = 0, Smoke developed = 5

1.3 Submittals

A. Submit under provisions of Section 01300

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Samples of siding design, size and color for approval.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

1.4 Quality Assurance

Installer qualifications: Minimum of 2 years' experience with installation of similar products.

1.5 Delivery, Storage and Handling

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 Project Conditions

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 Warranty

A. Product Warranty: Limited product warranty against manufacturing defects.

1. Lap vertical siding for 50 years.
2. Trim for 10 years.

PART 2 PRODUCTS

2.1 Manufacturer

Material to be supplied by James Hardie Building Products or approved fiber cement siding manufacturer.

2.2 Materials

A. Lap Siding: Hardieplank as manufactured by James Hardie Building Products, Inc. Type: Cedarmill Select 7-1/4 inches (191mm) with 6 inches (152 mm) exposure or approved equal.

B. Trim: Hardietrim Fascia and Moulding as manufactured by James Hardie Building Products, Inc., or approved equal. Trim to be 1” thickness and width as shown on drawings.

C. Soffit Panels: HardieSoffit as manufactured by James Hardie Building Products, Inc. Type: ¼ inch Vented Cedarmill panels or approved equal.

2.3 Fasteners

Wood Framing Fasteners: All fasteners shall be stainless steel. Select in accordance with local codes and manufacturers installation recommendations.

2.4 Finishes

Factory Primer: Provide factory applied universal primer.

PART 3 EXECUTION

3.1 Examination

A. Do not begin installation until substrates have been properly prepared.

B. If framing preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

C. Nominal minimum of 2-inch by 4-inch (51 m by 102 mm) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.

1. Install water-resistive barriers and claddings to dry surfaces.

2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.

3. Protect siding from other trades.

3.2 Preparation

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 Installation – Fiber Cement Lap Siding

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Starting: Install a minimum ¼-inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.

C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer’s installation instructions.

D. Align vertical joints of the planks over framing members.

E. Maintain clearance between siding and adjacent finished grade.

F. Locate splices at least one stud cavity away from window and door openings.

G. Wind Resistance: Where a specified level of wind resistance is required, lap siding is installed to framing members and secured with fasteners described in Table No. 2 in National Evaluation Service Report No. NER-405.

3.4 Installation – Fiber Cement Trim & Soffit

A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.

B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.

C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.

D. Maintain clearance between trim and adjacent finished grade.

E. Trim inside corner with single board.

F. Outside Corner Board: For 3/4 inch (19 mm) trim only. Install single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten trim board to trim board.

G. Allow 1/8 inch gap (+/- 1/32 inch) between trim and siding.

H. Seal gap with high quality, paint-able caulk.

I. Shim frieze board as required to align with corner trim.

J. Install trim fascia over structural subfascia.

3.5 Finishing

Finish factory primed siding in accordance with specifications Section 09900.

3.6 Protection

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Final Completion.

END OF SECTION

SECTION 07610

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 Scope

A. The work includes furnishing and installing each type of flashing and sheet metal work including gutters and downspouts as indicated on the Drawings and by provisions of this Section.

B. They types of work specified in this Section include the following:

1. Galvanized metal flashings
2. Prefinished galvanized downspout and gutter

PART 2 PRODUCTS

2.1 Materials

A. Pre-finished Galvanized Steel Sheet -- 24 gage, commercial quality, galvanized steel sheet complying with ASTM A 525, G90 for hot-dip galvanizing, pre-finished with baked-on polyester coating, not less than 1.0 mil thick. Provide material in color selected by Owner.

B. Galvanized Steel Sheet -- 24 gage minimum, commercial quality, galvanized steel sheet with minimum of 0.20 percent copper content, complying with ASTM A 525, G90 for hot-dip galvanizing, mill phosphatized, unless otherwise indicated.

C. Miscellaneous Materials and Accessories

1. Solder -- Except as otherwise indicated or recommended by metal manufacturer, provide 100 percent lead free solder for tinning and soldering galvanized metal joints.

2. Visually Exposed Fasteners -- Stainless steel pop rivets with heads finished to match color of pre-finished metal material.

3. Concealed Fasteners -- Zinc coated, type as required and recommended by manufacturer for materials and substrates involved.

4. Mastic Sealant -- Polyisobutylene, non-hardening, non-skinning, non-migrating sealant typical for flashing lap joint applications.

2.2 Fabricated Units

A. General

1. Shop fabricate metal counter flashings, cap and sill flashings, and similar items to comply with profiles and sizes shown, and to comply with standard industry details as shown by SMACNA in the "Architectural Sheet Metal Manual."

2. Comply with metal producers' recommendations for tinning, soldering, and cleaning flux from galvanized metal fabrications. Provide stainless steel rivets at exposed fastenings in pre-finished metal fabrications.

3. Form exposed sheet metal work without oil-canning, buckling and tool marks, true to line and level with exposed edges folded back to form hems.

4. Where movable joints are required for proper installation of mastic sealant, in compliance with SMACNA standards.

B. Pipe Jack Sleeve Fastenings

1. Fabricate pipe, roof penetration sleeves from galvanized material fully tinned and soldered at seams. Provide stack sleeve of diameter ½-inch greater than penetrating pipe and same height above with 3-inch high conical base and embedment flange 12-inch greater than diameter of base. Furnish flanges at top of stack sleeve for attachment of counter flashing cap.

2. Fabricate counter flashing cap with interior pipe sleeve and conical cap to fit over pipe and stack sleeve. Size interior sleeve to tightly fit pipe diameter and to into pipe not less than 3 inches. Size conical cap to extend not less than 3 inches below top of stack sleeve with space above to permit not less than 1-inch pipe movement. Rivet counter flashing cap to flanges of stack sleeve.

C. Counter Flashings

1. Fabricate counter flashings from galvanized material to size and profiles shown in 10-foot minimum lengths with continuous 20 gage galvanized cleat at hemmed lower drip edge.

2. Where top leg of counter flashing is not covered by other applied materials or otherwise supported, provide with integral hemmed sealant dam and anchor to wall substrates with 1/8 inch by 1-1/2 inch galvanized float bar, prepared with fastener holes drilled or punched at 8-inch o.c. Coordinate size of holes with anchors to be used. Form sealant dam with 3/4-inch minimum outward-turned hemmed leg.

3. At inside and outside corners, provide double lapped, tinned and fully soldered assemblies, shop assembled prior to installation. Do not solder flashing corners after installation other than to render remedial surface repairs. If joint separation should occur, remove flashings and resolder as required.

D. Cap Flashings

1. Fabricate lap seamed cap flashings from galvanized material with hemmed drips on both sides and continuous 20 gage galvanized cleat at front edge.

2. Shop assemble cap end-to wall closure flashings with double lapped, riveted and mastic sealed construction. Provide vertical legs with sealant dam as required for counter flashings.

E. Wall Flashings

1. Fabricate wall flashings from galvanized material with flat locked, mastic filled vertical seams spaced not greater than 4 feet o.c.

2. Form as required to closely follow substrate profile and interlock with counter and cap flashing assemblies without exposed fasteners. Secure to walls with 20 gage galvanized cleat concealed by edge hems.

PART 3 EXECUTION

3.1 General

A. Comply with manufacturer's instructions and recommendation for handling and installation of flashing and sheet metal work.

B. Coordinate the work with other work for the correct sequencing of items which make up the entire membrane or system of weatherproofing and rain drainage. It is required that the flashing and sheet metal work be permanently water-tight, and not deteriorate in excess of manufacturer's published limitations.

C. Coordinate work of this Section with interfacing and adjoining work for proper sequence of each installation. Provide flashing and sheet metal work which is fully compatible with interfacing or adjoining work to ensure the best total assembly performance for weather resistance and durability.

3.2 Installation of Metal Work

A. Comply with details and profiles as shown, and comply with SMACNA "Architectural Sheet Metal Manual" recommendations for installation of the work.

B. For non-moving seams provide sealed flat-lock seams, except as otherwise indicated. Comply with metal producers' recommendations for tinning, soldering and cleaning the joints of soldered work.

C. Provide for thermal expansion of all exposed sheet metal work exceeding 20-foot running length, except as otherwise indicated.

D. Conceal fasteners and expansion provisions wherever possible. Fold back edges on concealed side of exposed edges, to form a hem and stiffen material.

E. Provide flashing reglets as shown or as required to seal work to existing substrates. Seal assembled joint with sealant as indicated.

F. Do not proceed with the installation of flashing and sheet metal work until curb and substrate construction, blocking, and other construction to receive the work is completed.

G. Examine the substrate and the conditions under which flashing and sheet metal work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.3 Cleaning and Protection

A. Clean visually exposed metal surfaces and other surfaces indicated to be painted. Remove corrosive substances, including soldering flux, which might cause deterioration of metal surfaces or final finish.

B. Provide surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration at time of acceptance by Owner.

END OF SECTION

SECTION 07810

OPERABLE SKYLIGHTS

PART 1 GENERAL

1.1 Section Includes

A. Performance and product component information for operable skylights shown on the project drawings.

B. Unit skylight mounted on site-built curbs.

C. Engineered flashings

1.2 Reference Standards

A. ASTM E 283– Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specific Pressure Differences Across the Specimen.

B. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

C. ASTM E 331– Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

D. ASTM E 1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles(s) and Exposed to Cyclic Pressure Differentials.

E. ASTM E 1996 – Standard Specifications for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

F. National Fenestration Rating Council, NFRC 100, Procedure for Determining Fenestration Product U-factors.

G. National Fenestration Rating Council, NFRC 200, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

H. National Fenestration Rating Council, NFRC 300, Test Method for Determining Solar Optical Properties of Glazing Materials and Systems.

1.3 System Description

A. Skylight: Bottom hung venting curb mount skylight that consists of integrated components -an interior condensation drainage gasket, an insulating glass unit, exterior structurally glazed, roll-formed aluminum sash and frame counter flashing.

B. Configuration: Outward opening to 90 degrees from closed, continuous bottom hinged production-installed manual operator, engineered mounting system with durable foam to seal the skylight to the curb.

C. Operation: Sash is operated by manual skylight operator.

D. Condensation Control: Integral internal condensation collection system and drainage slots.

1.4 Performance Requirements

A. Curb mount skylights are independently tested in accordance with listed standards for compliance with the unit skylight provisions of the latest OEESC, IBC and IRC model building codes. Rated performance grade may vary with skylight size and glazing type. The lowest design pressure values have been listed below.

B. AAMA/WDMA/CSA 101/I.S.2/A440-11 (NAFS-11) performance grades must be greater than or equal to the values listed below. Other specific data is listed in the chart just below.

1. Downward design pressure = 165 psf
2. Uplift Design Pressure = 30 psf

C. Highest Measured Air Leakage: 0.1 l/s/m² (0.02 CFM/ft²) of total unit area, measured at a differential pressure of 75 Pa (1.57 psf) in accordance with ASTM E 283.

D. Water Penetration: No water penetration occurred when measured in accordance with ASTM E 331 with a test pressure differential of 720 Pa (15 psf).

E. Thermal Performance: Tested and certified in accordance with NFRC 100 and 200 procedures. U = 0.54 Btu/hr*ft² * F°or less, SHGC = 0.24 or less, and VT = 0.54 or more (clear) or VT = 0.40 or more (white). Meets U.S. ENERGY STAR® criteria for all zones.

F. System accommodates movement between sash and frame and perimeter framing, without damage to components or deterioration of seals.

G. Weep drainage system designed to channel water entering joints, condensation occurring in glazing channel, or migrating moisture occurring within system or exterior by means of gaskets with integrated condensation gutter.

1.5 Submittals

A. Product Data: Manufacturer's installation details and product data sheets included:

1. Preparation details and installation instructions
2. Product Data sheets with storage and handling information

B. Architectural/Cross Sectional Drawings

1. Mounting details
2. Frame sizes
3. Flashing details

C. Shop Drawings

1. Indicate material types, gauge, finishes, and installation details.

1.6 Quality Assurance

A. Manufacturer Qualifications:

1. Skylight manufacturer shall have a minimum of ten years experience in design and fabrication of deck mount glass skylights.

2. Flashings shall be engineered and manufactured for the roofing material and skylight.

3. Skylight installed with three layers of protection: pre-attached skylight gasket provides a tight seal between a standard site-built curb, adhesive underlayment for secondary water protection, engineered flashing for primary protection.

B. Source Limitations: Obtain unit skylights, flashings, and accessories from a single source and from a single manufacturer.

C. Thermal Performance – rated per applicable NFRC procedures.

1. Provide NFRC certified unit skylight ratings on an attached label.

a. Qualify under Energy Star criteria in all 50 states and attach verifying label.

D. Provided NFRC certified unit skylights with an attached label.

1.7 Coordination

A. Coordinate unit skylight flashing requirements with roofing system.

B. Coordinate size and locations of curbs with actual unit skylight. If the slope of the roof is less than 14 degrees.

1.8 Warranty

A. Standard Manufacturer's warranty. 20 years on the insulated glass unit performance at described in the manufactures published literature, 10 years warranty on all factory components as described in manufactures published literature.

1.9 Delivery, Handling, Storage

A. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

B. Store and protect products in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.1 Manufacturers

A. Acceptable Manufacturers:

1. VELUX America Inc.
2. Architectural Specialties Inc.

B. Substitutions: Approved equal.

2.2 Materials

A. Maintenance free exterior aluminum frame and sash covers: Roll formed 15 gauge, 1.5 mm (0.06") thick, prefinished neutral gray, production engineered, and fabricated to fit.

B. Rigid polyvinyl chloride (PVC) for the frame and sash components with co-extruded gaskets and white finish. EPS filler where possible.

C. Fasteners: (Skylight to curb) #8 x 1½" stainless steel wood screw

D. Glazing (Options)

1. Dual-pane with warm edge technology, 95% argon gas, and LoE³ silver coating that increases visible light over standard LoE coatings while lowering the solar heat gain. The following glazing options are available:

2. Tempered LoE³ pane over a laminated heat strengthened interior pane with a (0.030") polyvinyl butyral interlayer.

3. Tempered LoE³ pane over tempered pane

4. Tempered LoE³ pane over laminated heat strengthened interior pane with a (0.090") polyvinyl butyral interlayer.

5. Tempered LoE³ pane over a laminated tempered interior pane with a (0.030") polyvinyl butyral interlayer to achieve higher snow load ratings.

6. Acrylic or polycarbonate (domed, pyramid or ridge shape).

E. Operators and Manual Operator Accessories: Manual control rods and extension poles available on manually operated venting skylights.

F. Weather stripping: Co-extruded or factory applied thermoplastic elastomer gasketing throughout entire frame and sash, profiled to effect weather seal.

2.3 Fabrication

A. Fabricated PVC frame with welded corners and EPS-filled air pockets for improved energy efficiency. The operator is also enclosed within the frame for a seamless low profile design.

B. Fabricated one piece aluminum counter flashing system with welded corners.

C. Provide permanent external drainage channels to manage water flow and drain to the exterior. Provide internal drainage of glazing spaces to exterior through gasketing to remove condensation.

D. All units are factory glazed with hot melt silicone-based exterior seal.

2.4 Finishes

A. Exterior surfaces: Maintenance free roll-formed aluminum exterior sash frame with neutral gray Kynar 500 polyvinylidene fluoride resin finish. Maintenance free roll-formed exterior frame, painted with neutral gray powder coat.

B. Maintenance free flashing: Roll formed aluminum, neutral gray, baked on polyester polyamide primer and finish coats.

C. Interior Surface: White maintenance free PVC.

D. Operator – concealed within the skylight frame.

PART 3 EXECUTION

3.1 Examination

A. Verify rough opening dimensions and proper orientation of skylight.

3.2 Installation

A. Install skylight in accordance with manufacturer's installation instructions and local building code requirements.

B. Align skylight level, free of warp or twist; maintain dimensional tolerances.

C. Attach skylight to field-constructed curb with screws furnished by manufacturer to accommodate construction tolerances and other irregularities.

D. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.

E. Coordinate attachment and seal of perimeter air and vapor barrier material.

F. Install manufacturer's engineered perimeter flashing in accordance with manufacturer's installation instructions to achieve weather tight installation

3.3 Cleaning

A. Clean exposed skylight according to manufacturer's instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded or damaged during the construction process.

D. During the construction process, protect the skylight surfaces from contact with contaminate.

END SECTION

SECTION 07920

SEALANTS AND CAULKING

PART 1 GENERAL

1.1 Description

The work includes sealing or caulking joints between dissimilar materials for watertight seal. Provide watertight caulked joints at all building exterior locations where possible water penetration through joint may occur. If caulking systems for such joints are not shown, provide as specifically approved.

Terminology -- Where the words “sealants” or “caulking” are used in this text, they shall be considered to be synonymous and shall mean sealant or caulking compounds as specified under Part 2 of this specification.

PART 2 PRODUCTS

2.1 Materials

A. Type A Sealant

1. Application -- General building sealant.

2. Material -- One component polyurethane sealant.

   a. Vulkem 116 as manufactured by Tremco.
   b. Sonolastic NP1 as manufactured by BASF.

B. Type B Sealant

1. Application -- General building sealant for wide joints.

2. Materials -- Self leveling one (1) component polyurethane.

   a. Vulkem 45 as manufactured by Tremco.

C. Filler Gasket (Backer Rod) Cord Strip

1. Dow Chemical Ethafoam.
2. Sonneborn Sonolastic Closed-cell Backer Rod.
3. Equal approved by ENGINEER .

PART 3 EXECUTION

3.1 Preparation

Surfaces to receive caulking materials shall be thoroughly clean and free of any non-compatible primers or protective coatings, including lacquers, form coatings, clear sealers, etc. Brush out all foreign matter and loose particles. Clean metal surfaces with solvents and wipe dry while the surface is still wet with solvent.

3.2 Primers and Bond Breakers

Apply to surfaces as required; verify with manufacturer. In general, prime all concrete and Portland cement based plaster or grout surfaces. Prime wood surfaces where specifically required. Use proper type primers and bond breakers, apply per sealant manufacturer's printed instructions.

3.3 Gaskets or Fillers

Compress all gaskets to tight fit. Where required as backing for caulking system, roll or stretch in gasket sections to depth from sealant face or as shown (in general, to 3/8-inch).

Install gun grade material with gun nozzle of similar size as joint width as shown. Tool all beads, after application to assume full firm contact. Strike off excess material.

Maintain edge surfaces adjacent to joints clean and free of caulking stain and excess material. Trim joints as required per manufacturer's printed instructions.

Do not apply caulking materials to a "bleeding" type of surface, such as asphaltic or other oil-emitting types. Where such material occurs at caulking joint (roofing, etc.), isolate from caulking with gasket filler.

Avoid mixing any water in caulking mixture before and during application. Do not thin material.

3.4 Corrections and Cleanup

Remove all damaged, defective or improperly installed sealant and/or caulking and replace.

Clean and remove all sealant and caulking from adjacent surfaces.

Upon completion of the work, remove all disused implements, rubbish, and debris, and leave premises neat and clean.

END OF SECTION

SECTION 09800

PROTECTIVE COATINGS

PART 1 GENERAL

1.1 The Requirement

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. This specification is applicable to coated pipe, steel, concrete and other surfaces listed in the coating schedule at the end of this section. Pipe corrosion protection systems, galvanizing and anodizing are specified elsewhere within the contract documents.

C. 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.

D. 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.

E. 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.

F. Damaged Factory Finish -- If directed by the ENGINEER, refinish the entire exposed surfaces of equipment chipped, scratched or otherwise damaged in shipment or installation.

G. 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. "Systems and Specifications" - Volume 2 of The Society for Protective Coatings (SSPC).

2. 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. Architectural Standards

1. "Architectural Specification Manual" by the Painting and Decorating Contractors of America (PDCA), 333 Taylor Avenue North, Seattle, Washington 98109.

2. American Architectural Manufacturing Association (AAMA) standards for painting.

E. 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. Painter Qualifications -- The Painting/Coating CONTRACTOR must be capable of performing the various items of work as specified. The Painting/Coating CONTRACTOR shall furnish a statement covering experience on similar work, a list of machinery, plant and other equipment

available for the proposed work, and a financial statement, including a complete statement of the Painter/Coating CONTRACTOR's financial ability and experience in performing similar painting and coating work. The Painting/Coating CONTRACTOR shall have a minimum of five (5) years practical experience and a successful history in the application of the specified products to concrete/steel surfaces. Upon request, the Painting/Coating CONTRACTOR shall substantiate this requirement by furnishing a list of references, which shall include jobs of similar nature.

B. The CONTRACTOR shall give the ENGINEER a minimum of 3 days advance notice of the start of any field surface preparation work of coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

C. 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.

D. 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.

E. 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.

F. 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.

G. 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.

H. 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.

I. 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.

J. 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.

K. 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.

L. 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 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.

M. Inspection Device -- The CONTRACTOR shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gages shall be made available for the ENGINEER'S use at all times while coating is being done, until final acceptance of such coatings. The CONTRACTOR shall provide the services of a trained operator of the holiday detection devices until the final acceptance of such coatings.

N. Holiday Testing -- The CONTRACTOR shall holiday test all coated ferrous surfaces. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested.

1. Coatings With Thickness Exceeding 20 Mils -- For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or approved equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. Coatings With Thickness of 20 Mils or Less -- For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M1 nondestructive type holiday detector, K-D Bird Dog, or approved equal shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal, shall be added to the water prior to wetting the detector sponge.

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.

1.7 Extra Stock

Provide one gallon of each type and color, fully labeled, at completion of job.

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 OWNER. 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 OWNER. 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 Tneme-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 750 UVX, 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 9.0-10.0 mils each, Carboline Bitumastic 50, 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.

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 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 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 -- Vertical, exterior concrete masonry unit walls exposed to view.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply prime, intermediate and top coat, 75 ft^2/gal, 100 ft^2/gal and 100 ft^2/gal respectively for each coat of Tnemec Series 156 Envirocrete or approved equal. Color as selected by Owner.

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, 2 mils. Apply finish coats (two or more coats 6 mils total) of single component, water based acrylic latex coating, Tnemec Series 6, Carboline 3350 or equal. Total DFT = 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 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 -- Exterior brick 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 coats of masonry water retardant material. The system shall be clear, non-staining, silane-modified-siloxane, Fabrishield 161, Rainstopper 1500, or equal. The selected coating system shall provide a minimum of a five-year manufacturer's warranty.

7. Coating System 306

a. Location – Steel and aluminum surfaces exposed to view.

b. Surface Preparation – As specified by the coating manufacturer

c. Coating System – Shop applied thermoplastic powder coating system consisting of 70% Polyvinylidene fluoride (PVDF) resins such as Kynar 500 as a manufactured by Arkema Inc or approved equal. Powder coating on aluminum shall comply with AAMA 2605 specifications. Apply as many coats as required to provide minimum thicknesses of 1.5 mils on aluminum, 8 mils on steel surfaces. Color as selected by Owner.

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 Society for Protective Coatings 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 from carbon steel surfaces.

7. Pickling (SSPC-SP8) – Preparing steel surfaces by chemical reaction, electrolysis, or both, typically used in conjunction with other surface preparations.

8. 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.

9. Power Tool Cleaning to Bare metal (SSPC-SP11) – On surfaces where abrasive blasting is not possible, removal of all rust, mill scale, visible oil, paint, oxides, corrosion products, and other foreign matter to bare clean metal surface, and other foreign matter as required.

10. High- and Ultra High- Pressure Water Jetting (SSPC-SP WJ-1 through WJ-4): Water jetting at high-pressure (5,000 psi) to ultra-high-pressure (30,000 psi) to prepare a surface for recoating. Four degrees of surfaces cleanliness by water jetting are as follows:

WJ-1	Clean to Bare Substrate
WJ-2	Very Thorough Cleaning
WJ-3	Thorough Cleaning
WJ-4	Light Cleaning

11. Surface Preparation of Concrete (SSPC-SP-13) - Surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems.

12. Industrial Blast Cleaning (SSPC-SP14): Blast cleaning to remove all visible oil, grease, dust and dirt, when viewed without magnification.

13. Commercial Power Tool Cleaning (SSPC SP-15) – Power tool cleaning of steel to produce a commercial grade cleaned surface having 1.0 mil surface profile.

14. Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals (SSPC SP-16) -- Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust and loose paint from metal surfaces other than carbon steel.

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 the appropriate SSPC Paint Specification standard 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 appropriate SSPC Paint Specification 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

Coating Schedule

Item	Location	Material	Coating System
Piping	Reservoir interior, submerged	Ductile Iron	Coating System 102
Shotcrete Walls	Reservoir exterior, below grade	Concrete	Coating System 103
Piping	Inside Pump Station (interior & exterior surface)	Steel	Coating System 203
Piping	Inside Pump Station (exterior pipe surface)	Ductile Iron	Coating System 102
Piping	Vaults (exterior pipe surface)	Ductile Iron	Coating System 102
* Handrails/ Guardrails & Staircase	Exterior Reservoir	Steel	Coating System 306
Vent shroud	Reservoir roof vent	Aluminum	Coating System 306
Louvers	Pump Stations	Aluminum	Factory coated per manufacturer
Miscellaneous Metals	Pump Stations & Vaults (exterior surface)	Steel	Coating System 101
Exterior Eves & Siding	Pump Station	Fiber Cement	Coating System 303
Exterior Trim & Fascia	Pump Station	Fiber Cement	Coating System 303

* Where handrails are to be field welded, taper paint layers back from welded end. Leave each layer approximately 6 inches back from previous layer. Provide sufficient exposed length of railing as to not cause damage from field welding to shop prime/paint.

NOTES: 1.Fusion bonded epoxy [ANSI/AWWA C213] can be substituted for coal tar epoxy. Potable water epoxy, NSF approved, shall be used for all surfaces in contact with potable water.

END OF SECTION

SECTION 10210

EXTRUDED ALUMINUM MITERED CORNER PENTHOUSE

PART 1 GENERAL

1.1 Section Includes

A. Louvered penthouses.

1.2 Related Sections

A. Section 06100 - Rough Carpentry.
B. Section 07400 - Metal Roofing.
C. Section 07610 - Flashing and Sheet Metal.
D. Section 07920 – Sealants and Caulking.
E. Section 09800 – Protective Coatings.

1.3 References

A. AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AAMA 2605 - High Performance Organic Coatings on Architectural Extrusions and Panels.

C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings

G. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

H. ASTM D2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.

1.4 Submittals

A. Submit under provisions of Section 01300.

B. Product Data: For each product to be used, including:

1. Manufacturer's product data including performance data.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings:

1. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

D. Samples: Submit sample of louver to show frame, blades, bird screen, vertical supports, sill, accessories, finish, and color.

1.5 Quality Assurance

A. Manufacturer Qualifications:

1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.

2. Manufacturer shall be International Organization for Standardization (ISO) 9000 accredited.

B. Installer Qualifications.

1.6 Delivery, Storage, and Handling

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 Project Conditions

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not

install products under environmental conditions outside manufacturer's absolute limits.

1.8 Warranty

A. Manufacturer shall provide standard limited warranty for penthouse systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.

B. Manufacturer shall provide 20 year limited warranty for floropolymer-based finish on extruded aluminum substrates.

1. Finish coating shall not peel, blister, chip, crack or check.

2. Chalking, fading or erosion of finish when measured by the following tests:

a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.

b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822.

c. Finish coating shall not erode at a rate in excess of .01 mils/year as determined by Florida test sample.

PART 2 PRODUCTS

2.1 Manufacturers

A. Acceptable Manufacturers:

1. Ruskin Company
2. Greenheck

B. Requests for substitutions will be considered in accordance with provisions of Section 01300.

2.2 Louvered Penthouse

A. Fabrication:

1. Model: PH811S as manufactured by Ruskin Company or WRH as manufactured by Greenheck

2. Roof:

a. Material: Formed aluminum,
b. Thickness: 0.080 inch (2.1 mm), nominal.
c. 1 inch (25 mm) fiberglass roof insulation.
d. Provide bitumastic roof undercoating.

3. Structural Support: 1-1/2 inches by 4 inches by 1-1/2 inches (38mm by 102 by 38 mm) 6063T5 extruded aluminum.

4. Sill Flashing:

a. .125 inch (3 mm) thick formed aluminum

5. Installation Hardware:

a. Tie-down cables and bolts to connect to structure.
b. Clip angles and fasteners to connect to the curb.
c. Roof curb is not provided with manufactured louvered penthouse.

6. Assembly:

a. Factory and field assembled louver components. Mechanically fastened construction.

B. Design Load: Incorporate structural supports required to withstand wind load of:

1. Per Code.

2.3 Accessories

A. Bird Screen:

1. Aluminum: Aluminum, 1/2 inch mesh by 0.063 inch (13 mm mesh by 1.6 mm), intercrimp.

2. Frame: Removable, rewireable.

B. Insect Screens:

1. Aluminum, size 20 mesh.

2.4 Finishes

A. Standard mill finish

B. Manufacturer’s performance coatings

1. Color as indicated in coating schedule or by Owner

C. Shop applied and field coatings, see Section 09800 – Protective Coatings

1. Color as indicated in coating schedule or by Owner

PART 3 EXECUTION

3.1 Examination

A. Inspect areas to receive penthouses. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the penthouses. Do not proceed with installation until unsatisfactory conditions are corrected.

B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 Preparation

A. Clean opening thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 Installation

A. Install penthouses at locations indicated on the drawings and in accordance with manufacturer's instructions.

B. Install penthouses plumb, level and in alignment with adjacent work.

C. Apply field topcoat within 6 months of application of shop prime coat. Apply field topcoat as specified in Section 09910.

3.4 Cleaning

A. Clean penthouse surfaces in accordance with manufacturer's instructions.

B. Touch-up, repair or replace damaged products before Substantial Completion.

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.

C. Pump Station Equipment - CONTRACTOR shall provide all labor, equipment and materials and perform all operations in connection with the installation and testing of pump station equipment specified within other sections of these technical specifications.

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 and OWNER procured supplier 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 and/or OWNER procured suppliers/manufacturers shall submit to the ENGINEER a torsional and lateral vibration analysis of the equipment, in accordance with Section 01300-Submittals. 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. See Section 01655, "Testing, Training and System Start-up", for detailed project testing and start-up requirements.

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 01300-Submittals 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.

G. Sheaves for belt driven equipment shall be laser aligned.

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.

END OF SECTION

SECTION 11100

PUMPS, GENERAL

PART 1 GENERAL

1.1 Description

A. The provisions of this Section shall apply to all pumps and pumping equipment except where otherwise indicated.

B. Where two or more pump systems of the same type or size are required, the pumps shall all be produced by the same manufacturer.

C. CONTRACTOR shall provide all labor, equipment and materials and perform all operations in connection with the installation and testing of pumps selected by the OWNER.

D. CONTRACTOR shall coordinate and utilize all factory testing, installation, start-up and field testing services supplied in conjunction with the pumping equipment.

E. All work performed under this section shall be in accordance with all approved trade practices and manufacturer's recommendations.

1.2 Submittals

A. Submittals shall be furnished in accordance with Section 01300.

B. Shop Drawings shall contain the following information

1. Pump name, identification number and specification Section number.

2. Performance data curves showing head, capacity, horsepower demand, NPSH required and pump efficiency over the entire operating range of the pump. The pump manufacturer shall indicate separately the head, capacity, horsepower demand, overall efficiency and minimum submergence required at the design flow conditions and the maximum and minimum flow conditions. A family of performance curves at intervals of 100 rpm from minimum speed to maximum speed shall be provided for each centrifugal pump equipped with a variable speed drive, and a curve for each speed on two-speed pumps.

3. The limits on the performance curves recommended for stable operation without surge, cavitation or excessive vibration.

4. Assembly and installation drawings including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

C. Complete motor nameplate data as defined by NEMA, motor manufacturer and any motor modifications.

D. Operation and Maintenance Manual containing the required information for each pump section.

E. A spare parts list containing the required information for each pump section.

F. Signed, dated and certified factory test data for each pump system which requires factory testing submitted before shipment of equipment.

G. Certifications

1. Manufacturer's certification of proper installation
2. CONTRACTOR's certification of satisfactory field testing

H. All pump motor information as required in division 16.

I. Provide lateral and torsional analysis as specified in Section 11000, Paragraph 1.3D.

J. Pump anchorage calculation and analysis is not required for pump mounted on existing pump barrels.

PART 2 PRODUCTS

2.1 General

A. Materials and equipment shall be standard products of a manufacturer and distributor regularly engaged in the manufacture and distribution of such products for at least 2 (two) years and shall be suitable for the service intended. All materials and equipment shall be new and unused except for the testing specified herein.

B. Compliance with the requirements of the individual pump sections may necessitate modifications to the manufacturer's standard equipment.

C. All centrifugal pumps shall have a continuously rising performance curve. In no case shall the required horsepower at any point on the performance curve exceed the rated horsepower of the motor or engine or encroach on the service factor.

D. All components of each pump system provided under the pump sections shall be entirely compatible. Each unit of pumping equipment shall incorporate all basic mechanisms, couplings, electric motors or engine drives, variable speed controls, necessary mountings and appurtenances.

E. The pumps shall be supplied by a distributor authorized to service them throughout the warranty period and beyond. The distributor shall be located within a 100-mile radius of the site.

F. The pumps shall be warranted by the manufacturer for a minimum of one (1) year from the date of installation.

G. All materials and coatings coming in contact with potable water shall be ANSI/NSF Standard 61 approved.

H. The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, suction cans, baseplates, couplings, guards and other accessories.

I. The complete pump assembly shall be designed and built for continuous service at any and all points within the specified range of operation, without overheating, without damaging cavitation, and without excessive vibration or noise.

2.2 Materials

A. All materials shall be suitable for the intended application; materials not specified shall be high-grade, standard commercial quality, free from all defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements:

1. Cast iron pump casings and bowls shall be of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Casings, Class 30, or equal.

2. Stainless steel pump shafts shall be Type 416 or 316. Miscellaneous stainless steel shall be of Type 316, except in a septic environment.

3. Anchor bolts, washers, and nuts supplied by the CONTRACTOR for non-corrosive applications shall be galvanized steel in accordance with the requirements of Section 5500 - Metal Fabrications. Anchor bolts,

washers and nuts in corrosive service applications shall be stainless steel in accordance with that Section.

2.3 Pump Components, General

A. Flanges -- Suction and discharge flanges shall conform to ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 12, 125, 250, and 800 or B16.5 - Flanges and Flanged Fittings dimensions.

B. Handholes -- Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.

2.4 Pump Appurtenances

A. Nameplates -- Each pump shall be equipped with a stainless steel nameplate indicating serial numbers, rated head and flow, impeller size, pump speed and Manufacturer's name and model number.

B. Gauges – CONTRACTOR shall provide and install pressure gauges as shown on the drawings.

1. All pumps (except sample pumps, sump pumps, hot water circulating pumps and chemical metering pumps) shall be equipped with pressure gauges on the pump discharge. Pump suction lines shall be provided with compound gauges. Gauges shall be located in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings. Isolation diaphragms shall be provided for all gauges except where pumping potable water.

2. Where subject to shock or vibrations, the gauges shall be wall-mounted or attached to galvanized channel floor stands and connected by means of flexible connectors.

2.5 Factory Testing

A. The following tests shall be conducted on each indicated pump system

1. Pump Systems -- All centrifugal pump systems 50 hp and larger shall be tested at the pump factory in accordance with the American National Standard for Centrifugal Pump Tests (ANSI/HI 1.6) or the American National Standard for Vertical Pump Tests (ANSI/HI 2.6) as approved by ANSI and published by the Hydraulic Institute. Tests shall be performed using the complete pump system to be furnished, including the motor. For motors 100 hp and smaller , the manufacturer's certified test motor shall be acceptable. The following minimum test data shall be submitted:

a. Hydrostatic test data

b. A minimum of five hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, recorded on data sheets as defined by the Hydraulic Institute.

c. Pump curves showing head, flow, bhp, efficiency and NPSH requirements.

d. Certification that the pump horsepower demand did not exceed the rated motor hp beyond the 1.0 service rating at any point on the curve.

e. Pump test data curves showing head, flowrate, bhp, and efficiency. Acceptance level shall be Grade 1E as defined by ANSI/HI 14.6.

2. Factory Witnessed Tests - Factory witnessed testing for this project not required

3. Acceptance -- In the event of failure of any pump to meet any of the requirements, the CONTRACTOR and Pump Manufacturer shall make all necessary modifications, repairs or replacements to conform to the requirements of the Contract Documents and the pump shall be retested at no additional cost to the OWNER until found satisfactory.

B. The pump manufacturer shall complete a lateral and torsional analysis as specified in Section 11000, Paragraph 1.3D. This analysis shall identify the dry and wet lateral critical and the torsional critical speeds of the pump system, and shall be submitted for review as part of the pump submittal.

PART 3 EXECUTION

3.1. CONTRACTOR Coordination with Pump Supplier and Manufacturer

A. As part of this construction contract, the CONTRACTOR shall utilize the full value of the OWNER- acquired services for start-up and testing services from the Pump Supplier.

B. An authorized service representative of the manufacturer shall visit the project site to witness the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted and readied for operation:

1. Installation of the equipment

2. Inspection, checking and adjusting the equipment

3. Startup and field testing for proper operation

4. Performing field adjustments to ensure that the equipment installation and operation comply with requirements

5. Requirements are more specifically detailed herein and in individual pump specifications

C. Instruction of the OWNER's Personnel

1. An authorized training representative of the manufacturer shall visit the project site to instruct the OWNER's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.

2. The representative shall have at least two year's experience in training.

3. Training shall be scheduled a minimum of three weeks in advance of the first session.

4. Proposed training material and a detailed outline of each lesson shall be submitted for review. Comments shall be incorporated into the material.

5. The training materials shall remain with the trainees.

6. The OWNER may videotape the training for later use with the OWNER's personnel.

3.2 Installation

A. General -- Pumping equipment shall be installed in accordance with the manufacturer's written recommendations.

B. Alignment -- All equipment shall be field tested to verify proper alignment, operation as specified and freedom from binding, scraping, vibration, shaft

runout or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

C. Lubricants -- The CONTRACTOR shall provide the necessary oil and grease for initial operation.

3.3 Field Tests

A. Each pump system shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, cavitation or overheating of bearings. Field testing methods and allowable tolerances shall comply with current version of the Hydraulics Institute standards for the type of pumps installed.

B. The following field testing shall be conducted

1. Startup, check and operate the pump system over its entire speed range. Where vibration analysis and measurement is required, it shall be within the amplitude limits specified and recommended by the Hydraulic Institute Standards at a minimum of four pumping conditions defined by the ENGINEER.

2. Obtain concurrent readings of motor voltage, amperage, pump suction head and pump discharge head for at least four pumping conditions at each pump rotational speed. Check each power lead to the motor for proper current balance.

3. Determine bearing temperatures by contact type thermometer. A run time of at least 20 minutes shall precede this test, unless insufficient liquid volume is available.

4. Electrical and instrumentation tests shall conform to the requirements of the Section under which that equipment is specified.

5. Field vibration readings shall be conducted by an Owner selected certified testing agency, paid for by the CONTRACTOR, with readings taken at the following positions with the average not exceeding the current Hydraulic Institutes standards for the type of pump installed.

a. Measurements shall be taken at the locations as specified in the current Hydraulic Institute standards for the type of pump installed.

6. Provide written proof of vibration readings and provide test data.

C. Field testing will be witnessed by the ENGINEER. The CONTRACTOR shall furnish three days advance notice of field testing.

D. In the event any pumping system fails to meet the test requirements, it shall be modified and retested as above until it satisfies the requirements.

E. After each pumping system has satisfied the requirements, the CONTRACTOR shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all persons present during the tests and the test data.

F. CONTRACTOR shall bear all costs of field tests, including additional services of the manufacturer's representative required beyond those specified.

END OF SECTION

SECTION 11101

VERTICAL TURBINE PUMPS

PART 1 GENERAL

1.1 Description

A. Work covered in this Section includes furnishing, installing, start-up and operation training for vertical turbine pumps of the following three types: deep well (lineshaft), wet pit, short setting or close-coupled (lineshaft), and barrel or can (lineshaft). Vertical turbine pumps shall be of the open line shaft and fresh water lubricated type. Like items of equipment specified herein shall be the end product of one manufacturer. Electrical controls and motor design requirements are specified in this section and the electrical section of these specifications. The pump supplier shall be responsible for coordinating the pump requirements with the pump drive manufacturer and shall be responsible for the overall pump and drive requirements.

B. The CONTRACTOR shall provide all labor, equipment and materials and perform all operations in connection with the installation and testing of one variable speed vertical turbine pump and motor specified herein within the City of West Linn's existing Bolton Pump Station, including power and control cables and accessories to make the installation complete. This work shall also include relocating existing 200 hp vertical turbine pump located in Pump No. 1 pump can to Pump No. 3 pump can as shown on the Plans.

C. CONTRACTOR shall coordinate and utilize installation start-up and testing services supplied in conjunction with the pumping equipment.

1.2 Submittals During Construction

Submittals during construction shall be made in accordance with Section 01300 Submittals , and Section 11100 Pumps, General.

1.3 Reference Specifications, Codes and Standards

Pumps shall meet the requirements of the latest version of ANSI/AWWA E-101, Vertical Turbine Pumps – Line Shaft and Submersible Types and the Hydraulic Institute Standards, except where modified herein.

1.4 Vibration Analysis and Testing

A. Pump vendor shall provide vibration analysis per Paragraph 1.3 D. within Section 11000 - Equipment, General and Paragraph 2.5B within Section 11100 - Pumps, General. Field vibration measurements during field testing of each pump-motor unit shall be provided per section 3.3 of Specification 11100 – Pumps, General.

B. Pump manufacturer shall provide the factory tests for each pump supplied in accordance with section 2.5 of Section 11100 - Pumps, General.

PART 2 PRODUCTS

2.1 Description

A. Identification:

Location	Bolton Pump Station
Pump Label(s)	Pump No. 1
Quantity	1

B. Performance Requirements at Full Pump Speed:

Maximum Shutoff Head (ft)	550
Minimum Shutoff Head (ft)	475
Design Flow Capacity:	
Duty Pt. 1	600 gpm @ 440 ft TDH
[1]Duty Pt. 2	900 gpm @ 325 ft TDH
Duty Pt. 3	1,100 gpm @ 221 ft TDH
Minimum Bowl Efficiency:	
Duty Pt. 1	80.0%
[1]Duty Pt. 2	80.0%
Duty Pt. 3	68.0%
Maximum Pump Speed (rpm)	1,800
Maximum Motor Size	100 hp

NOTE: 1. Duty Point 2 shall be guaranteed for Grade 1E Testing

C. Performance Requirements at Variable Speed

Minimum Flow Capacity	180 gpm @ 300 ft TDH
Minimum Pump Speed (rpm)	1,350

D. Operating Conditions:

Duty	Continuous
Drive	Variable Speed
Ambient Environment	Indoor
Ambient Temperature	33° - 104° F
Fluid Service	Potable Water
Fluid Temperature	33° - 65° F
Fluid pH Range	6.0 to 8.0
Fluid Specific Gravity	1.0
Fluid Viscosity (absolute) (centipoises at 60° F)	1.12
Pump Station Floor Elevation	448.5 ft
Existing 36-inch Suction Header Invert Elevation (verify)	431.05 ft
Max. Net Positive Suction Head (NPSH) required at Duty Point 2	13.0 ft
Minimum Available Submergence	Not Applicable

E. Pump Dimensions:

Suction Diameter on "T" Head (in)	Not Applicable
Suction Flange Rating (ANSI) on "T" Head (psi)	Not Applicable
Discharge Diameter (in)	8
Discharge Flange Rating (ANSI) (psi)	250
Minimum Column Shaft Diameter (in)	To be determined from vibration analysis per Paragraph 1.3 D. within Section 11000 - Equipment, General
Minimum Pump Bowl Shaft Diameter (in)	Per manufacturer
Minimum Free Area Between Pump and Suction Barrel (sq in)	Not Applicable
Maximum Pump Diameter (in)	Not Applicable
Minimum Column Diameter (in)	8
Setting (Distance from underside of discharge head or base plate to column pipe connection at bowl assembly)	As shown on drawings.

F. Other Requirements

The head-capacity curve shall exhibit a uniformly rising characteristic from free discharge to shutoff. The pump motor shall be non-overloading throughout the entire pump curve.

2.2 Pump Construction

A. The bowls shall be cast-iron, lined and coated with a two component, self priming coating applied in a two coat process, over a sandblasted surface, to an 8 to 10 mil dry film thickness. Lining and coating shall be Tnemec Series 140 Pota-Pox Plus or equal.

B. The impellers shall be ASTM B584 bronze or Type 316 stainless steel and shall be statically and dynamically balanced.

C. Replaceable impeller and pump bowl wear rings shall be provided. The wear rings shall be ASTM B62 UNS C83600 bronze. For pumps with stainless steel impellers, Type 315 stainless steel impeller wear rings shall be provided, bronze for the pump bowls.

D. The bowl shaft shall be stainless steel, Type 410, 416, or 316.

E. The suction bell shall be cast-iron with a bottom bearing and streamlined ribs. Lining and coating shall be the same as bowls.

F. The column pipe shall be not less than Schedule 40 steel pipe joined with threaded sleeve-type couplings. Epoxy lining and coating shall be same as bowls. Pipe sections shall not exceed 10 feet in length.

G. The line shaft and couplings shall be Type 416 stainless and sized such that the natural frequency of the shaft is avoided by a minimum 25 percent throughout the entire operating range. Line shaft sections shall not exceed 10 feet in length.

H. Line shaft lubrication shall be by water.

I. The shaft seal shall be a mechanical type seal and equipped with multiple non-clogging coil springs and non-sliding, internal, secondary elasteners. Metal parts shall be Type 316 stainless steel alloy 20, or Hastelloy B or C. Sealing materials shall be carbon and ceramic.

J. The line shaft bearings shall be rubber with bronze retainers at each joint for open line shaft.

K. The discharge head shall be the manufacturer's standard fabricated steel. Fabricated steel discharge head shall be reinforced to withstand pipe thrust, lined with a fusion bonded epoxy and shall include flange and base plate. For intake and deep well applications, the discharge head shall include a connection to allow pre-lubrication of the pump shaft and bearings. Lining and coating shall be the same as bowls. If shown on the drawings, forged steel half-couplings for air valve, pressure switch and drain connections shall be a minimum of 1 1/4-inch and 3,000 lbs.

L. The motor shaft coupling shall be a 4-piece, heavy-duty adjustable spacer coupling, with registered fit, to allow for mechanical seal removal, with machined registered fit per pump manufacturer and complying with ANSI/AWWA E-103 and ANSI/HI 2.1 through 2.5 specifications.

M. The bottom bearing shall be a close tolerance sleeve type conforming to ANSI/AWWA E-103 and ANSI/HI 2.1 through 2.5 specifications with a

length minimum of 2 1/2 times shaft diameter. Suction case shall be permanently grease lubricated with non-soluble grease.

N. The bowl and suction case bearings shall be of the bronze sleeve type.

2.3 Existing Suction Barrel

The vertical turbine pump assembly shall be configured to fit within the existing 20-inch diameter pump barrel and 36-inch diameter suction header as shown on the Plans. CONTRACTOR shall field verify and confirm all existing suction barrel dimensions and depths.

2.4 Turning Vans

The vertical turbine pump shall be equipped with a 90 degree turning vane located within the pump station's existing 36-inch diameter suction header as shown on the plans. Turning vane assembly design and position shall comply with Hydraulic Institute (ANSI-HI 9.8).

2.5 Motors

Each pump shall be provided with a vertically mounted solid shaft electric motor that conforms to the following requirements and the specifications in Division 16. In the event of conflicts, the more restrictive specification shall apply. The brake horsepower required by the driven equipment anywhere on the pump curve shall not exceed the rated nameplate horsepower of the motor. The ratings indicated are minimums. Motors shall be designed to accept the total, unbalanced thrusts imposed by the pump.

2.6 Pump Controls

For control see Specifications Divisions 16 and 17.

2.7 Spare Parts

The pumps shall be provided with the following spare parts for each pump:

- One mechanical seal

2.8 Manufacturers

A. Acceptable vertical turbine pump manufacturer shall be Floway Pumps. Acceptable Bowl Model shall be 11 JKM.

PART 3 EXECUTION

3.1 Services of Manufacturer

A. Installation -- The service representative of the manufacturer shall be continuously present at the site to supervise the assembly and installation of the pumps.

B. Inspection, Startup and Field Adjustment -- The service representative of the manufacturer shall be present at the site for not less than 3 work days in addition to those days provided in the previous paragraph, to furnish the services required by Section 11100 Pumps, General. Coordinate with OWNER.

C. Instruction of OWNER's Personnel -- The training representative of the manufacturer shall be present at the site for 1 work day in addition to those days provided in the previous paragraph, to furnish services required by Section 11100 Pumps, General. Coordinate with OWNER.

D. For the purposes of this paragraph, a work day is defined as an eight hour period at the site, excluding travel time.

E. The ENGINEER may require that the inspection, startup, and field adjustment services above be furnished in three separate trips.

3.2 Installation within Existing Pump Barrel

CONTRACTOR shall install pumps within pump station's existing 20-inch diameter pump barrel and 36-inch diameter suction header as shown on the Plans.

END OF SECTION

SECTION 11268

RESERVOIR STORAGE TANK HYDRODYNAMIC MIXING SYSTEM

PART 1 GENERAL

1.1 Description

Work under this Section applies to the furnishing and installation of a hydrodynamic mixing system (HMS) inside a cast-in-place concrete finished water storage reservoir.

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, flexible connectors, valves, accessories, lining and coating, testing, and disinfection 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 drawings are not pipe construction or fabrication drawings. It is the CONTRACTOR's responsibility to develop the details necessary to construct all hydrodynamic mixing piping systems, to accommodate the specific equipment provided, and to provide and install all materials necessary 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 B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys

ANSI/AWWA C606 Grooved and Shouldered Joints

ANSI/AWS D1.1 Structural Welding Code

ASTM A 193 Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

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, for mixing systems, in accordance with the contract documents and as specified in the related 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 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 OWNER for review prior to the fabrication of any pipe.

D. NSF 61 Certification

A copy of the NSF 61 Certified listing for the valves used in the HMS shall be provided. The valves themselves must be NSF 61 certified, not just the elastomer used in construction of the valves.

E. Validation of Long-term Performance

The HMS designer/supplier shall supply at least one inspection report showing proper operation of, and no deterioration of, the duckbill valves after being in service in a water storage tank mixing application for a minimum of 10 years.

F. Test Report on Elastomer Exposure to Chlorine and Chloramine

A copy of the test report from an accredited independent laboratory confirming there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 “Standard Test Method for Rubber Property – Effect of Liquids.”

G. System Installation Drawings

The HMS manufacturer shall be responsible for providing engineering installation drawings of the manifold piping system components as supplied by the manufacturer. These drawings shall include plan view piping arrangement, sections and elevations as required, duckbill nozzle orientation details and all dimensions required for locating the system within the specified dimensions of the tank. Drawings shall be a minimum of 11 x 17 inches. Six (6) sets of plans shall be provided to the OWNER for review and approval. Two (2) sets of final fabrication and installation drawings shall be included with the shipment of the manifold piping equipment.

H. Design Calculations

The HMS manufacturer MUST include within the submittal package the following design calculations and reference information:

1. Calculations showing the fill time required, under isothermal conditions, for the HMS system to achieve complete mix of the reservoir volume at minimum, average and peak fill rates. Complete mixing defined as 95% homogenous solution. The theory and equations used in calculating the mixing times must be as described in the Rossman, L.A. and W.M. Grayman (1999) reference. HMS design flows for this system are shown in the table below:

	Minimum	Average	Maximum
Inflow (gpm)	2,250	5,000	7,000
Outflow (gpm)	500	2,000	7,500

2. A *representative* Computational Fluid Dynamics (CFD) model evaluation of the proposed HMS system configuration applied *within a reservoir of similar geometry*. Model output documentation shall include all design variables applied for the simulation, plot of the 3-D geometry showing the mesh definition, velocity magnitude vector and contour plots at different cross-sections throughout the water volume, simulated tracer animations showing the spatial and temporal distribution of inlet water in real time during the fill cycle.

3. Hydraulic curves showing thrust vs. flow for the inlet nozzles.

4. Hydraulic calculations showing the resulting jet velocities of each inlet nozzle at minimum, average, and peak fill rates.

5. Hydraulic calculations showing the flow distribution among all inlet ports at minimum, average, and peak fill rates.

6. Manifold hydraulic calculations showing the total headloss of the HMS at minimum, average, and peak fill and draw rates. Headloss shall include all minor losses and headloss of nozzles and outlet check valves.

7. Hydraulic curves for each outlet check valves showing headloss vs. flow.

8. Calculations showing the terminal rise height of the jets that discharge at an angle above horizontal. The terminal rise height shall be calculated assuming 10°F and 20°F colder inlet water and calculated at minimum, average and peak fill rates. The theory and equations used to calculate the terminal rise height shall be included.

9. If the calculations and supporting data provided do not show compliance with the hydrodynamic requirements of the system as interpreted by the ENGINEER or OWNER, then the submittal shall be rejected.

I. Installation, Operation and Maintenance Manuals

Within 30 days of final approval of the installation drawings, by the OWNER, the HMS valve manufacturer shall provide four (4) sets of the installation portion of the Installation, Operation and Maintenance (IOM) Manuals for the applicable system. Within 30 days of final approval, by the OWNER, of the installed system the manufacturer shall provide six (6) copies of the complete Installation, Operation and Maintenance (IOM) Manual for final review and approval. The manuals shall be in the following format and include the listed required information as a minimum:

1. Enclosed in a 3-ring binder with project title and system designation shown on the front cover and side binder.

2. Table of contents

3. Copy of design calculations for the manifold system as defined in the previous section.

4. Copy of complete set of the installation plans.

5. Copy of NSF61 Certified Listing for the valves

6. Parts and equipment list with specification numbers for ordering of replacement parts.

7. Product specification sheets for nozzles, outlet valves, expansion joints, concrete anchors, and any other specialized items supplied with the system.

8. Installation guidelines for the HMS manifold system.

9. Operational procedures for the HMS manifold system.

10. Guidelines for repair of system components.

11. Schedule for suggested periodic maintenance of the manifold system.

12. In addition to bound 3-ring binder specified above, CONTRACTOR shall submit the operations and maintenance manual in electronic format. Electronic documents shall be clear and legible, developed from the original documents, and shall be in the latest version of Adobe Acrobat (.pdf) format.

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 OWNER 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.

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 Manifold Piping for Hydrodynamic Mixing System

Manifold inlet piping for the reservoir HMS shall be constructed of high density polyethylene (HDPE) pressure pipe as detailed in Section 02641, HDPE Pressure Pipe. Flanged connections shall use stainless steel hardware.

2.2 Inlet Nozzles for HMS

A. Inlet ports/nozzles shall be duckbill-style check valves that allow fluid to enter the reservoir during fill cycles and prevent flow in the reverse direction through the nozzle during draw periods. Inlet ports/nozzles may not be fixed-diameter ports or pipes.

B. The duckbill valves shall be NSF61 Certified. NSF61 approved/Certified materials will not be accepted in lieu of valve certification.

C. Inlet ports/nozzles shall have a variable diameter vs. flow hydraulic profile that provides a non-linear jet velocity vs. flow characteristic and a linear headloss vs. flow characteristic. The hydraulic characteristics of the duckbill valves shall be defined by "Hydraulic Code".

D. The inlet ports/nozzles shall discharge an elliptically shaped jet. The nozzle must have been modeled by an independent laboratory using Laser Induced Fluorescence (LIF).

E. Manufacturer shall have conducted independent hydraulic testing to determine headloss and jet velocity characteristics on a minimum of eight (8) sizes of duckbill valves ranging from 2" through 48". The testing must include multiple constructions (stiffness) within each size and must have been conducted for free discharge (discharge to atmosphere) and submerged conditions.

F. Manufacturer shall have conducted an independent hydraulic test where multiple valves (at least four) of the same size and construction (stiffness) were tested to validate the submitted headloss characteristics and to prove the repeatability of the manufacturing process to produce the same hydraulic characteristics.

G. Manufacturer shall have conducted independent hydraulic testing to study the flow distribution characteristics of duckbill valves installed on multiport manifolds.

H. Manufacturer to have conducted Finite Element Analysis (FEA) on various duckbill valves to determine deflection, stress, and strain characteristics under various load conditions. Modeling must have been done for flowing conditions (positive differential pressure) and reverse differential pressure.

I. Manufacturer must have conducted in-house backpressure testing on duckbill valves ranging from 3/4" to 48".

J. Manufacturer shall have at least fifteen (15) years experience in the manufacturing of "duckbill" style elastomeric valves.

K. Manufacturer must have duckbill valves installed on manifold piping systems in at least 100 distribution system reservoirs.

L. Manufacturer must have representative inspection videos showing the duckbill valves discharging water into the reservoir during an initial fill (unsubmerged). Manufacturer must also have representative underwater inspection videos

showing the operation of the valves when submerged. Representative videos can be submitted upon request from the engineer.

M. The duckbill style nozzles shall be one-piece elastomer matrix with internal fabric reinforcing designed to produce the required discharge velocity and minimum headloss requirements as stipulated in the Submittals section. The flange portion shall be an integral portion of the nozzle with fabric reinforcing spanning across the joint between the flange and nozzle body.

N. The elastomer used in construction of the duckbill valves must have been tested by an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 "Standard Test Method for Rubber Property – Effect of Liquids."

O. The manufacturer's name, plant location, serial number and product part number which designates nozzle size, material and construction specifications shall be bonded onto the surface of the nozzle.

2.3 Anti-seizing Compound

Anti-seizing compound shall be food grade and NSF 61 certified.

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 OWNER shall be made.

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.

Anti-seizing compound shall be used with all stainless steel bolting.

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 OWNER. 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. Provide floor stands, wall bracing, concrete piers, etc., for all lines running near the floors or near walls and which cannot be properly supported or suspended by the walls or floors. Hanging of any pipe from another is prohibited.

D. Equipment shall be positioned and aligned so that no strain shall be induced within the equipment during or subsequent to the installation of pipework.

E. When temporary supports are used, they shall be sufficiently rigid to prevent any shifting or distortion of the piping or related work.

F. 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.

3.4 Joining

Manifold inlet piping for the reservoir HMS shall be joined as detailed in Section 02641, HDPE Pressure Pipe.

3.5 Testing

Manifold inlet piping for the reservoir HMS shall be hydrostatically tested and disinfected as detailed in Section 02641, HDPE Pressure Pipe.

END OF SECTION

SECTION 11900

FALL PREVENTION SYSTEM

PART 1 GENERAL

1.1 Related Documents

The requirements of the plans and all other sections and provisions of the specifications are applicable to the work to be performed under this section.

1.2 Description of Work

The safety equipment work includes the provision and installation of fall prevention systems at each fixed ladder as shown on the drawings and as required to meet all safety and occupational code requirements.

1.3 Quality Assurance

A. Comply with requirements of OR-OSHA regulations and all applicable codes and standards. Install according to manufacturer's instructions.

B. Provide all system components from a single manufacturer that will assure compatibility of all components.

PART 2 PRODUCTS

2.1 Fall Prevention System

A. Fall prevention system shall be a flexible cable ladder system that includes cable, trolley, safety belt or harness, and all mounting, installation and alignment hardware and other accessories as may be necessary to provide a complete and operational system.

B. Fall prevention system to be LAD-SAF by DBI-SALA (Capital Safety) without exception to match Owner's existing systems.

A pivot dismount section or removable extension shall be provided at locations shown on the plans. The pivot dismount section shall allow a person to step off of the ladder and onto the adjacent surface prior to unclipping from the cable. Provide removable extensions where openings include access hatches.

Cable systems to be installed in reservoir wet-well interior, including fall prevention cables, fasteners, extensions, and appurtenances, shall be type 304 stainless steel. NSF-61 certified rubber bushings shall be provided at all ladder rung connections to prevent damage to ladder coatings.

Cable systems to be installed in reservoir dry areas, including fall prevention cables, fasteners, extensions, and appurtenances, shall be type 304 or 316 stainless steel. Neoprene rubber bushing shall be provided at all ladder rung connections to prevent damage to coatings.

PART 3 EXECUTION

3.1 Installation

Install fall prevention system according to manufacturer's instructions. Provide two (2) Exofit Vest Style Harness (1108525), size as requested by OWNER.

END OF SECTION

SECTION 13100

PACKAGE TYPE PRV STATION

PART 1 GENERAL

1.1 Scope

A. Work covered in this section includes furnishing, installing, start-up and operation training for a package type Pressure Reducing Valve (PRV) station.

B. All equipment specified in this section shall be furnished by one manufacturer.

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:

AISC – "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", including "Commentary of the AISC Specifications"

AISC – "Specifications for the Design of Cold-Formed Steel Structural Members"

AWS – "Structural Welding Code"

B. 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.

C. Shop Assembly – Pre-assemble items in the shop to the greatest extent possible, so as to minimize field assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

D. Commercial Standards:

ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.
ANSI/ASME B1.20.1	General Purpose Pipe Threads (Inches).
ASTM A 36	Specification for Structural Steel.

NEMA ICS 6	1988 (Rev. 1) Enclosures for Industrial Control and Systems.
NFPA 70	Current National Electrical Code.
SSPC-SP1	Solvent Cleaning.
SSPC-SP2	Hand Tool Cleaning.
SSPC-SP3	Power Tool Cleaning.
SSPC-SP6	Commercial Blast Cleaning.
ASTM A 125	Hot Dipped Galvanizing.

1.3 Contractor Submittals

The information listed below shall be submitted to the ENGINEER for review in accordance with Section 01100. The submittal shall, as a minimum, include the following data drawings and other descriptive materials.

A. A CAD shop drawings to describe and show PRV station construction and materials.

1.4 Information to be Provided

A. O&M manual information in accordance with manufacturer's requirements.

1.5 Quality Assurance

A. PRV Station Responsibility and Coordination

1. The CONTRACTOR shall cause all equipment specified under this section to be furnished by the PRV station manufacturer who shall be responsible for the adequacy and compatibility of all PRV station components. Any component of the complete PRV station not provided by the manufacturer should be designed, fabricated, tested, and installed by factory-authorized representatives experienced in the design and manufacture of the PRV station equipment specified herein. This requirement, however, shall not be construed as relieving the CONTRACTOR of the overall responsibility for this portion of the work.

2. The CONTRACTOR shall cause the PRV station manufacturer and its suppliers to coordinate design of the PRV station such that all equipment is compatible and capable of achieving the performance requirements specified herein.

B. Design Requirements

The PRV station site and cross section arrangement shown on the drawings is based upon the best information available to the ENGINEER at the time of design and is not intended to show exact dimensions peculiar to any specific equipment unless otherwise shown or specified. It is anticipated that the connected piping and valves shown, in part or in whole, may have to be modified in order to accommodate the specific PRV station furnished. No additional payment will be made for such modifications. All necessary calculations and drawings for any related design shall be submitted to the ENGINEER for approval prior to beginning the work.

1.6 Start-up Services

Installation of the package PRV station, including all water connections to the station, will be performed by the Contractor. When the station is ready for operation, the PRV station manufacturer shall provide the services of a qualified technician, who shall review the installation and start-up of the PRV station. The control valve manufacturer will have an established service department w/ service person and service vehicle equipped with all tools and parts necessary to maintain and repair control valves furnished in these stations.

1.7 Warranty

The CONTRACTOR shall warrant the package PRV station to be of quality construction, free from defects in material and factory workmanship. The PRV station chamber and cover shall be warranted for a period of two (2) years to be free from defects, resistant to rust, corrosion, or physical failures occurring in normal service, when installed in accordance with the manufacturer's recommendations.

The interior equipment, valves, piping, and apparatus shall be warranted for a period of two (2) years , excepting only those items normally consumed in service, such as light bulbs, oil, grease, gaskets, or O-rings. The CONTRACTOR shall be solely responsible for the PRV station and all related components; warranties, and guarantees by the suppliers of various components will not be accepted.

Major components, which fail to perform as specified by the ENGINEER or prove defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the CONTRACTOR without cost of parts or labor to the OWNER. After start-up service has been performed, labor to replace accessory items, or other accessible and easily serviced parts, shall be the responsibility of the OWNER. Such components, parts, or repairs determined to have failed because of defects in workmanship or materials will be replaced or repaired F.O.B. factory or other designated location.

PART 2 PRODUCTS

2.1 General

The package type PRV station shall be a pre-engineered and shop assembled station. It shall include all necessary valves, piping and controls for a complete and operable system as specified and as shown on the drawings and supplemental drawings.

The package PRV station shall be delivered to the job site requiring no additional fabrication or similar work, other than placement, and connections to supply and discharge pipes necessary for a fully functional unit.

Factory assembly of the package station shall include but not be limited to: control valves with isolation valves; inlet and outlet pressure gauges with isolation valves; line strainers, when used with blowdown valves installed; air release valves with isolation valves; ¾" hose bib with ball valves and vacuum breaker; aluminum access ladder with safety post; couplings to allow easy valve removal; and all needed appurtenances.

2.2 Experience Requirements

The package PRV station shall be the product of a manufacturer who has the financial resources, technical qualifications, experience, organization and facilities adequate to design and manufacture package PRV stations of the type specified. The manufacturer shall have a minimum of 15 years of experience in manufacturing PRV stations and shall have completed at least one hundred prior successful installations, within the area, of package type PRV stations similar in size and scope to the installation herein specified.

Said proof of experience shall be included in the submittal package and shall include facility locations, names and phone numbers of operators or persons familiar with system performance, dates of operation, and other pertinent information required by the Engineer.

Lack of required experience will be grounds for rejection of a submitted package PRV station, and the Contractor will be required to submit an alternate station which can meet the above experience requirement. No change in the bid price will be allowed for furnishing an alternate station, which will meet these specifications.

Acceptable Manufacturers:

A. GC Systems, Inc.

2.3 Station Enclosure

Valve Chambers shall be (2) piece pre-cast reinforced concrete H2O load rated with openings to accommodate all piping and mastic for seam. Station chamber and access

shall be rated for direct traffic. Chamber interior shall be painted with White CS55 sealant to improve lighting. Chamber exterior shall be sealed with Black CS55 sealant or insulated with polyurethane foam as required to provide a watertight enclosure. Chamber shall have provision for 30" manhole frame with cover or access hatch.

2.4 Piping

All 3" and larger pipe to be fabricated from schedule 40 steel to AWWA M11 Steel Pipe design Standards. Finished pipe to be sandblasted, epoxy lined and coated with NSF 61 approved epoxy to AWWA C210 specifications. 2" and smaller pipe to be stainless steel to comply with lead free requirements.

2.5 Testing and Start-Up

After the package PRV station has been installed in the field, the PRV station manufacturer shall furnish competent personnel to start up and test the complete package system. An operational test, simulating service conditions, shall be given to check for leaks in all piping, valves and seals, and all auxiliary equipment. All irregularities shall be corrected to the satisfaction of the Engineer.

PART 3 EXECUTION

3.1 Package PRV Station

A. The Contractor shall furnish, install, test and adjust the complete package PRV station, consisting of the PRVs, isolation valves, air release valves, sump pumps, piping, and controls, mounted in a concrete chamber enclosure.

B. The unit shall be installed at the location shown of the Plans.

C. The package PRV station shall be tested after installation. Testing will be conducted by the manufacturer's representative, and will consist of simulating flow demand requirements by operating a fire hydrant in the system. Normal sequencing of PRVs shall be simulated.

END OF SECTION

SECTION 13206

PRESTRESSED CONCRETE RESERVOIR

PART 1 GENERAL

1.1 Description

A. This section covers the complete furnishing and installation of seven-wire strand and bars for circumferential and vertical prestressing, respectively, of concrete walls and the complete shotcreting operations. This section also covers the qualifications for the RESERVOIR CONTRACTOR, the RESERVOIR PRESTRESSOR and the SHOTCRETER. This section also covers general requirements for the reservoir and construction materials used in the reservoir. In the event of a discrepancy between this section of the Specifications and any other section of the Specifications, this section shall govern. The words "stressing machine" may refer to either circumferential wrapping machinery or vertical tendon stressing equipment.

B. The CONTRACTOR shall furnish and erect a prestressed concrete reservoir of the capacity shown on the Drawings, consisting of a concrete roof, concrete floor and a poured-in-place concrete corewall, post-tensioned vertically with steel rods and circumferentially with wrapped strand and protected with several coats of shotcrete and coating system(s).

C. The reservoir shall conform to the dimensions and be equipped with the appurtenances shown on the Drawings and as specified herein.

D. Concrete work shall conform to the provisions of all Sections in Division 3 as supplemented and modified by this section.

1.2 Submittals

A. Submittals shall be made in accordance with Section 01300, SUBMITTALS. The following information and materials shall be provided:

1. CONTRACTOR shall submit shop drawings of the circumferential prestressing wrapping schedule and the intermediate lockoff elevations for the ENGINEER's approval before the wall pour is made.

2. CONTRACTOR shall submit shop drawings of the reinforcing steel for the ENGINEER's approval per Section 03210 REINFORCING STEEL.

3. CONTRACTOR shall submit shop drawings of the wall and roof shoring systems for the ENGINEER's approval per 03300 CAST-IN-PLACE CONCRETE.

4. CONTRACTOR shall submit manufacturer's certification for the vertical tendons, seismic cables and circumferential strand-wrapping cable.

1.3 Codes and Standards

In addition to compliance with the provisions of the current edition of ANSI/AWWA D110 all associated accessories and appurtenances shall be designed and constructed in accordance with all applicable local requirements including the following Codes, Standards:

A. The current editions of the International Building Code and State of Oregon Structural Specialty Code.

B. Oregon Occupational Safety and Health Code.

C. Oregon Administrative Rules Chapter 333 for Public Water System published by the Oregon Health Division.

D. AISC Manual - Specification for the design, fabrication and creation of structural steel for buildings.

1.4 Quality Assurance

A. 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.

B. All references to standards of AWWA or other organizations shall be the latest version of those standards.

C. Current NSF Standard 61 Certification for the systems being offered to include the generation system, brine and solution tanks, and chemical feed and handling components.

1.5 Warranty Requirements

Refer to the Standard General Conditions Article 6.19 and the Supplementary General Conditions SC-6.19(D) for warranty requirements.

1.6 Contractor Prequalification

Prequalification of the RESERVOIR CONTRACTOR and PRESTRESSOR apply to this project. Refer to Section 01100, SPECIAL PROVISIONS, for prequalification requirements.

1.7 Work by Pre-qualified RESERVOIR CONTRACTOR

A. Pre-qualifications for RESERVOIR CONTRACTOR are specified in Section 01100 SPECIAL PROVISIONS.

B. The RESERVIOR CONTRACTOR shall performed all work by employees hired directly by the RESERVOIR CONTRACTOR for the construction of the reservoir structure and appurtenances except for the following work which may be sublet:

1. Concrete forming and placing

2. Specialty work such as rebar installation, scaffolding and concrete finishing may be sublet to contractors experienced in these aspects of prestressed concrete reservoir construction.

3. Prestressing work to be performed by the prequalified RESERVOIR PRESTRESSOR

4. Reservoir shotcrete work to be performed by the prequalified RESEROVOIR PRESTRESSOR

1.8 Work by RESERVOIR PRESTRESSOR

A. Pre-qualifications for RESERVOIR PRESTRESSOR are specified in Section 01100 SPECIAL PROVISIONS.

B. The RESERVOIR PRESTRESSOR shall perform all work described below either by employees hired directly by the RESERVOIR PRESTRESSOR or by employees hired by the RESERVOIR CONTRACTOR under direct supervision of the pre-qualified superintendent identified by the RESERVOIR PRESTRESSOR.

1. Furnish, stress and pressure grout the vertical prestressing tendons with epoxy.

2. Abrasive blast the exterior concrete core wall.

3. Furnish and install the horizontal prestressing strand.

4. Apply the shotcrete covercoat application over the strand.

1.9 Product Delivery, Storage and Handling

A. Prestressing steel shall be adequately packaged against intrusion of chemical contaminants (from the atmosphere or otherwise) for the protection of the steel against physical damage and corrosion during (and subsequently as the result of) shipping and storage.

B. Prestressing steel that has sustained physical damage through rust or otherwise will be rejected.

C. All materials and prestressing material delivered to the job site shall be stored off the ground on planks, supported by 4-inch by 4-inch timber, which must be covered with polyethylene or sizalkraft paper to prevent any moisture from coming up from the bottom.

D. Reels of strand, prestressing tendons, anchorages, etc., shall be stacked neatly and as compact as possible.

E. All materials for tendons and all fabricated tendons shall be covered with tarpaulins in such a manner that water, rain, moisture and dust are kept away.

PART 2 PRODUCTS

2.1 Seven-Wire Strand

A. Hot-dipped galvanized seven-wire strand used for prestressing shall meet the following minimum requirements unless otherwise shown on the Drawings:

Item	Specification Type A
1. Nominal strand diameter	3/8-inch
2. Nominal area after galv.	0.089 in²
3. Nominal weight/1000 LF	303 lbs.
4. Pitch (Strand diameters)	12-16
5. Tensile strength (min.)	21,400 lbs.
6. Yield strength @ 1% extension (min).	16,000 lbs.
7. Elong. in 24-inch at fracture (min.)	4.5 percent
8. Weight of zinc coating (min.)	0.85 oz./ft.²

B. Hot-dipped galvanized seven-wire strand shall be manufactured in accordance with ASTM A416 prior to galvanizing. Each wire of the strand shall be individually hot-dipped galvanized before being stranded.

C. Single wire prestressing material shall not be utilized in lieu of seven-wire strand prestressing material.

2.2 High-Strength Threadbars - Galvanized

A. Deformations of the threadbars shall form a screw-thread suitable for mechanically coupling lengths of thread bar and for positive attachment of anchor assemblies.

B. Deformations shall conform to ASTM A722, Type II requirements and shall be uniform such that any length of bar may be cut at any point and the internal threads of a coupling designated for that size of bar can be freely screwed on the bar. The bars and their deformations shall be hot rolled.

C. Tensile and Physical Properties shall meet the following requirements with bars being manufactured in accordance with ASTM A722, Type II:

Item	Unit	Specifications	
1. Nominal diameter	inches	1.25	1.375
2. Min. tensile force	kips (min.)	187	237
3. Yield force at 0.2% offset	kips (min.)	150	190
4. Elong. in 20 bar (diameter)	% (min.)	4	4
5. Nom. cross-sectional area	sq. inches	1.245	1.577
6. Nominal bar weight	lbs/ft.	4.39	5.56
7. Min. wt. of zinc coating	oz/sq.ft.	0.85	0.85

Note: To provide reduced relaxation, more uniform elastic modulus and reduced residual stress in the critical thread area, only threadbars that are stress relieved after the threads are formed will be accepted. All threadbars shall be proof stressed after stress relieving and threading. Threadbars with cold rolled threads or threadbars with quenched or tempered steels will not be permitted. Threadbars shall have a maximum carbon content of 0.55 percent. Only manufacturers with not less than 5 years of experience, under their current name, in the manufacturing of post-tensioning material meeting all the requirements of this specification will be accepted.

2.3. Anchorages for Vertical Post-Tensioned Tendons

A. All post-tensioned prestressing shall be secured at the ends by means of approved permanent anchoring devices, which shall hold the prestressing steel

at a force not less than 95 percent of the guaranteed minimum tensile strength of the prestressing steel.

B. The load from the vertical prestressing anchoring device shall be distributed to the concrete through steel bearing plates of dimensions and details shown on the Drawings.

C. All vertical prestressing anchor plate dimensions, all dimensions relating to the conical hole in the top and bottom of the bearing plate (35 degree cone angle with the vertical), all steel tubing attached to the top bearing plate, and all tendon spacings shall strictly conform to the details shown on the Drawings.

D. Fully-threaded anchor connections shall be used at both ends of the vertical prestressing bar, which shall incorporate a spherical-shaped bearing surface to match the conical surface in the bearing plate.

E. The contact point of the spherical-shaped vertical prestressing bearing surface to conical hole shall be approximately 1/4-inch to 1/2-inch below the bearing plate surface.

F. Wedge anchors shall not be used for permanent anchor hardware.

2.4 Testing of Prestressing Material

A. Prestressor shall furnish at his own expense Mill test certificates showing the dimensional and physical characteristics of each size, heat or reel of the prestressing steel he has furnished.

B. CONTRACTOR shall furnish evidence, to the satisfaction of the ENGINEER, prior to the preparation of shop drawings and installation of vertical tendons, that the proposed tendon anchorage system meets the requirements of these specifications. The ENGINEER may order additional tests to be taken. Should such additional tests not meet the specifications, such expenses shall be paid for by CONTRACTOR; otherwise such expenses shall be borne by the OWNER.

C. Before any stressing operation may be started, Prestressor shall calibrate all recording equipment at an approved testing laboratory to the satisfaction of the ENGINEER.

D. All continuous force readings for either the vertical or the circumferential prestressing operations shall be developed with electronic (or the substantial equivalent) force (strain gauge method) sensing transducers, all having a maximum non-linearity error of $\pm$ 0.5 percent and a maximum hysteresis error of $\pm$ 0.25 percent.

2.5 Anchor Pockets for Vertical Tendons

A. Anchor pockets for vertical prestressing tendons shall consist of steel cans, hot-dipped galvanized after cutting (unless shown otherwise on the Drawings) and subsequently welded to the top bearing plate.

B. Anchor pockets shall be adequately sealed from moisture and concrete intrusion by wooden lids and 2-inch wide plastic adhesive tape.

C. Anchor pockets for vertical prestressing tendons must have adequate provisions for flushing of ducts with water during concrete placement.

2.6 Ducts for Vertical Tendons

A. Duct enclosures for vertical prestressing steel shall be standard 1.25 inch or 1.375 inch diameter PVC pipe class 160 or class 200, respectively, unless otherwise specified on the Drawings.

B. All ducts shall be provided with expandable valves to facilitate the injection of epoxy after prestressing.

C. All connection details shall be as shown on the Drawings.

2.7 Epoxy Grout for Vertical Tendons

A. The vertical tendon system shall offer complete 2-part epoxy protection of the prestressing steel inside ducting and anchors.

B. Portland Cement grout will not be accepted.

2.8 Portland Cement

Portland cement for the reservoir construction and shotcreting shall meet the requirements set out in Section 03300 CAST-IN-PLACE CONCRETE.

2.9 Shotcrete

A. Fine aggregates

1. Fine aggregates shall meet the requirements set out in Section 03300 CAST-IN-PLACE CONCRETE.

2. A well-graded, coarse sand shall be used for all shotcrete applications.

3. Coarse sand shall generally consist of the following gradation:

Sieve Size	% Passing by Weight
3/8-inch	100
No. 4	95 -100
No. 8	80 - 100
No. 16	50 - 85
No. 30	25 - 60
No. 50	10 - 30
No. 100	2 - 10

The fineness modulus shall fall between 2.70 and 3.00.

4. Plastersand shall be used for finish coatings if smooth (as opposed to "natural") surfaces are required on the Drawings.

5. Plastersand shall meet the following gradation:

Sieve Size	% Passing by Weight
3/8-inch	100
No. 4	97 -100
No. 8	90 - 98
No. 16	70 - 85
No. 30	35 - 55
No. 50	15 - 25
No. 10	2 - 8

The fineness modulus shall fall between 2.40 and 2.75.

B. Rebound

1. Rebound is defined as aggregate mixed with some cements, which ricochets off the surface during the application of shotcrete because of collision with the harder surface, reinforcement, or with the aggregate particles themselves, which amount varies with the position of the work, air pressure, cement content, maximum size and grading of aggregate, amount of reinforcing and thickness of layer.

2. Rebound materials may not be reused in any form for shotcrete.

C. Water

Water shall meet the requirements set out in Section 03300 CAST-IN-PLACE CONCRETE.

D. Air-Entrainment & Admixtures

Air-entrainment and admixtures shall meet the requirements set out in Section 03300 CAST-IN-PLACE CONCRETE.

E. Fibrous Shotcrete Reinforcement

1. All shotcrete, unless otherwise specified here-in, shall be fibrous reinforced. Such material shall consist of 100 percent virgin polypropylene fibrillated fibers specifically manufactured for use as concrete/shotcrete secondary reinforcement. The required volume of fibers to be added per cubic yard of shotcrete shall be as specified in these Specifications.

2. Polypropylene fibers will help to provide greater control of cracking from drying shrinkage and thermal expansion/contraction, a reduction of permeability, an increased impact capacity, an improved shatter/abrasion resistance and added toughness of the shotcrete.

3. The fibers shall be manufactured in accordance with applicable building codes and ASTM C1116 Type III 4.1.3. and ASTM C1116 (Ref. ASTM C1018) Performance Level I_5 outlined in Section 21, Note 17. Fibrous concrete reinforcement shall be as manufactured by the FIBERMESH COMPANY, or equal.

4. Acceptable polypropylene fibers shall have the following physical characteristics:

   a. Specific gravity = 0.91
   b. Tensile strength = 80-110 ksi
   c. Fiber length = graded per manufacturer

F. Shotcrete Proportioning

1. Each one cubic yard of mortar in the ready mix truck or mixer shall consist of 0.1 percent (1.5 lbs. per cubic yards) polypropylene fibers as specified in these Specifications and a mix ratio of 3lbs. of moist sand to 1lb. of Portland cement. Up to 50oz. of PRO-KRETE-R or POZZOLITH 300R may be added at the option of Shotcreter during warm weather conditions.

2. Whenever night temperatures are expected to drop below 35F, “high early” Portland cement shall be used in lieu of regular Portland cement. Should “high early” Portland cement not be available, the mix design shall consist of a moist sand-Portland cement mix ratio, by weight, no greater than 2.59.

3. If the batching procedure requires that smaller volumes of cement and sand be used, the required cement-to-sand ratio shall still be strictly adhered to.

4. Additives other than PRO-KRETE-R or POZZOLITH 300R (such as POZZOLITH 300N or others) shall not be used unless specifically approved by the ENGINEER, after careful consideration of its corrosive influence on prestressing steels.

5. If used by the shotcreter, the total volumetric air content of the shotcrete before placement shall not exceed 7 percent (plus or minus one percent) as determined by ASTM C173 or ASTM C231.

6. Unless otherwise shown on the Drawings, shotcrete cylinder strengths at 28 days shall be no less than 4,500psi. Higher shotcrete cylinder strengths shall not permit a reduction in the above specified cement contents. The cement content in the above mix designs may be increased should the specified 28-day strength requirement not be met.

7. The polypropylene fibers and admixtures shall be added to the shotcrete at the time it is batched and in the amounts as required here-in. Such additives shall be mixed in strict conformance to the manufacturer's instructions and recommendations for uniform and complete distribution. Each certificate of delivery supplied by the shotcrete supplier shall indicate the additive trade name, manufacturer's name and amount per cubic yard added to each batch of shotcrete.

PART 3 EXECUTION

3.1 Circumferential Prestressing Equipment

A. The circumferential stressing system shall produce a continuously, electronically (or substantial equivalent) monitored permanent stress or force recording along its full length as it is being applied and the stress variation in any strand at any point around the circumference shall not be greater than $\pm$ 1.5 percent of the ultimate strength of the steel. In addition to this recording, any system which deflects the tensioned prestressing material between the tensioning device and the wall after it has left the tensioning device, shall provide a similar continuously monitored stress or force record along its full length as it is being applied to the wall. These recordings shall show that, either before or after deflection, the stress variation in the prestressing material at any point around the circumference shall not be greater than $\pm$ 1.5 percent of the ultimate strength of the steel.

Due to prior instances of force measurement inaccuracies and the inherent problems associated with hand-held stressometers, no manual recorded force readings will be accepted. This requirement shall be strictly adhered to.

B. Any wrapping that does not meet the stress tolerances specified and/or cannot meet the requirements of these specifications, will not be accepted and will be removed at CONTRACTOR's expense. CONTRACTOR shall be responsible for all costs associated with meeting the specified tolerances.

C. Since wrapping systems which utilize single solid prestressing wire will not provide the desired bond between the prestressing wire and the shotcrete and since single solid prestressing wire will not provide an adequate safety factor against failure, only machine wrapping systems which utilize seven-wire prestressing strandwrapping will be allowed.

D. Since intermittent force applications can result in an unequal stress distribution around the wall (due to friction losses), the prestressing system shall be capable of applying a continuous wrapped force at any point around the circumference within the specified tolerances. Circumferential stressing systems based on jack-operated cable or rod-type tendons will not be allowed.

3.2 Circumferential Prestressing Application

A. Wrapped strand shall be anchored to the wall at least once for every coil or reel.

B. Permanently anchoring one strand to a previously wrapped strand will not be permitted.

C. Wrapped strand ends shall be joined by suitable splicing methods that shall develop 90 percent of the full strength of the strand.

D. Use of different alloys in the splicing material will not be permitted.

E. The clear spacing between any two wrapped strands in the vertical direction shall be 1.5 strand diameters or 3/8 inch, whichever is larger.

F. All wrapped strands not meeting the spacing requirements shall be spread by approved methods or shall otherwise be removed.

3.3 Vertical Prestressing Equipment

A. The Prestressor shall provide a continuously, electronically (or substantial equivalent), monitored permanent force-elongation record from zero to full force at the final lockoff for all of the vertical prestressing work.

B. The ordinate of the permanent recording shall show the elongation in inches and the abscissa shall show the force in pounds or kips.

C. Manually recorded force and elongation readings will not be accepted.

D. The vertical tendon stressing machinery shall have automatic electronic tensioning cut-off devices or equivalent means to ensure that the specified force and elongation is not exceeded at any time during any tendon stressing operation.

E. The force readings at the stressed bar ends, immediately after lock-off, for any stressing operation, on any tendon, shall not fluctuate more than +/- 1.5 percent (of the minimum ultimate strength of the steel) from the desired average force setting.

F. The maximum applied force, immediately after lock-off for the final stressing operation on any tendon, shall be no greater than 75 percent of the minimum ultimate strength of the steel.

3.4 Vertical Prestressing Application

A. All permanent anchor hardware shall have a ball-shaped threaded nut that can be screwed down on to a matching coneshaped bearing surface in the bearing plate after the desired tension on the anchor hardware and/or prestressing steel has been applied.

B. The number and spacing of tendons, if shown on the Drawings, shall not be altered under any condition.

C. High-strength threadbars shall be used for vertical prestressing which meet the requirements of these Specifications.

D. All ducts shall be clean and free of water and deleterious materials that would impair bonding of the grout or interfere with grouting procedures.

E. Grout injection pipes shall be fitted with positive mechanical shutoff valves, which shall not be removed within the first 24 hours.

F. Grouting of tendons shall be started at the lowest grout connection.

G. Each vertical tendon duct shall be pumped until the entire nut at the top anchor has been covered. Peagravel and/or clean sand may be placed (at Prestressor's option) in the tendon can as a filler prior to or after epoxy pumping.

H. In cold weather, and especially during frosts, special precautions must be taken to avoid the freezing of grout. In the event that the grouting procedure cannot

be postponed, the wall temperature must be kept above the freezing point with hot blankets or by other approved means.

I. Upon completion of the vertical stressing and grouting operation, all anchor pocket areas above the anchor nuts shall be drypacked with a one (1) cement to two (2) sand mortar mix immediately after the epoxy coating on the inside can surface has become tacky, or alternately, the metal can may filled with concrete aggregates and epoxy.

J. The inside surfaces of any metal cans to be drypacked shall be coated with a 2-part epoxy.

K. Drypacking shall not proceed until the epoxy coat has become tacky.

L. The drypack surface shall be finished flush with the adjoining concrete surface.

M. Vertical tendon components shall be assembled off the ground and as detailed on the Drawings.

N. Particular attention shall be given to sufficient taping of damaged joint connections and holes in PVC tubing.

O. Vertical prestressing tendons shall be accurately placed at the locations shown on the Drawings, or as approved by the ENGINEER, and shall be securely fastened in place to reinforcing steel and form ties to prevent movement during placement of concrete.

P. All vertical tendons shall be fully assembled before they are installed in the forms.

Q. All vertical tendons shall be flushed with water from the top immediately upon completion of the concrete vibrating operation.

R. Flushing of ducts shall proceed after the pouring and vibrating of concrete around the tendons has been completed.

S. Water shall be introduced through a taped-off hole in the wooden lids on the anchor pockets and be permitted to drain through the bottom grout tube. Flushing shall not be accomplished by introducing water through the bottom connection.

T. Upon completion of the water flushing operation of vertical tendons, the ducts shall be given a short burst of compressed air from the top only to remove any accumulations of water at the bottom of the ducts.

U. Cleaning of tendons with air only, or removal of water with air from the bottom connection, will not be permitted.

V. Placing of vertical tendons shall be done to proper locations, elevations and alignments, with a maximum tolerance of plus or minus 1/4-inch.

W. All vertical tendons shall be properly tied at the anchor plates and shall be tied with #4 bars at two (2) feet intervals between the anchor plates, unless shown otherwise on the Drawings.

X. Anchor plates must be installed at right angles to the tendon alignment near the anchor. Anchor plates must be installed with the longer sides, if applicable, aligned parallel with the wall forms and secured to prevent rotation while concrete is placed. The maximum permissible misalignment of anchor plate to tendon alignment is plus or minus 2.5 degrees.

Y. Unless indicated otherwise on the Drawings, the minimum concrete cover around metal anchor pockets and bearing plates shall be 1.5 inches.

Z. The clearance between bottom anchor plate and waterstop in reservoir walls shall be no less than two (2) inches nor more than four (4) inches.

3.5 Circumferential and Vertical Prestressing Operations

A. The maximum initial electronically (or substantial equivalent) recorded steel stress shall not exceed 75 percent of the guaranteed minimum ultimate strength (M.U.S.) of the steel at any time during and after stressing.

B. Each vertical tendon in the wall shall be stressed to the values shown on the Drawings before circumferential prestressing starts.

C. An automatic, continuously electronically (or substantial equivalent) monitored permanent recording of the applied force, at any point on the strand, at any point on and around the reservoir wall, must be made during the entire circumferential prestressing application. All such recordings must be based on a continuous sensing of the applied force on the strand between the tensioning drum and the wall when, and as, the strand is being wrapped and laid on the wall.

D. The force setting on wrapping and tendon stressing machinery shall be such that the applied forces fall within the specified minimum or maximum stress or force limitations; the force setting shall be corrected immediately when the applied force falls outside the required force tolerance limitations.

E. In the event that the stressing machinery is incapable of holding the applied forces within the specified stress or force limitations, the ENGINEER will

order, at CONTRACTOR's expense, the removal and replacement of such machinery in favor of a different stressing process capable of maintaining such tolerance requirements.

F. The loss in stress in post-tensioned prestressing steel due to creep and shrinkage of concrete creep of steel and sequence stressing shall be assumed as 25,000psi.

G. The final stress is the average initial stress reduced by the stress loss of 25,000psi.

H. The final force is the steel section multiplied by the final stress.

I. The final force shall be no less than the required working force shown on the Drawings.

J. The continuous, electronically-produced force application chart during the wrapping application becomes the property of the OWNER.

K. Manual, individual or intermittent force readings taken on wrapped strand in full bodily contact with the wall will not be accepted. Force readings based on anything other than instantaneous force readings, as the strand is being tensioned, and wrapped around the reservoir, will not be accepted.

L. An automatic, continuously electronically (or substantial equivalent) monitored and simultaneously recorded force-elongation reading must be made for each vertical stressing application.

M. The force-elongation reading must represent the true relationship between the elongation at any given point of the vertical stressing operation and the applied force on the prestressing steel at that same point.

N. The force-elongation relationship must be constantly maintained from the beginning, starting with the removal of the slack to the point of lock-off and complete release of the force on the vertical prestressing steel after retraction of the stressing piston or equivalent stressing device.

O. All electronically produced force-elongation readings during the vertical tendon stressing operations become the property of the OWNER.

P. The ultimate initial prestressing force for vertical tendons shall not be applied until the concrete compressive strength in the wall shall have reached the specified 28-day strength.

Q. Wrapping may start when the concrete has reached a strength of 4,000psi; however, under no circumstance shall the compressive stress, under any condition, exceed 55 percent.

R. In the event that gaps between the corewall and the wrapped strand develop that exceed 3/8-inch, wrapping shall be discontinued and the wall shall be built up with shotcrete to provide the proper curvature. Alternately, if approved by the ENGINEER, the gaps may be drypacked after wrapping is completed and before shotcreting is started.

S. Wrapping over intermediate shotcrete coats or built-up shotcrete areas may commence 12 hours after the shotcrete has been applied or when the shotcrete has reached a strength of 250psi, whichever is later.

T. Because prestressing strand exposed to excessive temperatures greatly increases the possibility of irrevocable damage, such as steel embrittlement, stress corrosion, or wire splitting, the temperature of the prestressed material during application shall not be allowed to increase by more than fifty degrees at any time during such application due to the stressing technique. No system which relies on pulling the prestressing material through a die to create a force, will be allowed.

U. All vertical prestressing tendon ducting shall be pressure grouted with an approved 2 part water insensitive epoxy and approved epoxy grouting equipment. Circumferential prestressing anchors shall be drypacked with cement grout or epoxy, at the CONTRACTOR's option.

V. Grout injection pipes shall be fitted with positive mechanical shutoff valves, which shall not be removed within the first 24 hours.

W. Grouting of tendons shall be started at the lowest grout connection.

3.6 Safety Precautions

A. Every precaution shall be taken to keep personnel and visitors outside the danger area of breaking strands or bars.

B. At no time shall anyone stand in the line of stressed vertical tendons or stressed strand.

C. No work shall be performed by anyone, other than the prestressing crew, within 100 feet from the wrapping operation or the application of the vertical tendon stressing operation.

D. Where access to the site by unauthorized persons is outside the CONTRACTOR's control, while prestressing work is in progress,

CONTRACTOR shall erect protective fencing to prevent breaking strand from endangering such persons.

E. There shall be no welding to anchor plates after the tendons have been assembled, neither shall prestressing steel be used as a "ground" for welding operations.

3.7 Abrasive Blasting

Exterior surfaces of the concrete corewall and dome-ring (if any), which will receive strandwrapping shall be abrasive blasted, regardless of the forming method used, by a mechanical etching or shotblast system combined with a vacuum recovery system, or a self-contained waterblasting system. Systems that have not been used successfully in the past to prepare circular reservoir wall surfaces for shotcreteting and strandwrapping or systems which rely on sandblasting or steel shot without a vacuum system will not be allowed. The surface shall be abrasive blasted sufficiently to remove all laitance, form oil or other type of coatings. The surface shall be cut to a minimum CSP5 profile, as established by the International Concrete Repair Institute (ICRI), over a minimum of 90 percent of the surface being prepared as measured over any one foot square area. The prestressing subcontractor who is performing the abrasive blasting shall make available to the inspector ICRI sample coupons to assist in evaluating the abrasive cut.

3.8. Shotcrete Equipment

A. Mixing

This shall be done in conformance with the requirements of Section 03300 CAST-IN-PLACE CONCRETE.

B. Delivery Equipment

1. The delivery equipment shall be of an approved design and size which has given satisfactory results in similar previous work.

2. The equipment shall be capable of discharging mixed materials into the hose under close control and shall be able to deliver a continuous smooth stream of uniformly mixed material at the proper velocity to the discharge nozzle, free from slugs of any kind.

3. The nozzle shall be of a design and size that will ensure a smooth and uninterrupted flow of materials.

4. Delivery equipment shall be thoroughly cleaned at the end of each shift.

5. Equipment parts shall be regularly inspected and replaced as required.

6. The equipment must allow for the concrete, water and air to be distributed to the automated shotcrete tower through a swivel pin located at the center of the reservoir.

C. Air Supply

The air capacity of the compressor shall be large enough that the minimum amount of air to be available at the nozzle shall be no less than 400 CFM, irrespective of whether or not air from the same air supply is used for other purposes.

3.9 Shotcrete Application Process

A. Shotcrete shall be applied under the wet mix process only.

B. Nozzles shall be mounted on power driven machinery enabling the nozzle to travel parallel to the surface to be sprayed at a uniform linear or bidirectional speed.

C. The nozzle shall be kept at a uniform constant distance from the surface, always insuring a right angle spray of the material to the surface.

D. Hand operated nozzles and shotcreting operations dependent on the performance of the nozzleman will not be accepted except where additional shotcrete is needed to correct flat areas or for architectural surface treatments.

E. Grout materials shall be delivered to the jobsite in ready-mix trucks from approved batching plants. However, job mixing will be accepted provided automatic weigh batch plants are used.

F. The sand, cement and water shall be premixed before being pumped through a 2" minimum hose by specially designed mortar pumps.

G. The high velocity impact shall be developed pneumatically by injecting compressed air at the nozzle.

3.10 Shotcrete Placing and Finishing

A. General

1. Shotcrete shall be applied in a steady, uninterrupted flow.

2. Should the flow become intermittent for any cause, the machine operator shall direct the nozzle away from the work until it again becomes constant, or shut off the flow of materials.

B. Position of Pneumatic Nozzles

The nozzle shall be held at approximately right angles to the surface and shall be kept at the proper and the same distance from the surface dictated by good practice standards for the type of application, type of nozzle and air pressure employed.

C. Shotcreting More Than One Layer

1. Sufficient time shall be allowed for each layer of shotcrete to set up so it may take the next layer without sagging.

2. The shotcrete shall be started at the bottom of the wall until all wrapped strand has been covered. Subsequent shotcrete layers may be applied from the top down or from the bottom up at the discretion of the Shotcreter.

3. While the nozzle travels around the wall, the nozzle shall be raised or lowered at a uniform rate in such a manner that an adequate overlapping of coatings and a uniform finish will develop.

4. The nozzle shall be spiraled up or down around the reservoir to either the top or the bottom of the wall or to the termination of the intermediate strand layer.

3.11 Application of Shotcrete

A. To ensure proper penetration around the strand and proper conveyance of the material through the hose, a 5-inch to 7-inch slump of the mortar at the pump is recommended.

B. The application of the shotcrete in the number and thickness of layers specified here-in is mandatory for proper penetration of shotcrete behind prestressing steel and to reduce shrinkage due to more uniform in-depth drying of the shotcrete. The moisture absorption by earlier applied layers is relied upon to improve the bond and strength of the material and to reduce drying shrinkage of the applied shotcrete.

C. Shotcrete Covercoats Over Wrapped Strand

1. Each layer of wrapped prestressing steel shall be covered with shotcrete until a minimum cover of 3/8-inch over the steel has been obtained.

2. The final covercoat, to make up for the full thickness of shotcrete over the final strand layer, shall be applied in at least three (3) layers of equal thickness.

3. Each layer of shotcrete shall be completed for the full circumference of the reservoir and substantially the full height of that layer before the next layer of shotcrete may be applied.

D. Coating Thickness

1. All shotcrete coatings shall be built up in layers of approximately 3/8-inch in thickness until the final required thickness has been obtained.

2. Unless otherwise shown on the Drawings, the minimum shotcrete cover over all wrapped steel shall be 1.5-inch.

E. Finish Coat

1. After the minimum shotcrete cover specified over the wrapped prestressing strand has been completed by the automated shotcrete procedure, only if such finish requirements are shown on the drawings, the exterior surface shall be given an acceptable float finish true to line and curvature and to details noted or shown on the Drawings.

2. If a float finish is required on the drawings, plaster or hand-applied shotcrete may be used to build up and level the surface and to obtain the desired surface finish and projections.

3. The finish coat mix (if a smooth float finish is required on the drawings) shall consist of a minimum of one sack of cement for each 3-1/2 cubic feet of moist plaster sand.

4. If no finish requirements are shown on the Drawings, it is intended to have a natural original gun finish of the shotcrete covercoat.

F. Protection of Adjacent Buildings and Surface

1. Shotcreter shall take every possible precaution to protect adjacent buildings, concrete surfaces, vehicles, equipment, etc., from being damaged by overshooting shotcrete and by materials carried away by the wind.

2. Overshot shotcrete and rebound materials deposited on the roof shall be removed before it adheres to the concrete surface.

3. CONTRACTOR shall pay for all damages caused by Shotcreter's operations under this contract.

3.12 Shotcrete Tests

Testing of shotcrete shall conform to Section 03300-3.13, “Concrete Tests” of these Specifications.

3.13 Hand Placed Shotcrete for Repairs Only

A. To ensure a high quality shotcrete, the Shotcreter shall satisfy the ENGINEER that the nozzleman has had sufficient and acceptable experience in the application of structural shotcrete.

B. Shotcrete nozzleman must be certified per ACI 506.

C. The nozzleman shall be capable of applying thin coats of even and uniform thickness.

D. Experience gained on shotcrete pool and ditch construction will not be considered as experience for qualifying the nozzleman, unless approved by the ENGINEER.

3.14 Restrictions on Shotcrete Operation

A. Shotcrete shall not be applied under such strong wind conditions that a considerable amount of cement and moisture will be removed by the wind from the mortar spray between the nozzle and the surface on which the shotcrete is applied.

B. Shotcrete may be applied in cold weather provided the surfaces are not frozen.

C. The temperature during the day must be expected to rise to at least 40^{o} F and the night temperature of the first night after the shotcrete application must not be expected to drop below 27^{o} F.

D. The use of Type 3 Portland cement is required (when readily available) in the event shotcrete is applied at temperatures below 40^{o} F.

E. The Shotcreter may apply shotcrete under the conditions specified herein solely at his own risk.

F. Whenever rain or frost has damaged shotcrete which has not had a chance to set up, such shotcrete shall be removed and replaced.

G. Shotcreter shall consult with the ENGINEER to determine whether or not the shotcrete damaged by rain or frost will be accepted before applying any new layers of shotcrete.

3.15 Shotcrete Watercuring

A. Intermediate layers of shotcrete shall be kept damp by hand curing or other means no sooner than 12 hours after the shotcrete has been applied.

B. This watercuring is not required should additional shotcrete be applied on the entire wall surface within the following 12 hours.

C. An indiscriminate use of continuous watercure for intermediate layers shall be avoided.

D. Complete shotcrete surfaces, which do not receive any additional coatings, shall be watercured for a period of at least seven (7) days by encapsulating the shotcrete inside of plastic sheeting. Such plastic sheeting shall be lapped and sealed as necessary to properly cure the shotcrete. Membrane curing methods utilizing curing compounds or wax-based residuals will not be permitted.

E. Wall coatings, as specified in Section 09900, shall be applied no later than five (5) days after completion of the watercuring. If conditions make it impossible to apply coatings within the five (5) day period, shotcrete shall be watercured for a period of ten (10) days instead of the seven (7) days specified herein.

3.16 Cleaning, Inspection and Waterproofing

A. After construction is completed, the interior of the reservoir shall be completely hosed out and cleaned of all dirt and loose material. The reservoir floor shall be power washed for clear detection of possible cracks.

B. CONTRACTOR shall notify ENGINEER at least 48 hours before interior of reservoir is clean and ready for inspection by the ENGINEER.

C. Floor, wall, footing, column and roof cracks, which may have developed from drying shrinkage, shall not be taped or chipped out and caulked. All cracks shall be pumped and sealed with a two-part water insensitive epoxy by a qualified and certified technician or subcontractor per specification Section 03740. No repair shall before performed until ENGINEER has completed inspection of the interior of the reservoir. Any repairs performed by the CONTRACTOR prior to inspection by the ENGINEER will be required to be removed as per the ENGINEER by the CONTRACTOR at no expense to the OWNER.

3.17 Testing and Repairing Leaks

A. Testing

1. Leak testing shall be performed after all required concrete surface repair has been completed and accepted by the ENGINEER.

2. Leak test procedure per the current edition of AWWA D110.

3. CONTRACTOR shall notify ENGINEER and OWNER 72 hours before reservoir is ready for filling.

4. After filling the reservoir, the water level shall be held at the overflow for a period of 72 hours. The reservoir and the drain lines from the ring drain shall then be examined for evidence of leaks. All leaks shall be repaired to the satisfaction of the ENGINEER. Any areas that, in the opinion of the ENGINEER, are exposed to contamination during the repair work shall be re-chlorinated to the ENGINEER's satisfaction.

5. Testing shall be completed before the reservoir is backfilled.

B. Leak Detection Methods

1. Leaks in floor construction joints may be detected with the aid of a diver.

2. Mud or cement deposits on the floor, when stirred up, would flow to the leak and may so indicate where the leaks are.

3. Honeycomb and cracks around waterstops may be detected through tapping with a hammer along the joint.

4. Any of these procedures may be insisted upon by the ENGINEER when epoxy injection has not stopped the leaks.

5. Leakage through joints, which may have resulted from bent over waterstops or honeycomb under or around waterstops may require the removal of concrete around the waterstops in suspected areas.

6. Chipped out concrete areas shall be properly drypacked with a mix of one (1) part cement to two (2) part coarse sand, after coating the existing concrete surface with an approved epoxy.

C. Acceptance

1. The net liquid loss shall not exceed 0.05 of 1.0 percent of reservoir capacity per 24 hours after the reservoir has been filled.

2. There shall be no visible running leaks or water puddles.

3. Damp spots on the exterior wall surface shall not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand. The source of water movement through the wall shall be located and repaired per these Specifications.

4. Any cracks, voids, honeycomb or cold joints shall be repaired as per AWWA D110. Any cracks or crazing shall be observed by the ENGINEER prior to any repairs being made. If cracks are repaired prior to observation by ENGINEER, the repair will be required to be removed and the repair completed following observation. If requested by the Contractor to stop floor leakage and if allowed by the Owner, the floor may be covered with a minimum of two inches of water and pure cement shall then be spread evenly over the entire floor area at the rate of one sack of cement to every 1000 square feet of floor area. The floor shall not be allowed to dry after the application of cement. If the reservoir has been cement seeded and if the reservoir is drained during the warranty period, Contractor shall be given fourteen (14) days advance notice and Contractor shall promptly remove all cement residue from the reservoir floor and clean the reservoir to the Owners satisfaction. The Owner shall pay for the subsequent reservoir disinfection and chlorination.

5. The reservoir shall not be backfilled until and unless the ENGINEER has accepted the tests.

6. This Section shall be applicable during the entire specified warranty period of the reservoir.

3.18 Disinfecting and Filling

A. Refer to Section 01652, RESERVOIR DISINFECTION, for disinfection requirements.

B. The reservoir should only be filled during normal working hours, at the end of each day the reservoir and ring drain should be checked for any kind of visible leakage. If only damp spots and small puddles of water are noted, the filling can continue. If major leaks are noted, they should be thoroughly investigated prior to continuing to fill the reservoir.

END OF SECTION

SECTION 13207

PRESTRESSED CONCRETE RESERVOIR ACCESSORIES

PART 1 GENERAL

1.1 Description

This Section covers miscellaneous specialties associated with reservoir construction as specified and indicated on the drawings, including hatches, vents, ladders and other appurtenances and accessories. Reservoir construction, foundation construction earthwork, electrical, mechanical and yard piping, landscaping, buildings, doors and provisions for other related project work is covered elsewhere in the specifications.

1.2 Design

A. General

Fabrications and erection of ladders shall be in accordance with the latest edition of the OSHA Standards, except as specified herein.

B. Codes and Standards

In addition to compliance with the provisions of the current edition of ANSI/AWWA D110 all associated accessories and appurtenances shall be designed and constructed in accordance with all applicable local requirements including the following Codes, Standards:

1. The current editions of the International Building Code and State of Oregon Structural Specialty Code.

2. Oregon Occupational Safety and Health Code.

3. Oregon Administrative Rules Chapter 333 for Public Water System published by the Oregon Health Division.

4. AISC Manual - Specification for the design, fabrication and creation of structural steel for buildings.

C. Physical Requirements

An interior access ladder shall be provided inside the reservoir, accessed via a ft by 8-ft roof hatch. The reservoir shall be equipped with a roof vent and

other accessories and appurtenances as shown on the drawings and more fully described in PART 2, MATERIALS.

Details of design and construction shall be such as to allow access to all surfaces for maintenance, cleaning and coating.

D. Submittal Requirements

The CONTRACTOR shall provide any and all shop drawings required by the ENGINEER to clearly delineate all proposed detail of construction. These shall include as a minimum all proposed accessories, attachments, and structure anchorages.

In addition, all components which will be shop fabricated shall be clearly identified. Shop drawings shall be provided for all proposed accessories.

PART 2 MATERIALS

2.1 Reservoir Accessories

The completed reservoir shall include all accessories shown on the drawings and described herein. All accessories shall be designed and constructed in accordance with all applicable Federal, State and local codes and standards.

A. Ladder -- An interior ladder shall be included, providing access into the reservoir from the reservoir roof as shown on the Drawings. The ladder shall be of steel fabrication as shown on the Drawings and shall include a fall prevention system as per Section 11900 of the specifications. The ladder mounted inside the reservoir shall be stainless steel type 316. The ladder may be constructed in section lengths as determined by the CONTRACTOR. Connection details of ladder sections shall be included in the shop drawings.

B. Roof Hatches -- See Section 05500-2.13 of the Specification for details.

C. PVC Reglet - A PVC reglet shall be placed at the top of the corewall as shown on the Drawings. The PVC reglet shall be a minimum of 3/4 inches deep and 1-1/4 inches wide. The PVC reglet shall have a reverse angle to help assure that the shotcrete will adhere to the reservoir corewall.

D. Reservoir Vent - The reservoir wet well shall be vented through a vent mounted on the reservoir roof above the high water level as shown on the Drawings. Reservoir vents shall be sized for adequate air flow at extreme reservoir fill/empty flow rates. Vent sizing shall be based on a minimum fill

rate of 7,000 gpm and an empty flow rate of 66,700 gpm. Vent shall be fitted with stainless steel screening for insect and pest obstruction, secured around all edges. Screen securing system shall be such as to allow maintenance replacement of screen fabric. Vent shall be accessed through the reservoir access hatches.

E. Piping –Unprimed and uncoated ductile iron water inlet, outlet, drain and overflow piping shall be provided as shown on the Drawings. Water inlet piping shall be 24 inches in diameter, water outlet piping shall be 24 inches in diameter, drain piping shall be 12 inches in diameter and overflow piping shall be 18 inches in diameter. The ductile iron inlet piping shall extend from the floor of the reservoir vertically to a plain end located approximately 30 inches above ground level inside the reservoir. The plain end will receive a stainless steel flanged coupling adapter and be bolted to a flanged ductile iron 90-degree vertical bend, which is to be bolted to a flanged ductile iron 24-inch by 18-inch reducer. A flanged ductile iron 22.25-degree horizontal bend will then transition to an HDPE inlet header manifold. The ductile iron outlet piping shall extend from the floor of the reservoir vertically to a flange located approximately 6 inches above ground level inside the reservoir. The ductile iron overflow piping shall extend from the floor of the reservoir vertically to a flange joint located approximately 9 inches above ground level inside reservoir and continue to the overflow elevation of the tank as rigid PVC pipe conforming to the requirements of AWWA C905 as shown on the Drawings . Overflow pipe shall be fitted with an HDPE cone inlet and shall be attached to the reservoir wall and extend up inside reservoir. The overflow pipe shall penetrate the floor of the reservoir and discharge to a manhole as shown on the Drawings.

All ductile iron piping shall be unprimed and uncoated pipe with either flanged ends as per AWWA C207-78 or plain ends as required. Plain end pipe shall include appropriate joining couplings, Rockwell, Dresser or approved equal. Where encased in concrete pipe blocks, piping shall be unprimed and uncoated ductile iron pipe as shown on drawings. No field welding of pipe sections will be allowed except near ends where pipe can be readily prepared and inspected without remote equipment. Flanged stub-outs shall be provided outside the reservoir foundation for connections to yard and site piping. Provisions covered elsewhere in these specifications for piping shall apply to this section. Overflow piping shall be supported laterally from the reservoir wall structure at a single location as shown in the Drawings.

F. Electrical and Instrumentation - The reservoir structure shall be equipped with level sensing and intrusion detection equipment.

PART 3 EXECUTION

3.1 General

All workmanship required for the fabrication and erection of the reservoir accessories shall be of the highest quality. All work shall conform to the standards set forth in the current edition of AWWA D110 except as modified herein. The accessories shall be constructed to true, plumb and concentric lines and dimensions.

3.2 Standards

All construction shall be in full conformance with all applicable Federal, State, and Local codes, standards and specifications including those set forth by the American Water Works Association (AWWA), International Building Code (IBC), American Welding Institute (AWI), the American Institute of Steel Construction (AISC), American Society of Testing Materials, (ASTM) and the Occupational Safety and Health Administration (OSHA).

3.3 Fabrication and Erection

A. Painting and Disinfection - Painting and disinfection shall be accomplished in accordance with requirements included elsewhere in these specifications.

B. Galvanizing - Galvanizing of reservoir accessories shall be according to Section 05500, Metal Fabrications.

C. Welds - All welds for reservoir accessories and appurtenances shall be full penetration and shall be 1/4” minimum, unless otherwise noted on drawings.

3.4 Submittals

The CONTRACTOR shall submit information as identified below. The submittal shall be presented in the form of a bound portfolio. All items shall be included in this single submittal package of which six copies shall be provided.

A. Shop Drawings - Shop drawings shall include: fabrication details of all required components and accessories, support details for all pipes and conduits, and any other information as may be required by the ENGINEER.

END OF SECTION

SECTION 13989

CORROSION PROTECTION SYSTEMS, ELECTRICAL ISOLATION SYSTEMS AND TEST STATIONS

PART 1 GENERAL

1.1 Description

A. This section covers the work necessary to furnish and install electrical isolation between the buried ductile iron pipe and existing pipelines, including bonds to form an electrically continuous pipeline, and test stations.

B. The CONTRACTOR shall furnish all labor, equipment and materials as required for the complete installation of the corrosion protection system specified herein. It is the intent of these Specifications that the CONTRACTOR furnish and install all materials and equipment and provide all labor required necessary to complete the work shown on the drawings or specified herein and elsewhere, and all other work items not specifically mentioned but reasonably inferred for a complete installation.

1.2 General

A. Like items of materials provided hereunder shall be the end product of one manufacturer to achieve standardization for appearance, maintenance, and replacement.

1.3 Definitions

A. Ferrous Metal Pipe/Fitting: Any pipe and/or fitting made of steel or iron and pipe containing steel or iron as a principle structural material, except reinforced concrete.

B. Lead, Lead Wires, Fitting Bonds, Cable: Insulated copper conductor; the same as wire.

C. Electrically Continuous Pipeline: A pipeline which has a linear electrical resistance equal to or less than the sum of the resistance of the pipe plus the maximum allowable bond resistance for each joint as specified in this section.

D. Electrical Isolation: The condition of being electrically isolated from other metallic structures (including, but not limited to, piping, reinforcement, casings, etc.) and the environment as defined in latest NACE Standard SP0169.

1.4 Submittals

A. The CONTRACTOR shall submit for approval the following items:

1. A complete list of equipment and material to be furnished, including name and manufacturer, catalog number, size, finish and other pertinent data necessary for proper identification and to determine conformance with Specifications.

2. A certified compliance report with an independent laboratory analysis the galvanic anode material and backfill material meets the requirements of this specification. Also include a detail of anode cable to anode connection.

3. Certification by the cable manufacturer-covering conformance of cable insulation to designated specification.

4. Thermite welder's certification. This is the person that performs the exothermic welding of the wires to the pipeline. The corrosion Engineer or cathodic protection specialist must certify the person(s) that will performing the exothermic welding. Only that person(s) can perform the exothermic welding.

5. Resume for corrosion Engineer or cathodic protection specialist.

B. Upon completion of the cathodic protection system, and as a condition of its acceptance, deliver, for use by the OWNER and ENGINEER, four complete bound sets of the following information:

1. Components of corrosion protection system, including copies of all Product Data and list of corrosion protection equipment suppliers with addresses and phone numbers;

2. Copies of all test reports, including test forms, general record keeping, and interpretation of results;

3. Copy of complete set of drawings showing where all anodes and test stations are located.

1.5 Quality Control

A. A qualified Engineer specializing in cathodic protection or a Cathodic Protection (CP) Specialist certified with NACE International (formally National Association of Corrosion Engineers) shall perform all testing on the cathodic protection system.

B. Electrical Isolation Test

1. All isolation joints shall be tested by the CONTRACTOR for electrical isolation after all connections have been made and before backfilling. The approved corrosion Engineer or CP specialist shall conduct testing. The Engineer or CP specialist shall be subject to approval by the ENGINEER.

2. If electrical isolation is not achieved as required, the CONTRACTOR shall complete the necessary repairs and retest to prove electrical isolation. Records of all test results, including test locations and equipment used for testing shall be submitted to the ENGINEER, prior to burial, for evaluation and acceptance or recommendations.

D. Final Tests

The CONTRACTOR's approved corrosion Engineer or CP specialist shall retest all isolation joints, after backfill. After completion of all tests and inspections, a detailed report describing any deficiencies detected will be submitted to the CONTRACTOR. The CONTRACTOR shall make all repairs necessary to correct these deficiencies at his own expense. The system shall then be retested prior to Final Acceptance. The CONTRACTOR shall pay for all retests made necessary by the corrections.

E. Skilled personnel who have had adequate experience in the methods and materials to be used shall do all thermite welding. The corrosion Engineer or CP specialist prior to commencing Work on the pipeline shall qualify thermite welder personnel. Equipment 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 thermite welders and bond tester. The corrosion Engineer or CP specialist shall provide a photograph and name of all personnel that is certified to perform the thermite welding and bond testing to the Engineer for approval.

PART 2 PRODUCTS

2.1 General

A. All Materials shall conform to the requirements set forth herein or as designated on the drawings, unless otherwise specified. All Materials must be new, free from defects and shall be of the best commercial quality for the purpose specified. All necessary items and accessories not shown on the drawings or specified herein, but which are required to fully carry out the

specified intent of the Work, shall be furnished without additional cost to the OWNER.

B. The CONTRACTOR is responsible to coordinate material compatibility. All components and materials may not be supplied by the same manufacturer; therefore, the CONTRACTOR shall supply the necessary dimensions and materials characteristics to the respective Material Supplier to insure the finished product is free of defects and irregularities that could occur from unmatched components.

C. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the contract documents.

2.2 Galvanic Anodes

A. High-Potential Magnesium Alloy:

1. Supply high potential magnesium anodes, nominal 29-inch length, and nominal 32 pound bare metal weight for reservoir pipe and 25-inch length and nominal 17 pound bare metal weight for service lines

2. Magnesium anodes shall meet the requirements of ASTM B-843-M1C High Potential magnesium Allow and ASTM G97 with an open circuit potential of (-) 1.7 VDC to CSE and a current efficiency of 50% or more.

B. Compliance Statement: Furnish an independent laboratory analysis guaranteeing that all anodes supplied meet all the requirements of this Specification.

C. Anode Wire: Supply each anode with #12 or #10 AWG solid copper wire with USE or THHN insulation. The wire shall be un-spliced length specified to the application but no less than 15 feet long.

D. Wire-to-Anode Connection: Shall be silver soldered by the Manufacturer. The anode connection shall be stronger than the wire.

E. Backfill Composition:

Ground Hydrated Gypsum	75 percent
Powdered Wyoming Bentonite	20 percent
Anhydrous Sodium Sulfate	5 percent

1. Backfill: Backfill shall have a grain size so that 100 percent is capable of passing through a 20-mesh screen and 50 percent will be retained by a 100-mesh screen. The backfill mixture shall be thoroughly mixed and firmly packaged around the galvanic anode within the cloth bag or cardboard tube by means of adequate vibration. The complete packaged galvanic anode shall weigh a minimum of 2.5 times the bare anode weight.

2. Packaging and Shipping: Provide electrode packaged in a plastic or heavy paper bag of sufficient thickness to protect the electrode, backfill, and cloth bag during normal shipping and handling.

2.3 Galvanic Ribbon Anode

A. High Potential Magnesium Ribbon Anodes

1 Provide the magnesium ribbon anodes in 22-foot roll lengths. They shall weigh 0.24 pounds per lineal inch and shall be ¾-inch wide by 3/8-inch thick. The anode shall be continuously extruded over a No 11 gauge iron wire core centrally located within the magnesium alloy.

2 Magnesium alloy shall be high potential magnesium, DOW "Galvomag" ribbon anode, or equal. Furnish an independent laboratory analysis certifying that the alloy supplied satisfies all requirements of this specification.

3 The anode shall have 5 feet #12 AWG wire with THHN or THWN insulation connected to the #12 gauge iron wire core (both ends). The connection shall be made using a crimp connector and connection coated with three layers of high voltage rubber tape and three layers of vinyl electrical tape.

2.4 Flush Mounted Test Station (Standard)

A. Test Box: Concrete body cast with a cast iron ring, with a minimum weight of 55 pounds and minimum dimensions of 8-inch inside diameter and 12-inches long. Furnish extensions as required to penetrate concrete surfaces by 4-inches minimum. Furnish with a 12-pound cast iron led with the letters "TS" or words "Test Station" cast into the lid.

B. Terminal Block: Plastic or glass-reinforced, ¼- inch thick laminate terminal board with minimum dimensions of 5-inches by 6-inches. Furnish terminal block with a minimum of twelve (12) terminals. Terminal nuts and studs shall be ¼-inch with double nuts for securing the studs to the terminal board. Terminal nuts, studs, flat and lock washers shall be nickel-plated brass, bronze, or Series 300 stainless steel.

C. Shunt: Shunts for test stations shall be 0.1 ohm minimum 6 amp capacity; Holloway Type RS manganin wire; Cott (red); Tinker & Rassor (red); or

approved equal. Furnish the required amount (0 to 3) for each test station, see Drawings.

D. Manufacturer and Products: Brooks; Models 1RT or 3RT; or approved equal

2.5 Test Station Wires

A. Wire: Single-conductor, No. 8 and No. 12 AWG stranded copper with 600-volt THWN, or THHN insulation (test stations) and single-conductor.

B. Insulation Color:

1. Anode – black
2. Anode (reservoir side) – black with green tape
3. New Pipe – blue
4. Existing pipe – white
5. New Pipe (reservoir side) – green

2.6 Exothermic Weld Materials

A. General: Exothermic weld materials shall consist of wire sleeves, welders, and weld cartridges according to the weld manufacturer's recommendations for each wire size and pipe or fitting size and material. All welding materials and equipment shall be the product of a single manufacturer. Interchanging materials of different manufacturers will not be acceptable.

B. Molds: Graphite. Ceramic "One-Shot" molds will not be acceptable.

C. Cartridges: Cast iron thermite weld cartridges shall be used for all cast and ductile iron pipe and fittings. Maximum cartridge size shall be 25 grams for steel and 32 grams for cast and ductile iron materials, respectively.

D. Welders and Cartridges: Provide the thermite weld materials for attaching copper wire to the pipe material using the appropriate types recommended by manufacturer.

E. Acceptable Suppliers: Erico Products Inc. (Cadweld), Cleveland, OH; Continental Industries, Inc. (Thermo- weld), Tulsa, OK; or equal.

2.7 Wire Connectors

A. Anode Connection to Service Pipe: Copper ground clamp, size for pipe, and as manufactured by Burndy Co., Thomas and Betts, or equal.

B. Test Station: One-piece, tin-plated crimp-on lug connector as manufactured by Burndy Co., Thomas and Betts, or equal.

2.8 Insulating Joints

A Insulating Joints: Flanges or couplings.

1. Complete assembly shall have an ANSI rating equal to or higher than that of the joint and pipeline.

2. Materials shall be resistant for the intended exposure, operation temperatures, and products in the pipeline.

B Flange Insulating Kits:

1. Gaskets: Full-face Type E with O-ring seal. The flange gasket shall be supplemented with a neoprene facing on each side to accomplish a seal.

2. Insulating Sleeves: Full-length fiberglass reinforced epoxy (NEMA G-10 grade).

3. Insulated Washers: Fiberglass reinforced epoxy (NEMA G-10 grade.

4. Steel Washers: Plated, hot-rolled steel, 1/8-inch thick.

5. Manufacturers: Pacific Seral, Inc, Central Plastics Co., Garlock, or equal.

C Flexible Insulated Couplings: Per manufacturer's recommendations

1. Manufacturers: Dresser Industries, Inc.; Romac Industries, Inc.; or equal.

D. Meter Insulated Couplings: Per manufacturer's recommendations

1. Manufacturers: Mueller Co.; or equal.

2.9 Electrical Tape / Coating

A. Linerless rubber high-voltage splicing tape suitable for moist and wet environments, such as Scotch 130C and Scotch 88, as manufactured by 3M Products, or equal.

B. Corrosion protection tape, 10 mil minimum thickness, such as Scotchrap 50 as manufactured by 3M Products, or equal.

2.10 Wire Insulation Repair

A. Wires shall be handled with care. Splices for damage to the wire insulation shall be required by spirally wrapping (50 percent overlay, minimum) with two

coats of high-voltage rubber splicing tape and two layers of vinyl electrical tape. Wire splices shall be made with suitable sized compression connectors as specified under PRODUCTS, this section, or mechanically secured and soldered with rosin cored 50/50 solder. The ENGINEER shall approve all splices.

2.11 Polyethylene Encasement

A. Provide linear low-density polyethylene film manufactured of virgin linear low-density polyethylene material per AWWA C105, tube style only. Minimum linear low-density polyethylene shall be 8 mils.

B. Minimum requirements for polyethylene encasement thickness, density of raw material, tensile strength, elongation, dielectric strength, impact resistance, and propagation tear resistance as stated n AWWA C105 shall be tested for and met. Tensile strength, elongation, and tear resistance shall be tested in both the machine and transverse directions.

C. Provide polyethylene manufacturer affidavit or certificate that all polyethylene encasement materials provided comply with AWWA standards and that all AWWA standard's inspection and test have been completed with copy of results for that lot or batch of material.

2.12 Geo-Membrane Encasement / Isolation Mat

A. Furnish 30 mil reinforced geo-membrane with 300V/mil dielectric strength and minimum 150# puncture resistance and 150# tensile strength.

PART 3 EXECUTION

3.1 General

A. The installation of the facilities herein specified and described shall conform to the latest applicable rules as set forth herein. Equipment or materials damaged in shipment or in the course of installation shall be replaced.

B. All materials and equipment associated with test stations and anodes, as shown and specified herein, shall be furnished and installed by the CONTRACTOR. The ENGINEER shall review any changes in design or method of installation of an item as specified.

C. All materials, workmanship and installation shall conform to all requirements of the legally constituted authority having jurisdiction. These authorities include, but are not limited to, the National Electric Code, General

Construction Safety Orders of the industrial Accident Commission; and all other applicable State, County, or City codes and regulations

D. Whenever the requirements of the specifications or drawings exceed those of the codes or manufacturer's instructions, the requirements of the specifications or drawings shall prevail. Where a larger size or better grade of material or a higher standard of workmanship is required, the most stringent requirement shall apply. Nothing in the Drawings or Specifications is to be construed to permit work not conforming to these regulations and codes. The CONTRACTOR shall be responsible for obtaining any required permits and inspections.

E. All materials and equipment to be used in construction shall be stored in such a manner to be protected from detrimental effects from the elements. If actual storage cannot be affected, materials and equipment shall be stacked well above ground level and protected from the elements as appropriate.

3.2 Anode Storage and Handling

A. Protect against weather, condensation, and mechanical damage. Immediately remove from site all mechanically damaged anodes.

3.3 Galvanic Anode Installation

A. General:

1. Reservoir pipe: Install galvanic anodes 5 foot below the pipe invert in native soil. Provide a minimum anode spacing of 5 feet from unprotected pipelines.

2. Service Pipe: Install anode 2 to 3 feet from the pipeline and 1-foot below pipe invert in native soil.

3. Galvanic anodes packaged in plastic bags, the plastic bag must be removed prior to installation.

4. A minimum of 10 gallons of water to be poured over the anode, just prior to backfilling in native soil.

5. Earth backfill around each anode shall be thoroughly compacted to a point 1 foot above the anode. Backfill material around each anode shall be native soil free of roots, organic matter, trash, and rocks. Stop backfill at specified grade for pipe trench to allow for placing of the select backfill for the pipe bedding.

6. All anode wires shall be buried a minimum of 36 inches below finish grade. Wires shall be handled with care. Splices or damage to the insulation on any wire shall be repaired in accordance with WIRE INSULATION REPAIR, this section.

B. Install 1 or 2 anodes per test station (see drawings) and one every 54' between test stations.

3.4 Galvanic Ribbon Anode Installation

A. The location of the ribbon anodes shall be shall be ½ the distance between the new main and the isolation mat as shown on the Drawings.

B. Attachment of the lead wires to the ribbon anodes shall be made by removing the magnesium from iron core and installing a crimp connector around the wire and anode core as shown on the Drawings. The attachment shall be made by the anode manufacturer or supplier. The connection shall be electrically insulated by spirally wrapping (minimum 50 percent overlap) with three layers of high voltage rubber splicing tape and three layers of vinyl electrical tape as shown on the Drawings.

C. Connection of the ribbon anode to the pipe shall be made using the exothermite weld type connection as shown on the Drawings. 3.5 Test Station Installation

3.5 Test Station Installation

A. The general locations of the test stations are shown on the Drawings. The CONTRACTOR shall determine the location of the test stations based on actual site conditions and as approved by the ENGINEER.

B. Test stations shall be located as shown on the drawings:

1. TS/IJ-1 – at all insulated joints, except service insulators
2. TS/IJ-2 – at reservoir connection insulator

C. Test wires shall be attached to the pipe as specified under WIRE CONNECTIONS, this section.

D. Locate all test stations behind curb and accessible areas.

E. The pipe, anode, monitoring coupons, and reference electrode wires shall be buried a minimum of 36 inches below finished grade.

F. Wire connections to test station terminals shall be with crimp-on spade lug terminals.

G. Shunts and buss bars to be connected to the terminals as shown in the Test Station Wiring Detail.

3.6 Wire Connections

A. Thermite Weld:

1. The electrical connections of copper wire to steel, ductile, and cast iron surfaces shall be by the thermite weld method. Observe proper safety precautions, welding procedures, thermite weld material selection, and surface preparation as recommended by the welder manufacturer. Assure that the pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the integrity of the fitting wall or protective lining.

2. Before the connection is made, the surface shall be cleaned to bare metal by filing or grinding the surface to produce a bright metal finish. All grinding shall be with a vitrified type-grinding wheel; the use of a resin, rubber, or shellac-impregnated type grinding wheels will not be acceptable. The prepared metal surface shall be dry.

3. Wire sleeves shall be installed on the ends of the wires before welding to the metal surface. Thermite welding shall be performed in strict accordance with the manufacturer's written instructions. After the weld connection has cooled, remove slag and physically test wire connection by hitting with a hammer while pulling on the wire at a 45^{o} angel; remove and replace any defective connections.

4. Coat wire connection with a thermite weld cap. Finish coating two (2) layers of polyethylene, except on fittings use one (1) layer of geo-membrane and two (2) layers of polyethylene, before backfilling.

B. Ground Clamp:

1. The electrical connection of copper wire to copper service pipe shall be by ground clamp.

2. Surface shall be clean before installing the clamp. When tightening the clamp down to the pipe, make sure it is tight enough not to move, make a good connection and without damaging the copper pipe.

3. Wrap the anode wire around the pipe 3 to 4 times than install the anode wire and tight down the screw so the wire cannot come out. After the connection is made, pull on the wire tightly, to make sure it cannot come out.

4. Coat the pipe and wire connection with corrosion protection tape in a cigarette still wrap, so there is double layer, before backfilling.

3.7 Polyethylene Encasement – Metallic Structures in Connection With PVC Pipe

A. Before installing the polyethylene, make sure the metallic structure is clean of native soil, dirt etc. Then install polyethylene, tube type, on the ductile iron pipe and appurtenance, in accordance with AWWA C105, Method A, two (2) layers of polyethylene tube for each length of pipe. The use of polyethylene sheets will not be allowed.

B. Install 30 mil geo-membrane around mechanical joints, appurtenances, and similar connections where polyethylene can be punctured or ripped. Tape the ends and seams of the geo-membrane with polyethylene tape and then cover the pipe joint with the adjoining (2) layers of polyethylene encasement.

3.8 Isolation Mat

A. Install 30 mil geo-membrane isolation mat between the new ductile iron main and the foreign pipeline crossing. The isolation mat shall be the trench with and run a distance of 10-feet to each side of the foreign line. The isolation mat shall not have any tears or holes in it.

B. If there is less than 1-foot between the pipelines, also include a galvanic ribbon anode between the pipeline and isolation mat.

3.9 Surface Restoration

A. Surface restoration shall be as approved by ENGINEER.

3.10 Field Testing

A. Test Equipment: Before construction begins, obtain the test equipment necessary for testing:

1. Model RF_IT radio frequency insulator tester, as manufactured by Tinker and Rasor, or equial

2. A Fluke Model 77 IV, Amprobe AM-510 multi-meter, or equal

3. Two Model 6B Copper-Copper Sulfate reference electrodes, as manufactured by Tinker and Rasor, or equal

4. 1 quart of copper sulfate anti-freeze solution

5. ½-pound of copper sulfate crystals.

B. Store test equipment at the Project site and maintain in accurately calibrated, working condition. The test equipment shall be available to the ENGINEER

for testing purposes. Upon completion of the Project, the test equipment listed above shall be turned over to the OWNER in clean, accurate, and fully functional condition, along with operation manuals, test wires, and cases supplied with the equipment.

C. Insulated Joint Testing – Prior to backfilling:

1. Test each joint after assembly with the insulator tester in accordance with the manufacturer's written instructions. Cathodic Protection Specialist shall monitor the test. Replace damaged or defective insulation parts. Provide the ENGINEER with 3 days' advance notice before beginning tests.

G Testing – After Backfilling (prior to pressure test):

1. The CONTRACTOR's Engineer or CP specialist shall perform test to clearly show the isolation joint is working or not working. If not working the CONTRACTOR, at his own expense, shall correct any defects. The test shall be re-performed after the repair. The Engineer or CP specialist shall tabulate all data recorded.

2. After construction is complete, the ENGINEER shall test the pipeline to ensure proper installation of the fitting bonds and test stations. Any construction defects identified during testing shall be located and corrected by the CONTRACTOR. Provide the ENGINEER with 3 days' advance notice before beginning tests. All test data shall be recorded and submitted to the ENGINEER.

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 provisions of Section 02620-2.2 of these Specifications. All ductile iron pipe fittings and specials shall conform to the provisions of Section 02620-2.3 of these Specifications.

B. Welded Steel Pipe and Fittings -- All welded steel pipe shall conform to the current provisions of AWWA C200 (Grade C, ASTM A283 steel plate). The pipe shall be heavy walled steel pipe. The wall thickness of welded steel pipe shall be 1/2-inch for 24-inch diameter and smaller unless shown otherwise on the drawings. Pipe shall be furnished to the indicated outside diameter unless shown otherwise on the drawings. Pipe shall be furnished with ends as shown on the plans or as required for the conditions of installation if not shown. Provide weldolets for taps where shown or required.

Steel fittings for pipe 24 inches in diameter and less shall be forged steel conforming to ANSI B16.9 and ASTM A234, Grade B. Mitered fittings will be permitted only where shown on the drawings. Fabricated elbows 0-30 degrees shall be two-piece, 30-60 degrees shall be three-piece, and 60-90 degrees shall be four piece unless shown otherwise on the drawings. All steel fittings shall be of schedule or wall thickness to match the pipe wall thickness. Mitered fittings shall be fabricated in accordance with the dimensions as shown in AWWA C208 if dimensions are not shown on the drawings.

Where design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-pound class. Where design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-pound class. Where design pressure is greater than 275 psi, up to a maximum of 300 psi, flanges shall conform to ANSI/AWWA C207 Class F. AWWA flanges shall not be exposed to test pressures greater than 125% of rated capacity.

Flanges for steel pipe 24 inches in diameter and less shall be welding neck or slip-on forged steel conforming to ANSI B16.5 and ASTM A181, Grade 1, flat-faced, as adjacent pipe and fittings may dictate. Slip-on flanges shall not be used adjacent to forged fittings unless the fitting is the long-tangent type.

Flanges for steel pipe larger than 24-inch diameter shall be fabricated in accordance with AWWA C207. Flanges shall be attached with bolt holes straddling the vertical axis unless otherwise shown. Gaskets for flanged pipe shall be full-faced gaskets equal to Garlock 3000 with Nitrile binder or approved equal.

Pipe shall be shop-fabricated to the extent possible. Any field welding shall conform to the current provisions of AWWA C206. Forged fittings shall be used for all line size laterals and tees unless otherwise shown on the drawings. Field welds shall be lap-welded slip joint, welded inside and outside, double-butt weld joint, or butt strap joint.

The interior of all welded steel pipes shall be given a white-metal blast cleaning conforming to SSPC-SP5 by the pipe manufacturer and given the protective coating specified hereinafter. Exterior of "wet" exposure piping shall be prepared per SSPC-SP5, white metal blast. Exterior of "dry" exposure piping shall be prepared per SSPC-SP10, near white metal blast. Exterior coating to be as described below.

Unless other linings or coatings are required elsewhere in the specifications or on the plans, steel pipe shall be lined and coated as follows (confirm per ENGINEER):

Lining	Fusion-bonded epoxy lined, AWWA C213 or liquid epoxy lined, in accordance with AWWA C210
Coating (Exposed)	Per Section 09800
Coating (Buried)	Per Section 09800

Before starting fabrication, the CONTRACTOR shall submit to the ENGINEER shop drawings for review. The shop drawings shall include a marking plan and details of standard pipe sections, special fittings, and bends. Dimensions, plate size, coating, and lining and other pertinent information shall be shown. The marking plan shall show the location of each pipe section and each special with each piece numbered or otherwise designated in sequence. All outlets and bends shall be attached on standard lengths of pipe or made up into special lengths so that, when installed, they will be located as indicated. The CONTRACTOR shall furnish the pipe fabricated and designated so that, when installed according to the marking plan, the location of all outlets and specials will correspond to the details of the construction plans. Each pipe and fitting shall be marked on the outside to indicate the class of pipe and location number on the marking plan. Calculations supporting collar, crotch plate, and other reinforcing sizes shall also be submitted. Fitting and reinforcing design shall conform to AWWA manual M11, latest edition.

C. 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 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.

D. Polyvinyl Chloride (PVC) Water Pipe and Fittings -- PVC pipe 4 inches and smaller shall be schedule 40, Type 1 Grade I normal impact PVC pipe conforming to ASTM D1785 and D2467 and shall be solvent welded.

E. 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.

F. 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. Restrained Flange Adapters for Ductile Iron Pipe -- See Section 02620-2.3.E.

C. Tapping Sleeves -- See Section 02620-2.3.F.

D. Flanged Insulating Joints

Insulating flanged joints shall conform to the following specifications:

1. Flanged joints shall be assembled, lined, and coated in shop. The joint assembly shall be delivered to the job site as a complete unit.

2. After assembly, the joint shall be tested for continuity. Electrical resistance between flanges and between each bolt and each flange shall be not less than 100,000 ohms.

3. Each complete insulating flange set shall include a full faced gasket, a full length insulating sleeve for each flange bolt, and two insulating washers and two steel washers for each bolt. Insulating sleeves and washers to be G-10 glass epoxy as manufactured by Accurate Plastics, Inc., or approved equal.

4. Gaskets shall be full face and conform to ANSI B16.21, suitable for the operating and test pressures of the pipe system. Gaskets shall be non-asbestos and non-phenolic compressed sheet packing with nitrile rubber binder. Gaskets shall be Garlock GYLON Style 3505, or equal.

5. Insulating washers shall be 3mm (1/8-inch) thick G-10 epoxy glass. Insulating washers shall fit within the bolt facing on the flange over the outside diameter of the sleeve, grind as necessary. Insulating sleeves shall extend the full width of both flanges, except where one flange hole is threaded where the sleeve shall extend through one flange and the gasket.

6. Washers shall be cadmium plated steel where buried and stainless steel where submerged. Washers shall fit within the bolt facing on the flange, grind as necessary.

7. The complete assembly shall have an ANSI/AWWA pressure rating equal to or greater than that of the flanges between which is installed.

E. Where required copper pipe to copper pipe connections shall be made with compression couplings. Couplings shall be Mueller Model 110 or approved equal.

F. 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.

G. 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.

H. 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.

I. 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.

J. 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.

K. 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.

L. Flexible Expansion Joints -- See 02620-2.3.G.

M. Insulating Union

Where required, insulating unions shall conform to the following specifications:

Insulating unions shall be galvanized malleable iron with a ground joint. Iron pipe threads shall conform to ANSI B2.1. Joint connections to copper alloy pipe and tube shall be copper solder or threaded brass ground joints. Insulations shall be nylon, which is bonded and molded onto the metal body. Union shall be rated for the operating and test pressures of the pipe system.

N. Pipe to Structure Flexible Connector

A flexible pipe to manhole connector shall be used in the connection of sanitary and drain sewer pipe to precast manholes and buildings. The connector shall be the sole element relied on to insure a flexible watertight seal of the pipe to the manhole. No adhesives or lubricants shall be employed in the installation of the connector to the manhole. The rubber for the connector shall comply with ASTM C923 and consist of EPDM and elastomers designed to be resistant to ozone, weather elements, chemicals, including acids, alkalis, animal and vegetable fats, oils and petroleum products from spills. The connector shall be Kor-N-Seal or approved equal.

All stainless steel elements of the connector shall be totally non-magnetic, Series 304 Stainless, excluding the worm screw for tightening the steel band around the pipe which shall be Series 305 Stainless. The worm screw for tightening the steel band shall be torqued by a break away torque wrench available from the precast manhole supplier and set for 60-70 inch/lbs.

The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer.

The connector shall be of a size specifically designed for the pipe material and size being utilized on the project.

Rubber seals used in concrete sewer pipe and culvert joints must meet the requirements given in ASTM specification C923.

O. Pressure Gauges

Pressure gauges shall be 3-1/2 inch diameter with stainless steel case, polycarbonate glass window, stainless steel movement, blowout disc and 1/2-inch NPT stainless steel lower connection. Gauges shall be Ashcroft Type 1009, glycerine-filled, or approved equal. Supply gauges complete with 1/2-inch Type 1095 stainless steel gauge cock and Type 11125 pressure snubber of porosity designation E.

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 cannot 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. Gaskets shall be non-asbestos and non-phenolic compressed sheet packing, best-quality full-face with nitrile rubber binder, one-sixteenth - (1/16) inch thick, conforming to ANSI B16.21 suitable for the operating and test pressures of the pipe system equal to Garlock 3000. Gaskets for 20 inches and larger flanged joints may be one-eighth -(1/8) inch thick.

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

Testing of all water and field plant piping systems shall be performed as specified elsewhere in this document.

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 warping 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 15101

GATE VALVES

PART 1 GENERAL

1.1 Description

The CONTRACTOR shall furnish and install gate valves, complete and operable, as shown and specified herein, including coatings and linings, appurtenances, operators, and accessories, in accordance with the requirements of the Contract Documents.

1.2 Submittals

As required by Section 15100.

PART 2 PRODUCTS

2.1 General

Gate valves shall be furnished and installed as shown and as specified herein.

2.2 Materials and Manufacturers

A. Gate Valves, 2 Inches and Under

Unless specified or shown otherwise on the drawings, gate valves two inches and under shall be Class 125 with bronze bodies and bonnets, non-rising stems, solid bronze discs and threaded ends. Valves shall be Figure B-103 as manufactured by Stockham, Model T-113 as manufactured by Nibco, Model 105 as manufactured by Milwaukee Valve, or approved equal.

B. Gate Valves, 3 Inches to 10 Inches

Gate valves for buried service shall be the resilient-seat type, with an iron body, non-rising stem, bolted bonnet, left opening and shall conform to AWWA Standard C509 or C515. Valves shall be lined and coated with a corrosion-resistant fusion bonded epoxy conforming to AWWA C550 and NSF 61. Valve ends shall be as shown on the plans. The CONTRACTOR, as specified elsewhere, shall furnish a valve box and cover, with all buried service valves installed. Gate valve stem extensions shall be furnished and installed on deep buried valves as specified in Section 15100.

Tapping valves shall comply with the above specifications and shall have an alignment ring dimension of the tapping flange that conforms to MSS SP 60 to ensure true alignment of the valve with the tapping sleeve. The outlet end of the valve shall be as indicated on the plans. Tapping valves shall include a minimum 3/8-inch diameter NPT pipe plug on the bonnet of the valve body to aid in field testing of the valve.

Acceptable gate valve manufacturers are as follows:

1. Clow Valve Company
2. M&H Valve
3. U.S. Pipe & Foundry Company
4. American AVK
5. American Flow Control
6. Mueller
7. Waterous
8. Or approved equal.

C. Fire Hydrant Valves

Fire hydrant valve shall be Mueller Resilient Wedge gate valve A-2360-16 without exception.

D. In-Plant Service

Gate valves for in-plant or exposed service shall meet the above specifications and shall be furnished with handwheel operators.

PART 3 EXECUTION

3.1 General

Valve installation shall be in accordance with Section 15100 and the manufacturer's requirements.

END OF SECTION

SECTION 15102

BUTTERFLY VALVES

PART 1 GENERAL

1.1 Description

The CONTRACTOR shall furnish and install butterfly valves, complete, as shown and specified herein, including coatings and linings, appurtenances, operators, and accessories, in accordance with the requirements of the Contract Documents.

1.2 Submittals

As required by Section 15100 and Section 01300.

PART 2 PRODUCTS

2.1 General

A. Butterfly valves furnished under this section shall be of the rubber seated, tight-closing type. Metal to metal seating surfaces shall not be used. Butterfly valves shall be bubble-tight at the rated pressure with flow in either direction, and shall be satisfactory for operation following long periods of inactivity. Valve discs shall rotate a full 90 degrees from the open position to closed position. Class 150 valves shall meet the full requirements of AWWA Standard C504 for Class 150B. Class 250 valves shall conform to the requirements of AWWA Standard C504 subject to the requirements herein.

B. Valve shafts shall consist of the one-piece type or "stub-shaft" type. "Stub-shaft" type valve shafts shall be inserted a minimum of one and one-half (1-1/2) shaft diameters into the valve disk hub. Valve shafts shall have a minimum diameter extending through the valve bearings and into the valve disc, as specified in AWWA Standard C504. Valve shafts shall be full size for that portion of the shaft extending through the valve bearings, valve disc and shaft seal. Any portion of the shaft turned down for any reason shall have fillets with radii equal to the offset to minimize stress concentrations at the junction of the different shaft diameters. The turned down portion of the shaft shall be capable of transmitting the maximum operator torque without exceeding a torsional steel stress of 11,500 pounds per square inch (psi). Valve shafts shall be constructed of wrought stainless steel, model or carbon-steel, with stainless steel journals. When carbon-steel shafts and stainless steel

journals are used, static seals shall be provided to isolate the interior of the disc and the shaft from water.

C. Valve discs shall be of cast design with no external ribs transverse to the flow. The design shall be such to sustain full differential pressure across the closed valve disc without exceeding a working stress to one fifth of the tensile strength of the disc material. Valve discs shall be constructed from cast iron, alloy cast iron or ductile iron.

D. Rubber seats applied to either the body or the disc, shall be constructed from new, natural or synthetic rubber, secured to the valve body or disc, and designed to provide tight shut-off and facilitate removal and replacement at the site. Rubber seats shall mate with the following acceptable surfaces: stainless steel, monel, bronze Grade A, D or E, or alloy cast iron. Rubber seats that are applied to the valve body and are penetrated by the valve shaft shall be adequately reinforced and clamped, mechanically secured, bonded or vulcanized to the valve body to prevent the seat from being inflated by pressure behind the valve seat. Rubber seats shall be resistant to microbiological attack, copper poisoning and ozone attack. All clamps and retaining rings for rubber seats shall be corrosion resistant.

E. Valve bearings shall be of the sleeve type contained in the hubs of the valve body. Sleeve bearings fitted into the valve body shall be of self-lubricating materials approved for use with potable water.

F. Valve shaft seals shall be designed for the use of standard split-v type packing, standard "O" ring seals or for pull down packing. "O" rings used for shaft seals shall be contained in a removable corrosion-resistant recess. Shaft seals shall be designed to allow seal replacement without removal of the valve shaft.

G. Valve operators for in-plant valves shall conform to AWWA C504 and be of the manual type with handwheel operator unless specified otherwise below. Manual operators shall have all gearing totally enclosed and designed to produce the specified torque with a maximum pull of 60 pounds on the handwheel or chainwheel. Stop-limiting devices shall be provided in the operators for the open and closed positions. All operator components between the input and these stops shall be designed to withstand, without damage, a pull of 200 pounds for handwheel or chainwheel operators. All valves shall be equipped with adjustable mechanical stop limiting devices to prevent over-travel of the valve disc in the open and closed positions.

H. Manual operators for buried service valves and valves in below grade vaults shall be of the traveling nut, self- locking type and shall be designed to hold the valve in any intermediate position between full open and fully closed without creeping or fluttering. For buried services, operators shall be

equipped with a 2-inch square-operating nut (left opening) and shall be fully gasketed and grease-packed. For valves in below grade vaults, operators shall be equipped with a handwheel and shall be fully gasketed and grease-packed. A valve position indicator, if specified or shown, shall be furnished for all valves for installation in a valve box. The valve indicator shall be hermetically sealed for installation inside a cast iron valve box, and shall show valve-disc position, direction of rotation and number of turns from full open to full close. The valve manufacturer shall provide the indicator.

I. Hydraulic Cylinder Actuators -- Cylinder actuators shall move the valve to any position from full open to fully closed when a maximum of 125 psi or a minimum of 60 psi is applied to the cylinder. All wetted parts of the cylinder shall be corrosion resistant and cylinder rods shall be chromium-plated stainless steel. Cylinders furnished with enclosed operating mechanisms shall have all wetted parts constructed of non-metallic materials except the cylinder rod which shall be chromium-plated stainless steel. Rod seats shall be of the non-adjustable wear-compensating type. A rod wiper for removing deposits inside the cylinder shall be provided in addition to the external dirt wiper. Cylinder actuators of this type shall be Pratt MDT with Dura-Cyl cylinder. Cylinder actuator shall come pre-piped with speed controls, bleed cocks and solenoid valves required to open and close the valve. Actuator shall be supplied with a limit switch assembly for remote indication of open or closed valve position.

J. All surfaces of the valve shall be clean, dry and free from grease before painting. For in-plant service, the valve surfaces except for disc, seating and finished portions shall be evenly coated with a primer compatible with paint systems specified elsewhere. For buried service valves and valves in below grade vaults, the interior and exterior valve surfaces shall be epoxy coated in accordance with AWWA Standard C550.

K. Acceptable Butterfly Valve manufacturers are as follows:

1. Mueller
2. Or approved equal

2.2 Class 150 Butterfly Valves

A. Valve bodies shall be constructed of cast iron conforming to ASTM A-126 Class B (with integrally cast flanged or mechanical joint ends). Flange drilling shall be in accordance with ANSI/B16.1 standard for cast iron flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be in strict accordance with AWWA C504.

B. Valve shafts shall be turned, ground and polished. Valve shafts shall be constructed of 18-8 Type 304 or Type 316 stainless steel. Shaft diameters must meet minimum requirements established by AWWA C504 for Class 150B.

2.3 Class 250 Butterfly Valves

A. Valve bodies shall be constructed of cast iron conforming to ASTM A-126 Class B (with integrally cast flanged or mechanical joint ends). Unless otherwise shown, Class 250 butterfly valve flanges shall have the same drilling as ANSI B16.1, Class 125 cast iron flanges and mechanical joint ends shall conform to ANSI 21.11. Two trunnions for shaft bearings shall be integral with each valve body.

B. Valve shafts shall be turned, ground and polished. Valve shafts shall be constructed of stainless steel, ASTM A-564, Type 630 or 18-18 Type 304.

PART 3 EXECUTION

3.1 General

Valve installation shall be in accordance with Section 15100 and manufacturer's requirements.

3.2 Testing

All valves 24-inches in diameter or larger, and all in-line transmission main valves, shall be pressure and leakage tested at the project site and shall pass the field testing prior to installation. Valves shall be tested at 1.5 times normal operating pressure, 150 psi minimum. No valve shall be accepted for installation that fails to pass the field pressure test. Any valves failing field pressure tests shall be replaced by CONTRACTOR at no additional cost to OWNER.

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. Swing check valves (1-inch through 4 inches) -- Swing check valves 4 inches and under 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.

2. Swing check valves (4-inch through 24 inches) -- Swing check valves shall be full waterway, rubber or metal seated, with end conditions as shown on the drawings. Swing check valves shall conform to all applicable provisions of AWWA C508. Swing check valves shall close tightly when the pressure downstream of the valve disc exceeds the upstream pressure.

3. Swing check valves shall be constructed of heavy cast iron conforming to ASTM A126 Class B; malleable iron castings conforming to ASTM A47 Grade 32510 or ASTM 197; ductile iron conforming to ASTM A395 or A536; or steel conforming to ASTM A108 or A307 Grade B. Swing check valves shall have metal on synthetic 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.

4. Swing check valve discs shall be constructed of cast iron or cast steel and shall be suspended from a non-corrosive hinge pin shaft constructed of stainless steel passing through a stuffing box. Swing check valves shall be furnished with NSF approved epoxy lining and coating conforming to AWWA C210.

5. Swing check valves 4-inch and larger shall be equipped with a lever and weight arm. Install lever arm on the side of the valve as shown on the Drawings.

B. Silent Check Valves

1. The silent check valve shall be ANSI Class 250 and globe-style. The valves shall be of the silent operating type that begins to close as the forward flow velocity diminishes and be fully closed at zero velocity preventing flow reversal and resultant water hammer or shock.

2. The valve design shall incorporate a center guided, spring loaded poppet, guided at opposite ends and having a short linear stroke that generates a flow area equal to the pipe. Valve interior shall be contoured and unrestricted to achieve maximum flow capacity along with minimum pressure drop.

3. The operation of the valve shall not be affected by the position of installation. It shall be capable of operating in the horizontal or vertical position with the flow op or down.

4. All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by the valve's spring. The spring shall be designed to withstand 100,000 cycle without failure and exert a force which allows the valve to start opening at a differential pressure of .5 PSI (.04 KG/CM^2) and to fully open at a flow velocity of 4 FPS (1.22 meters per second).

5. The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength and minimal flow velocity to fully open the valve.

6. The valve disc and seat shall be field replaceable and have a seating surface finish of 32 micro-inch or better to insure positive seating at all pressures. The leakage rate shall not exceed one-half the allowable rate allowed by the AWWA C508, or .4 oz. (15 milliliters) per hour per inch (millimeter) of valve size.

7. A Buna-N seal shall be furnished to provide zero leakage. The seal design shall provide for both a metal to metal seal and a metal to Buna-N seal to achieve resilient sealing at both low and high pressures without over loading or damaging the Buna-N seal.

8. Ends shall be flanged and have a working pressure of 250 psi.

9. Valve shall be hydrostatically tested at 1.5 times the rated working pressure. Testing per AWWA, ANSI, MSS or API standards conducted when specified.

C. Manufacturers

1. Swing Check Valves (Reservoir Valve Vault)

Swing check valves 4 inches and larger shall be Series 7800LW as manufactured by Val-Matic, or approved equal. Check valves 4 inches and under shall be red-white Toyo, or approved equal.

2. Silent Check Valves (Pump Station)

Silent check valves shall be Val-Matic 1800 series, or approved equal.

D. Coatings

Furnish swing and silent check valves with liquid epoxy lining and coating conforming to AWWA C550.

PART 3 EXECUTION

3.1 General

Valve installation shall be in accordance with Section 15100 and manufacturer's requirements.

3.2 Services Provided by Manufacturer's Representatives

The CONTRACTOR shall provide the services of the check valve manufacturer's representative to verify proper installation of the valves and to adjust the valves when construction is complete.

END OF SECTION

SECTION 15107

MISCELLANEOUS VALVES

PART 1 GENERAL

1.1 Description

A. The CONTRACTOR shall furnish and install miscellaneous valves complete, as shown on the drawings and/or specified herein, including coating and lining, appurtenances, operators, and accessories.

B. Miscellaneous valves include non-freeze wall hydrant, combination air and vacuum valves, strainers, small swing check valves.

1.2 Submittals

As required by Section 15100 and Section 01300.

PART 2 PRODUCTS

2.1 Materials and Manufacturers

A. Bronze Swing Check Valves

Bronze swing check valves shall be brass bodied threaded cap with end conditions as shown or required for the application. Bronze swing check valves shall be pressure class 150, "Y" pattern as manufactured by Stockham valves and fittings, or approved equal.

B. Pressure Type Air Release Valves (Pump Station)

Pressure type air release valves shall be float operated and shall incorporate a simple level mechanism to enable the valve to automatically release accumulated air from a fluid system while that system is pressurized and operating.

Air release valves shall close drop-tight, incorporating an easily renewable Viton seat, suitable for hot or cold water service. All internal metal parts shall be of stainless steel. The float shall be stainless steel, and be capable of withstanding a test pressure of 750 PSIG. The linkage/level mechanism shall be designed to prevent jamming.

The body and cover shall be of cast iron conforming to ASTM A126 Class B. Air release valves shall be designed to withstand a 450 PSIG test pressure.

Air release valves shall be as manufactured by GA Industries, Inc., Mars, PA, Figure #905 "Minimatic", Val-Matic Model 201C.2, or approved equal.

C. Combination Air/Vacuum Valves

The air/vacuum valve shall be two (2) independent valves, an air/vacuum valve and an air release valve, combined in a dual housing designed to withstand 300 psi. The valve shall be designed to exhaust large volumes of air when filling the pipeline, to release small quantities of air during operation, and to admit large volumes of air upon impending vacuum during draining.

Body and cover materials shall be cast iron ASTM A126, Class B. Orifice floats and orifices shall be ASTM A240 stainless steel and designed to withstand 1,000 psi. Valve seats shall be Buna-N. Combination air/vacuum valves shall be as manufactured by APCO Series 1700, or approved equal.

D. Strainers (Metal Body)

1. Equipment Requirements -- Strainers shall be of the Y-pattern or basket type, with flush connections, bronze bodies and screwed ends for sizes 3-inch and smaller, and cast iron and flanged ends for sizes greater than 3-inch. They shall be designed for not less than 250 psi working pressure in sizes 3-inch and smaller, and 125 psi working pressure in sizes over 3-inch. Strainers shall be of the same size as the entering pipe and the screens shall have a free area of not less than three times the cross-sectional area of the pipe.

2. Screens -- Unless otherwise indicated or required by the service fluid, the screen shall be of type 316 stainless steel or monel construction, easily removable, with the following mesh or perforations:

Strainer Size	Size of Perforations
1/4 - through 2-inch	20 mesh
2 1/2 through 5-inch	20 mesh
6 through 8-inch	1/8-inch diameter
over 8-inch	3/16-inch diameter

3. Strainers shall be manufactured by the following or equal.

Spriax-Sarco, Type BT and IF-125

E. Cast Iron Flap Valves

Flap valves shall be of ASTM A-126 cast iron construction with a bronze seat and bronze hinge pin. The valve shall be provided with a spigot, flanged or hub body as shown on the drawings. Flanged flap valves shall have 125 pound flanged ends unless otherwise noted on the drawings. The valve shall have two pivot points. Valves 16-inches and larger shall have the hinge pin secured with nuts. Valves 14-inches and smaller shall have the hinge pin secured with cotter pins. Flap valves shall be Troy Valve model A2540 or approved equal.

F. Shear Gates

Shear gate valves shall be ASTM A-126 cast iron frame with a bronze to bronze seat, bronze latch, and bronze hinge pin. Valve shall be provided with a double wedge and latch. The wedges are to be cast iron with bronze facing. Wedges shall be field replaceable. The valve shall be equipped with a pull rod made of galvanized steel that is long enough to facilitate valve operation without entering manhole. Pull rods shall be equipped with an adjustable cast iron hook for positioning the valve. Flanged shear gates shall have 125 lb flanged ends unless otherwise noted on the drawings. Shear gates shall be M & H style 44 or approved equal.

G. Ball Valves, 2 Inches and Under

Ball valves 2 inches and under shall be 400 lb. WOG with bronze body and trim, unless otherwise shown on the Drawings, TFE seat ring, and fluorocarbon O-ring seals. The valve shall be of three-piece construction so that maintenance can be performed without distributing the valve body after installation. Valves shall be Nibco T-590-Y or equal.

H. TF500 Blow-off Assemblies

The TF500 blow-off assemblies, or hydrants, shall be the depth as show on the Drawings with 2-inch diameter vertical FIP threaded inlet and 2-inch diameter NPT nozzle outlet. Hydrant shall be non-freezing and self-draining. Hydrant shall be operated by turning a top mounted square operating nut. CONTRACTOR shall provide OWNER with TF500 operating wrench. Hydrant must seal the drain outlet in all positions from ¼ open to fully open. Hydrant shall be 100% low-lead brass construction. All working parts shall be serviceable from above with no digging required. All wear parts (O-rings and valve seats) shall be of commonly-available dimensions and materials. Hydrant shall be the Truflo Model TF500 as manufactured by the Kupferle Foundry Co., or equal.

PART 3 EXECUTION

3.1 General

A. Valve installation shall be in accordance with Section 15100 and manufacturer's requirements.

B. Unless otherwise indicated, strainers shall be provided ahead of any control valves, regulators, and where shown, and shall be preceded by shut-off valves.

END OF SECTION

SECTION 15108

HYDRANTS

PART 1 GENERAL

1.1 Description

The CONTRACTOR shall furnish and install fire hydrants and filling hydrants, complete and operable, as shown and specified herein, including coatings and linings, appurtenances, operators, and accessories, in accordance with the requirements of the Contract Documents.

1.2 Submittals

As required by Section 15100

PART 2 PRODUCTS

2.1 General

Fire hydrants shall be furnished and installed as shown in the City of West Linn Drawing No. WL-401, per City Standards, and as specified herein. All hydrants of like kind shall be provided from a single manufacturer for this project.

2.2 Fire Hydrant Materials

A. Fire hydrants shall meet or exceed the requirements of AWWA Standard C502 and shall be equipped with a nominal 5 ¼ - inch valve opening, two 2-½ -inch hose nozzles and one 4-½ - inch pumper nozzle with 1-½ -inch pentagon operating nuts opening counter clockwise and a safety flange.

B. Hydrants shall be painted Miller OE 40 (Safety Yellow) with manufacturer's standard finish coat.

C. Acceptable fire hydrant manufacturers and models, without exception, are as follows:

1. Mueller, Centurion A-423
2. Clow, Medallion F-2545

D. The hydrant shall be arranged for a 3-1/2 foot bury unless otherwise specified.

E. Refer to Section 15101, Gate Valves, for hydrant valves.

2.3 Filling Station Hydrant

A. Hydrants for the filling station shall meet or exceed the requirements of AWWA Standard C502 and shall be equipped with a nominal 2-1/2" hose nozzle.

B. Hydrants shall be painted Miller OE 40 (Safety Yellow) with manufacturer's standard finish coat.

C. Acceptable filling station hydrant manufacturers and models, without exception, are as follows:

1. Mueller, 2-1/8" Post Type, A-411

PART 3 EXECUTION

3.1 General

Hydrant assembly installation shall be in accordance with Section 15100, manufacturer's requirements, City Standard Drawings and as shown on the Drawings.

END OF SECTION

SECTION 15111

PRESSURE REDUCING VALVES

PART 1 GENERAL

1.1 Description

The CONTRACTOR shall furnish and install pressure reducing valves complete, as shown on the drawings and/or specified herein, including coating and lining, appurtenances, operators, and accessories.

1.2 Submittals

As required by Section 15100

PART 2 PRODUCTS

2.1 Pressure Reducing Valve

A. Construction -- Valve shall be single seated, globe style, hydraulically operated and diaphragm actuated. Diaphragm assembly shall be guided top and bottom by a precision-machined stem. Resilient valve disc, retained on three sides by disc retainers, shall form a drip-tight seal with a renewable seat when pressure is applied above the diaphragm. Control of valve operation shall be by means of an externally mounted, hydraulic pilot system.

Main valve body and cover shall be ASTM A48 cast iron or ASTM A536 ductile iron, with flanged ends. Main valve trim shall be bronze. Pilot control components shall be ASTM B61 bronze or ASTM B283 brass with Type 303 stainless steel trim, and pilot tubing shall be copper. Rubber parts shall be BUNA N synthetic rubber.

B. Protective Coating -- Valve body and cover shall be lined and coated with an FDA approved fusion bonded epoxy coating system suitable for use with cast iron or ductile iron. The epoxy coating thickness and application shall be in accordance with AWWA C550.

C. Operating Conditions -- Inlet pressures to the valve may vary from 110 to 120 psig. Valve shall be capable of maintaining downstream pressure over a range of 20 to 85 psig. Initial setting shall be approximately 65 psig for the 1.5-inch valve and 60-psig for the 6-inch valve. Flow through the valve shall be one-way.

D. Operating Requirements -- Pressure Reducing Control: A pressure reducing control, located in the pilot system, shall sense the main valve outlet pressure, and shall cause the main valve to modulate (open and close) as required to maintain a constant pressure at the main valve outlet at all times. Adjusting the spring force in the pressure reducing control shall set the desired constant pressure. The valve shall have a check feature to positively prevent return flow when pressure reverses.

E. Accessories -- The following accessories shall be furnished with the valve:

1. Self-cleaning strainer for pilot system
2. Pilot system isolation valves on inlet, outlet, and cover lines
3. Opening speed control
4. Closing speed control
5. Check control
6. Visual valve position indicator

F. Pressure Rating -- Valve shall be suitable for a working water pressure of 200 psig.

G. Manufacturer -- Valve shall be Model 90-01 as manufactured by Cla-Val Co., Newport Beach, CA, without exception.

PART 3 EXECUTION

3.1 General

Valve installation shall be in accordance with Section 15100 and manufacturer's requirements.

3.2 Services Provided by Manufacturer's Representatives

The CONTRACTOR shall provide the services of the valve manufacturer's representative to verify proper installation of the valves and to adjust the valves when construction is complete. The manufacturer’s representative shall be GC Systems, Sumner, WA, (206) 882-2198.

3.3 Start-up and Testing

The CONTRACTOR shall coordinate the valve manufacturer’s representative and OWNER’s staff for operational testing. The OWNER will provide labor and equipment for fire hydrant flow testing near the PRV vault for the purpose of confirming the valve operation and settings. The OWNER will operate all fire hydrants and valves.

END OF SECTION

SECTION 15113

SURGE ANTICIPATOR VALVES

PART 1 GENERAL

1.1 Description

The CONTRACTOR shall furnish and install surge anticipator valve complete, as shown on the drawings and/or specified herein, including lining, appurtenances, operators, and accessories.

1.2 Submittals

As required by Section 15100

PART 2 PRODUCTS

2.1 Surge Anticipator Valve (3-inch and larger)

A. Construction -- Valve shall be single seated, globe or angle style as shown, hydraulically operated and diaphragm actuated. Diaphragm assembly shall be guided top and bottom by a precision machined stem. Resilient valve disc, retained on three sides by disc retainers, shall form a drip-tight seal with a renewable seat when pressure is applied above the diaphragm. Control of valve operation shall be by means of an externally mounted, hydraulic pilot system.

Main valve body and cover shall be ASTM A48 cast iron or ASTM A536 ductile iron, with flanged ends. Main valve trim shall be bronze. Pilot control components shall be ASTM B61 bronze or ASTM B283 brass with Type 303 stainless steel trim, and pilot tubing shall be copper. Rubber parts shall be BUNA N synthetic rubber.

B. Protective Coating -- Valve body and cover shall be lined and coated with an FDA approved fusion bonded epoxy coating system suitable for use with cast iron or ductile iron. The epoxy coating thickness and application shall be in accordance with AWWA C550.

C. Pressure Rating -- Valve shall be suitable for a working water pressure of 250 psig.

D. Operating Conditions -- Valve shall function properly with water supply to the pilot system of 75 to 200 psig pressure head.

E. Operating Requirements

Surge Anticipation and Pressure Relief -- The pilot system shall sense a low pressure (down surge) in the pump station discharge pipeline due to power failure. The pilot system will begin to open the valve in anticipation of a return high pressure wave. The low pressure pilot shall allow the valve to open to a preset amount as controlled by a hydraulic limiter. The high pressure pilot shall be set to open at any pressure above the normal operating pressure.

F. Accessories -- The following accessories shall be furnished with the valve.

1. Y strainer for pilot system
2. Pilot system isolation valves on inlet, outlet, and cover lines
3. Closing speed control
4. Limit switch on position indicator

G. Manufacturer -- Valve shall be model 52G-03BKC Surge Anticipator Valve, ductile iron body with bronze trim, 150 flange ends, with X105LCW micro switch installed, 15-75 spring range on CRA and 20-200 spring range on CRL, epoxy coated in and out as manufactured by Cla-Val Co., Newport Beach, CA, without exception.

PART 3 EXECUTION

3.1 General

Valve installation shall be in accordance with Section 15100 and manufacturer's requirements.

3.2 Services Provided by Manufacturer's Representatives

The CONTRACTOR shall provide the services of the valve manufacturer's representative to verify proper installation of the valves and to adjust the valves when construction is complete.

END OF SECTION

SECTION 15116

PUMP CONTROL VALVES

PART 1 GENERAL

1.1 Description

A. The CONTRACTOR shall furnish and install pump control valves complete for the new pump discharge piping as shown on the drawings and/or specified herein, including lining, appurtenances, operators, and accessories.

1.2 Submittals

As required by Section 15100.

PART 2 PRODUCTS

2.1 General

A. Construction -- Valve shall be single seated, globe style, hydraulically operated and diaphragm actuated. Diaphragm assembly shall be guided top and bottom by a precision machined stem. Resilient valve disc, retained on three sides by disc retainers, shall form a drip-tight seal with a renewable seat when pressure is applied above the diaphragm. Control of valve operation shall be by means of an externally mounted, hydraulic pilot system.

Main valve body and cover shall be ASTM A48 cast iron or ASTM A536 ductile iron, with flanged ends. Main valve trim shall be bronze. Pilot control components shall be ASTM B61 bronze or ASTM B283 brass with Type 303 stainless steel trim, and pilot tubing shall be copper. Rubber parts shall be BUNA N synthetic rubber.

B. Protective Coating -- Valve body and cover shall be lined and coated with an FDA approved fusion bonded epoxy coating system suitable for use with cast iron or ductile iron. The epoxy coating thickness and application shall be in accordance with AWWA C550.

C. Pump Control Operating Requirements --The pump control valves shall operate as follows:

1. On pump start-up, a solenoid control valve shall be energized and the main valve will open. On the pump shut-off signal, the solenoid control valve is de-energized, and the main valve slowly closes. A limit switch shall signal the pump to shut-off after the main valve closes. Opening and closing speed of the main valve shall be adjustable.

D. Accessories -- The following accessories shall be furnished with the valve.

1. Self-cleaning strainer for pilot system
2. Pilot system isolation valves on inlet, outlet, and cover lines
3. Opening speed control
4. Closing speed control
5. Solenoid control valve
6. Pilot three way control valve
7. Pilot check valves
8. Limit switch

E. Pressure Rating -- Valve shall be suitable for a working water pressure of 250 psig.

F. Manufacturer -- Valve shall be Model No. 60-11 using Model No. 100-02 Powertrol Valve, globe style, for the valve body as manufactured by Cla-Val Co., Newport Beach, CA, without exception.

PART 3 EXECUTION

3.1 General

Valve installation shall be in accordance with Section 15100 and manufacturer's requirements.

3.2 Services Provided by Manufacturer's Representatives

The CONTRACTOR shall provide the services of the valve manufacturer's representative to verify proper installation of the valves and to adjust the valves when construction is complete.

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, MCC's, package systems, panelboards, 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 16450 - Grounding

C. Section 16500 – Lighting

D. Section 16900 – Motors & Controls

E. Section 17000 – Instrumentation & Control

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 field verify all dimensions of equipment to be installed or provided by others so that correct clearances and connections may be made between the work installed by the Contractor and equipment installed or provided by others.

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 time.

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.

3.6 Guarantee

A. Materials, equipment, and workmanship shall be guaranteed in accordance with provisions of Section 01000 GENERAL REQUIREMENTS, in these Contract Documents.

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 16450 - Grounding

C. Section 16500 – Lighting

D. Section 16900 – Motors & Controls

E. Section 17000 – Instrumentation & Control

1.3 General

A. See CONDITIONS OF THE CONTRACT and Division 1, GENERAL REQUIREMENTS, and Section 16010, GENERAL ELECTRICAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are necessary for this project.

1.4 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 Washington.

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.

1.5 Submittals After Award of Contract

A. Submittals after award of Contract shall be made in accordance with Section 16010, GENERAL ELECTRICAL REQUIREMENTS.

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.

C. PVC Coated Rigid Galvanized Steel (PVC-RGS): Provide rigid polyvinyl chloride (PVC) coated conduit. Rigid conduit used in the coating process shall be hot dipped galvanized inside and out in accordance with 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 encased, direct burial underground, and exposed use. 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 Underground Electrical Manholes and Handholes

A. Provide precast concrete manhole and handhole units of the size and configuration indicated. Concrete in the precast unit shall develop a minimum compressive strength of 4,500 psi in 28 days. Cover units and frames shall be the type as specified as to size, appearance, and mechanical strength. Covers shall seat properly to prevent rocking. Provide racks for all cables. Provide pulling irons. Manholes and handholes shall be Utility Vault Company with hinged and spring locked steel cover, similar by Brooks Products, or equal.

B. Provide extension sections as required to accommodate duct bank burials and to bring cover flush with finished grade.

2.5 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. Single-pole: 4802-GRY/20AC1GRY
2. 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

2.6 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.

2.7 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.

I. Variable Frequency Drive Cable: Provide cable comprised of 3 copper phase conductors with 3 copper ground conductors for symmetrical grounding. The cable shall have duel copper shielding with XLPE rated insulation. Cable

assembly shall be UL 1227 600V and UL 2277 1000V listed for 90^{O}C wet/dry locations.

2.8 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. Install medium-voltage cable as indicated, according to manufacturer's written instructions and IEEE 576.

2. 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.

3. 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.

4. Install terminations at ends of conductors with standard kits. Conform to manufacturer's written instructions. Comply with classes of terminations indicated.

3.3 Manholes and Handholes

A. Inspect actual field conditions at the proposed location for each manhole and handhole and verify that it is free from interference with other utilities and free of flooding due to the characteristic flow of surface water. Make minor relocations as required to clear obstructions and minimize flooding. Set all manholes and handholes on a 24-inch deep rock bed. Provide a gasket and grout between all extension sections to seal manholes watertight.

B. Conduits generally shall enter the handhole or manhole at approximate right angles to the wall and as near as possible to one end of the wall, unless otherwise indicated. Grout around all conduits and duct banks entering the manhole or handhole.

C. Install 10' long ¾" diameter copper clad ground rod in each handhole. Bond all handhole metal parts with minimum 6 AWG copper ground conductor.

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 16500, Lighting.

D. Section 16900, Motors & Controls.

E. Section 17000, Instrumentation & Controls

1.2 System Description

A. Provide grounding and bonding of electrical service, 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.

1.5 Sequencing and Scheduling

A. Building Ground Electrode: Coordinate placement of ground rods and grounding electrode conductor in base of building footing prior to placement of concrete. Coordinate bonding of rebar with rebar installer prior to rough-in.

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. Concrete Encased Ground Electrode:

1. From the service equipment ground bus install grounding electrode conductor to footing foundation rebar.

2. Bond the grounding electrode conductor to three independent steel rebars. Each rebars minimum length is 20-feet.

3. Protect grounding electrode conductor extension from footing/foundation to service equipment with rigid PVC conduit. Do not use metal conduit for grounding electrode conductor protection.

B. Water Service Grounding: Bond building ground electrode and water service pipe to service ground bus. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.

C. 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.

D. 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.

E. 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.

F. Motors, Equipment and Appliances: Install code size equipment grounding conductor from outlet box to (motor) equipment frame or manufacturer's designated ground terminal.

G. 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.

H. Telecommunications Backboard: provide telecommunications grounding bar at each telecommunications backboard. Bond the grounding bar to service grounding bar in the main service equipment with a 6AWG copper equipment grounding conductor.

I. 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 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 Fluorescent 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.

2.5 LED Exit Light Fixtures

A. Exit light fixtures shall meet applicable requirements of NFPA and UL.

B. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.

C. There shall be no radioactive material used in the fixtures.

D. Fixtures:

1. Stencil to be 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.

2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.

3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

2.6 LED Luminaires

A. General:

1. LED luminaires shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.

2. LED luminaires shall be Reduction of Hazardous Substances (RoHS)-compliant.

3. LED drivers shall include the following features unless otherwise indicated:

a. Minimum efficiency: 85% at full load.
b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
c. Input Voltage: 120V (±10%) at 60 Hz.
d. Integral short circuit, open circuit, and overload protection.
e. Power Factor: ≥ 0.95.
f. Total Harmonic Distortion: ≤ 20%.
g. Comply with FCC 47 CFR Part 15.

4. LED modules shall include the following features unless otherwise indicated:

a. Comply with IES LM-79 and LM-80 requirements.

b. Minimum CRI 80 and color temperature 3000˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.

c. Minimum Rated Life: 100,000 hours per IES L70 and TM-21 with 70% rated lumen output at 40ºC, ambient.

d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. Housing, LED driver, and LED module shall be products of the same manufacturer.

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. Re-lamp 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.

1.2 Related Work

A. Section 16010 – General Electrical Requirements

B. Section 16100 - Basic Electrical Materials and Methods

C. Section 16450 – Grounding

D. Section 17000 – Instrumentation & Control

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. Motor Control Centers and 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.

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 drawings.

2. Polyphase motors shall have thermal overload heater elements provided integral in the motor controller for each ungrounded conductor.

C. Overload relays

1. All motor starters shall include fully programmable electronic overload relays. Overloads shall provide a 4.5:1 adjustment range matched to NEMA contactor sizes 00-6. Overload relays shall monitor individual all 3 phases for current and voltage.

2. Overloads shall include an alphanumeric LED display for local programming and diagnostic information. Local programming must be possible by applying 9 VDC to facilitate bench programming or programming without control power available.

3. Automatic, network, electronic and manual reset functions shall be supported.

4. The following protective functions shall be provided based on user configurable parameters: Over load / Under load / Jam, High / Low Voltage, Phase Unbalance and Reversal (voltage and current), Ground fault, Rapid cycling.

5. The overload shall provide the following user configurable parameters: Trip Class (5, 10, 15, 20, 30), Command (Trip, Reset/Run, Display Lock, Network Config Enable), Rapid Cycle Timer (RD1), Overload and Phase Unbalance Restart Delay (RD2), Under Load Restart Delay (RD3-Dry Well Recovery Timer), Number of restarts after faults (Automatic Reset Mode), Number of restarts after Under Load fault (Automatic Reset Mode), Under Load Trip Delay.

D. Manual 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.

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: Oiltight, heavy-duty type.

b. Pilot Lights: Provide oiltight heavy-duty, 125-volt transformer push-to-test type with LED lamp and lens colors as shown.

3. Operation Counter: Operation counter nonresetable type 0-99,999 counts, counting each time motor is energized. Voltage 120 Vac, 60 Hz. Flush mount in door. Operation counter shall be energized by motor starter auxiliary contact. Counters requiring batteries for any reason, including display readout, are not acceptable.

4. Running time meter: Furnish a digital cumulative non-resetable (to 99,999.9 hours) running time meter for each motor as shown on drawings. Provide 120 Vac 60 Hz unit. Flush mount in door. Running time meter shall be energized by motor starter auxiliary contact. Elapsed time meters requiring batteries for any reason, including display readout, are not acceptable.

2.3 Motor Control Center (MCC)

A. General

1. Steel material shall comply with UL 845 and CSA requirements.

2. Each MCC shall consist of one or more vertical sections of heavy gauge steel bolted together to form a rigid, free-standing assembly. A removable 7 gauge structural steel lifting angle shall be mounted full width of the MCC lineup at the top. Removable 7 gauge bottom channel sills shall be mounted underneath front and rear of the vertical sections extending the full width of the lineup. Vertical sections made of welded side-frame assembly formed from a minimum of 12 gauge steel. Internal reinforcement structural parts shall be of 12 and 14 gauge steel to provide a strong, rigid assembly. The entire assembly shall be constructed and packaged to withstand normal stresses included in transit and during installation.

3. The MCC shall be provided with a NEMA/EECMAC Class 1 Type B factory wired system. Plastic sleeve custom wire labels shall be provided for all control wiring. Wires shall be labeled as shown on the unit elementary diagrams.

B. MCC Finish

1. All steel parts shall be provided with UL and CSA listed acrylic/alkyd baked enamel paint finish, except plated parts used for ground connections. All painted parts shall undergo a multi-stage treatment process, followed by the finishing paint coat.

2. The standard paint finish shall be tested to UL 50 per ASTM B117 (5% ASTM Salt Spray) with no greater than 0.125 in (3 mm) loss of paint from a scribed line.

3. Paint color shall be #49 medium light gray per ANSI standard Z55.1-967 (60-70 gloss) on all surfaces unless specified otherwise. Control station plates and escutcheon plates shall be painted a contrasting gray. All unit interior saddles shall be painted white for better visibility inside the unit.

C. Structures

1. Structures shall be totally enclosed, dead-front, free-standing assemblies. Structures shall be capable of being bolted together to form a single assembly.

2. The overall height of the MCC shall not exceed 90 in (2286 mm) (not including base channel or lifting angle). Base channels, of 1.5 in (38 mm) in height, and lifting angles, of 3 in (76 mm) in height, shall be removable. The total width of one section shall be 20 in (508 mm); (widths of 25 in (630 mm), 30 in (760 mm), and 35 in (890 mm) can be used for larger devices).

3. Structures shall be NEMA type 12.

4. Each 20 in wide standard section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused space shall be covered by hinged blank doors and equipped to accept future units. Vertical bus openings shall be covered by manual bus shutters.

5. Each section shall include a top plate (single piece or two-piece). NEMA type 12 shall also include a bottom plate. Top and bottom plates shall be removable for ease in cutting conduit entry openings.

D. Wireways

1. Structures shall contain a minimum 12 in (305 mm) high horizontal wireway at the top of each section and a minimum 6 in (152 mm) high horizontal wireway at the bottom of each section. These wireways

shall run the full length of MCC to allow room for power and control cable to connect between units in different sections.

2. A full-depth vertical wireway shall be provided in each MCC section that accepts modular plug-in units. The vertical wireway shall connect with both the top and bottom horizontal wireway and shall be isolated from unit interiors by a full height barrier. The vertical wireway shall be 4 in (102 mm) wide minimum with a separate hinged door. There should be a minimum of 4,000 in^3 (65,548 cm^3) of cabling space available. Access to the wireways shall not require opening control unit doors. Structures that house a single, full section control unit are not required to have vertical wireways. Those control units must open directly into the MCC horizontal wireways.

E. Barriers

1. All power bussing and splice connections shall be isolated from the unit compartments and the wireways. The horizontal bus shall be mounted onto a glass filled polyester support assembly that braces the bus against the forces generated during a short circuit. The horizontal bus shall be isolated from the top horizontal wireway by a two-piece grounded steel barrier. This barrier shall be removable to allow access to the bus and connections for maintenance.

2. The vertical bus shall be housed in a molded glass-filled polyester support that provides bus insulation and braces the bus against the forces generated during a short circuit. These supports shall have openings every 3 in (75 mm) for unit stab-on connections. Each opening shall be provided with a manual shutter to close off the stab opening. These shutters shall be attached to the structure so that when they are removed (to allow a stab connection) they are retained in the structure and are readily accessible for use should a plug-in unit be removed from the MCC.

3. Barriers shall be provided in the vertical structure and unit designs to prevent the contact of any energized bus or terminal by a fish-tape inserted through the conduit or wireway areas.

F. Bussing

1. All phase, ground and neutral bussing and connectors shall be tin-plated copper .

2. The main horizontal bus shall be rated as shown on the drawings and shall extend the full length of the MCC. Bus ratings shall be based on 65° C maximum temperature rise in a 40° C ambient. Provisions shall

be provided for splicing additional sections onto either end of the MCC.

3. The horizontal bus splice bars shall be pre-assembled into a captive bus stack. This bus stack is installed into the end of the MCC power bus to allow the installation of additional sections. The main bus splice shall utilize four bolts, two on each side of the bus split, for each phase. Additional bolts must not be required when splicing higher amperage bus. The splice bolts shall secure to self-clenching nuts installed in the bus assembly. It shall be possible to maintain any bus connection with a single tool. "Nut and bolt" bus connections to the power bus shall not be permitted.

4. Each section that accepts plug-in units shall be provided with a vertical bus for distributing power from the main bus to the individual plug-in starter units. This bus shall be of the same material and plating as the main bus, and shall be rated at 600 A continuous. The vertical bus shall be connected directly to the horizontal bus stack without the use of risers or other intervening connectors. It shall be possible to maintain the vertical to horizontal bus connection with a single tool. "Nut and bolt" bus connections to the power bus shall not be permitted. When a back-to-back unit arrangement is utilized, separate vertical bus shall be provided for both the front and rear units.

5. A tin-plated copper ground bus shall be provided that runs the entire length of the MCC. The ground bus shall be 0.25 in (6.0 mm) x 1.0 in (25 mm) and be rated for 300 amps. A compression lug shall be provided in the MCC for a 4/0-250 kcmil ground cable. The ground bus shall be provided with (6) 0.38 in (10 mm) holes for each vertical section to accept customer-supplied ground lugs for any loads requiring a ground conductor.

6. Each vertical section shall have a tin-plated copper vertical ground bus that is connected to the horizontal ground bus. This vertical ground bus shall be installed so that the plug-in units engage the ground bus prior to engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-in unit.

7. The system shall be rated for an available short circuit capacity as shown on the drawings.

G. Typical Unit Construction

1. All surfaces (back, side and bottom plates) of the unit interior shall be painted white.

2. Units with magnetic-only circuit breaker disconnects through 400A frame, shall connect to the vertical bus through a spring reinforced stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus. Stabs on all plug-on units shall be solidly bussed to the unit disconnect. Cabled stab assemblies are not permitted. All circuit breakers shall have auxiliary contact that open when the breaker is open or tripped.

3. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.

4. Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal. All plug-on units shall use a twin-handle camming lever located at the top of the bucket to rack in and out the plug-on unit. The cam lever shall work in conjunction with the hanger brackets to ensure positive stab alignment.

5. A cast metal handle operator must be provided on each disconnect. With the unit stabs engaged onto the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit disconnect with clear indication of the disconnects status. All circuit breaker operators shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door.

6. A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. It shall be possible for authorized personnel to defeat these interlocks.

7. A non-defeatable interlock shall be provided between the handle operator and the cam lever to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position.

8. The plug-in unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.

9. Provisions shall be provided for locking all disconnects in the OFF position with up to three padlocks.

10. Handle mechanisms shall be located on the left side to encourage operators to stand to the left of the unit being switched.

11. Unit construction shall combine with the vertical wireway isolation barrier to provide a fully compartmentalized design.

H. Typical Combination Starter Unit Components

1. All combination starters shall utilize a unit disconnect as specified in the previous article. Magnetic starters shall be furnished in all combination starter units. All starters shall utilize NEMA/EEMAC rated contactors. Starters shall be provided with a three-pole, external manual reset, overload relay for solid-state thermal overload units.

2. Control circuit transformers shall include two primary protection fuses and one secondary fuse (in the non-ground secondary conductor). The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads. The transformer rating shall be fully visible from the front when the unit door is opened.

3. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.

4. NEMA/EEMAC Size 1-4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of the starter cubical without entering the vertical wireway. Starters shall be minimum NEMA Size 1.

5. Terminal blocks shall be the pull-apart type 600 volt and rated at 25 amps. All current carrying parts shall be tin-plated. Terminals shall be accessible from inside the unit when the unit door is opened. Terminal blocks shall be DIN rail mounted with the stationary portion of the block secured to the unit bottom plate. The stationary portion shall be used for factory connections, and shall remain attached to the unit when removed. The terminals used for field connections shall face forward so they can be wired without removing the unit or any of its components.

6. Nameplates shall be engraved phenolic nameplates for each MCC and unit compartment. Shall be white background with black letters, measuring a minimum of 1.5 in (38 mm) H x 6.25 in (159 mm) W total outside dimensions.

7. Overload relays shall be electronic as specified herein.

8. Solid State Reduced Voltage starter units shall have integral bypass contactor and shall be as specified herin.

I. Variable Frequency Drives (VFD)

1. Variable Frequency Drives: Provide microprocessor controlled starter where shown on the drawings.

a. General

1) The Variable Frequency Drive (VFD) and appurtenances shall be furnished by the Contractor. The contractor shall make all field connections, as required.

2) Control techniques other than pulse width modulated (PWM) are not acceptable.

3) The AC Drive shall meet IEC 664-1 and NEMA ICS 1 Standards.

4) The AC Drive shall include integral line reactors on the input and output power.

5) The efficiency of the drive shall be a minimum of 98% at full load speed.

6) The operating ambient temperature range without derating for the drive shall not exceed 14º to 122ºF.

7) The drive output voltage shall be adjustable from 0 to rated motor voltage.

8) The drive shall be manufactured by a firm with at least ten (10) years experience in the protection of this type of equipment.

9) The drive manufacturing facility shall be UL listed.

10) The VFD shall be capable and proven to communicate without error over a Profinet IP protocol network. Acceptance of the VFD shall be at the sole discretion of the Engineer.

2. Operating Characteristics

a. Upon power-up, the AC Drive shall automatically test for valid operation of memory, loss of analog reference input, loss of communication, DC to DC power supply, control power, and the pre-charge circuit.

b. The AC drive shall have a selectable ride through function which will allow the logic to maintain control for a minimum of one second without faulting.

c. For a fault condition other than a ground fault, short circuit, or internal fault, an auto restart function will provide up to 5 programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 600 seconds.

d. Upon loss of the analog process follower reference signal, the AC drive shall fault and/or operate at a user defined speed set between software programmed low speed and high-speed settings.

3. Design

a. The drive hardware shall employ the following power components:

1) Diode or fully gated bridge on the input.

2) Switching logic power supply operating from the DC bus.

3) Phase to phase and phase to ground MOV protection with jumpers to remove the phase to ground unit when applicable.

4) Microprocessor based inverter logic isolated from power circuits.

5) Latest generation IGBT inverter section.

6) Inverter section shall not require commutation capacitors.

7) Customer Interface common for all horsepower ratings. Interface choices shall include LED and LCD digital displays, programming keypad and operator keys option.

8) The Main Control Board shall be the same for all ratings to optimize spare parts stocking and exchange.

9) Common control connection for all ratings.

10) Device Peripheral Interface (DPI) for connection to common options.

11) Status LED for drive status, viewable through the cover.

12) Status LEDs for communications status, including embedded DPI status, adapter health and communications network status, viewable through the cover.

b. The drive shall be programmable or self-adjusting for the following:

1) Operate drive with motor disconnected.

2) Controlled shut down, when properly fused, with no component failure in the event of an output phase to phase or phase to ground short circuit and annunciation of the fault condition.

3) Adjustable PWM carrier frequency within a range of 2.5-8 kHz.

4) Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.

5) Multiple acceleration and deceleration rates.

6) All adjustments to be made with the door closed.

4. Operator interface

a. The operator interface terminal will offer the modification of AC drive adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local control, adjustment storage, self-test and diagnostics will be in plain English.

b. The display will be a high resolution, LCD backlighted screen capable of displaying graphics such as bar graphs as well as six lines of twenty-one alphanumeric characters.

c. The AC drive model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall all be listed on the drive identification display as viewed on the LCD display.

d. The display shall be configured to display one or two bar graphs with numeric data that are selectable and scalable by the operator. A user defined label function shall be available. As a minimum the selectable outputs shall consist of speed reference,

output frequency, output current, motor torque, output power, output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, elapsed time, motor speed, machine speed reference and machine speed.

e. The Keypad and all door mounted controls must be Type 12 rated.

5. Control

a. External pilot devices shall be able to be connected to a terminal strip for starting/stopping the AC Drive, speed control and displaying operating status. All control inputs and outputs will be software assignable.

b. 2-wire or 3-wire control strategy shall be defined within the software.

1) 2-wire control allows automatic restart of the AC Drive without operator intervention after a fault or loss of power.

2) 3-wire control requires operator intervention to restart the AC Drive after a fault or loss of power.

c. All logic connections shall be furnished on pull apart terminal strips.

d. There will be 2 software assignable, optically isolated analog inputs. The analog inputs will be software selectable and consist of the following configurations: 0-20 mA, 4-20 mA, 20-4 mA, x-20 mA (where x is user defined) 0-5 V, 1-5 V or 0-10 V.

e. There will be 6 software assignable, optically isolated logic inputs that will be selected and assigned in the software. The selection of assignments shall consist of run/reverse, jog, plus/minus speed (2 inputs required), setpoint memory, preset speeds (up to 2 inputs), auto/manual control, controlled stop, terminal or keypad control, by-pass (2 inputs required), motor switching, and fault reset.

f. Two voltage-free Form C relay output contacts will be provided. One of the contacts will indicate AC drive fault status. The other contact will be user assignable.

g. The AC Drive shall include IEC rated isolation contactors as specified or as shown.

6. Analog I/O shall consist of the following

a. Sufficient analog inputs and outputs to provide the functions as shown on the drawings. Each input shall be user configurable to 0 - 10V DC or 4-20 mA. They shall be user programmable for a variety of uses including frequency command, process loop inputs and others. Inputs shall be programmable for function, scaling (including invert), offset, signal loss detect and square root.

b. No jumpers or switches shall be required to configure the analog I/O. All functions shall be fully programmable.

7. Discrete I/O shall consist of the following

a. Sufficient and properly configured inputs and outputs to provide the functions shown on the drawings.

b. All inputs shall be configurable for sinking or sourcing. They shall be dividually programmable for functions from a list that includes Start (3-wire control), Run (2-wire control), Stop, External fault, Speed select, Jog, Process PI functions and others.

c. Outputs shall be rated at 250V AC/ 30V DC, 2.0 amps resistive or inductive.

d. Relays outputs shall be programmable to reflect different conditions including Fault, Alarm, At Speed, Drive Ready, PI Excess Error and others. Timers shall be available for each output to control the amount of time, after the occurring event, that the output relay actually changes state.

8. Options

a. Where required or shown on the Drawings, other options such as bypass, soft-start bypass, motor selection contactors, harmonic filter, etc. shall be provided as part of the package.

b. The VFD and all required options will be incorporated by the VFD manufacturer into an integrated package, for placement in an MCC section. Semi-conductor rated fuses shall be included to provide additional equipment protection. The VFD shall be rated for 100,000 AIC when the manufacturer's recommended

fuses are used. The VFD shall be UL Listed, and assembled by the VFD manufacturer in an ISO 9001 registered facility.

9. Protective Functions

   a. For each programmed warning and fault protection function, the drive shall display a message in complete English words or standard English abbreviations. The five (5) most recent fault messages and times shall be stored in the drive's fault history.

   b. The drive shall provide electronic motor overload protection qualified per UL508C.

   c. Protection shall be provided for AC line or DC bus overvoltage at 130% of max. rated or undervoltage at 65% of min. rated and input phase loss.

   d. A power loss ride through feature will allow the drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.

   e. Stall protection shall be programmable to provide a warning or stop the drive after the motor has operated above a programmed torque level for a programmed time limit.

   f. Underload protection shall be programmable to provide a warning or stop the drive after the motor has operated below a selected underload curve for a programmed time limit.

   g. Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.

10. The drive manufacturer shall provide adequate drawings and instruction material to facilitate installation of the drive by electrical and mechanical trades people employed by others.

11. Factory trained application engineering and service personnel that are thoroughly familiar with the drive products offered shall be locally available at the specifying and installation locations.

12. Drives shall have a warranty of 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time, and expenses.

13. Submittals - In addition to the information required in section 16010, the following information shall also be included:

    a. Outline Dimensions.

    b. Weight.

    c. Compliance to IEEE 519 – Harmonic analysis for particular jobsite including total voltage harmonic distortion and total current distortion.

        1) The drive manufacturer shall provide calculations, specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the drive manufacturer to ensure compliance with IEEE standard 519-1992, Guide for Harmonic Control and Reactive Compensation for Static Power Converters. The acceptance of this calculation must be completed prior to drive installation.

        2) Prior to installation, the drive manufacturer shall provide the estimated total harmonic distortion (THD) caused by the drives. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.

        3) If the voltage THD exceeds 5%, the drive manufacturer is to recommend the additional equipment required to reduce the voltage THD to an acceptable level.

14. The manufacturer shall size the VFD units and provide cooling fans for proper cooling of the specified drive.

15. Provide Square D Altivar 61 series.

2.4 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.

2.5 Motor Control Systems Furnished By Others

A. The contractor shall coordinate with the supplier, as required, for proper installation and operation of motor control systems.

B. In general, the contractor shall install equipment furnished by others 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 Water District 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

SECTION 16905

PREMIUM EFFICIENCY VERTICAL MOTORS

PART 1 GENERAL

1.1 Description of Work

A. Work consists of all motors and control shown on the drawings and specified herein and in other divisions of the specifications. In general, all motors shall be premium efficiency and 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. Motor rating and performance shall match that of pump. Pumping Unit Supplier shall be responsible to ensure pump and motor performance as a complete unit, under all operating conditions, defined for this project.

C. Along with the vertical turbine pumps, OWNER shall supply the vertical motors specified herein. CONTRACTOR shall provide all labor, equipment and materials and perform all operations in connection with the installation and testing of OWNER-supplied vertical turbine pumps and motor as specified in Section 11101- Vertical Turbine Pumps.

1.2 Submittals

A. Complete motor data shall be submitted and include the following data:

1. Motor manufacturer.
2. Motor type or model and dimension drawing to include motor weight.
3. Nominal Horsepower.
4. NEMA Design.
5. Enclosure.
6. Frame size.
7. Winding insulation class and treatment.
8. Rated ambient temperature.
9. Service factor.
10. Voltage, phase and frequency ratings.
11. Full load current at rated horsepower for application voltage.
12. Starting code letter, or locked KVA, or current.
13. Special winding configuration.
14. Rated full load speed.

15. Guaranteed minimum Power Factor at 100, 75 and 50 percent of full load.
16. Guaranteed minimum efficiencies at 100, 75 and 50 percent of full load.
17. Starting torque.
18. Full load torque.
19. Breakdown torque.
20. Rated temperature rise at rated horsepower.
21. Full load current at rated voltage.
22. Current at no load on shaft at rated voltage.
23. Connection diagram.
24. Rtd – Resistance Temperature Detector: 100 ohm Platinum.
25. Superimposed load speed torque curve over motor speed torque curve
26. Recommended spare parts list priced.

1.3 Factory Testing

Motors rated 100 hp and larger shall be factory tested in conformance with ANSI/IEEE 112, IEEE 43, and NEMA MG-2. Tests shall include full load heat run, performance, bearing (temperature, noise), locked rotor, speed torque, no-load saturation, surge, megohmmeter testing, and dielectric absorption ratio. Test report shall indicate test procedure and instrumentation used to measure and record data. Test report shall be certified by the motor manufacturer's test personnel and submitted to and approved by Owner's Representative prior to shipment of equipment.

1.4 Guaranty Period

Warranty requirements for pump motors shall be as specified in Section 11101.

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 $\pm$ 10% of nameplate rating.

3. Frequency variations to $\pm$ 5% of nameplate rating.

4. Combined voltage and frequency variations to $\pm$ 10% total, as long as frequency does not exceed $\pm$ 5%.

5. 3,300 foot maximum altitude.

2.2 Electric Motors

A. General: Electric motors shall be premium efficiency, solid shaft electric motors, design B, high thrust, squirrel cage, induction type having NEMA weather protected type I enclosures unless otherwise specified. Motors shall utilize adjustable spacer couplings. Motors shall be suitable electrically and mechanically to efficiently and effectively drive pumps. Motors shall operate in accordance with these specifications.

B. Unless specified otherwise, all materials, workmanship and tests shall conform with the applicable specifications to NEMA, IEEE, ASA and AFBMA.

C. Motor frame shall be steel or cast iron, aluminum shall not be permitted. Motors shall be rated for operation at 460 VAC, 3 phase, 60 hertz, Service factor of 1.15 or greater. Motors shall operate at standard RPM's as required by the pump or equipment which they drive.

D. Motors shall be rated for premium efficiency. Rated efficiencies shall be based on NEMA standards MG1-12.536 or standards imposed by the local electric utility, which ever is more restrictive.

E. Motors shall be capable of full load operation with voltage variations of +/- 10% and frequency variation of +/- 5%.

F. Motor starting current shall not exceed 650% of motor full load current.

G. Insulation system: All motors shall be provided with Class "F" or better insulation systems except that motor lead insulation may be class "B" or better. Completed windings, when tested in accordance with IEEE #57 shall show a thermal rating not less than 150 degrees for 30,000 hours of life.

H. Noise Level: Sound pressure levels shall be measured according to IEEE 85 and shall not exceed 85 decibels as measured on the A-weighted Scale at a distance of five (5) feet from any motor surface under no load, free field conditions.

I. Windings shall be held firmly in stator slots to prevent coil shift. Stator windings shall be of high conductivity copper magnet wire. Completed stator windings shall be provided with a properly cured, uniform impregnation for mechanical rigidity, moisture resistance, and protection against winding failure from accumulation of foreign conductive matter. The completed insulation system shall be capable of withstanding phase to ground rms voltage of 600 volts continuous and 2,300 volts instantaneous.

J. All motors used with variable frequency drives shall be inverter duty and shall have a minimum of 1,600 volt insulation on the windings.

K. Rated temperature rise above 40 degrees C ambient temperature, at service factor load of 1.15 shall not exceed 90 degrees C.

L. Motors rated 50 Hp and larger shall be rated NEMA locked rotor Code G or better.

M. Motors shall be dynamically balanced to a maximum of .001 inches peak to peak amplitude.

N. Motors shall be equipped with anti-friction type thrust and guide bearings. Angular contact thrust bearings shall be used. Bearings shall be of sufficient capacity to withstand all static and dynamic thrust loads, both momentary and continuous, imposed by the pump. Bearings shall provide minimum L-10 life of 60,000 hours based on continuous design thrust loads.

O. Motor thrust bearings shall be grease or oil lubricated. Oil lubrication systems shall provide optimum lubrication of bearings. Oil lubricated motors shall have visual level indicators and accessible fill and drain plugs. Grease lubricated motors shall provide access to zerc fittings.

P. Motors shall be equipped with non-reverse mechanisms which shall limit maximum reversal to 10 degrees of rotation.

Q. Motors shall be equipped with fabricated steel terminal boxes. The motor terminal box shall be one size larger than the manufacturer's recommendation. Separate accessory terminal boxes shall be provided for space heater and temperature sensors.

R. Motor Nameplates shall include Manufacturer name, serial number, rated horsepower, service factor, frequency, phase, load voltage, full load amps, full load speed, design designation, locked rotor current and or designation, insulation class, temperature rise, maximum ambient temperature, NEMA efficiency, and full load power factor, time rating, model #, bearing identification, frame size, thermal protection, nominal and guaranteed efficiency.

S. Motors shall be as manufactured by General Electric Company or US Motors.

2.3 Accessories

A. Motors shall be equipped with winding thermostats. Thermostats shall be snap action, bi-metal, temperature and shall be factory mounted integral to motor. Thermostats shall be provided with one normally closed contact with switch point pre-calibrated by manufacturer.

PART 3 EXECUTION

3.1 General

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.

3.2 Wiring

Arrange wiring in cabinets, panels and motor control centers neatly cut to proper length, and remove surplus wire. Apply stack-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 panel boards 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.

END OF SECTION

SECTION 17000

INSTRUMENTATION AND CONTROL

PART 1 GENERAL

1.1 Description of Work

A. The following supplements all sections of this specification and applies to all work specified, shown on the drawings, or required to provide a complete and operational Instrumentation and Control System (System).

B. This section covers all work necessary for furnishing, installing, adjusting, testing, documenting, and starting up the Instrumentation and Control (I & C) System.

C. Major constituents for this system include, but are not limited to, all materials, equipment, and work required to implement a complete and operating system of instrumentation and controls. The system shall include primary elements for process variable measurements, analog display and control elements, and discrete display and control elements.

D. Additional constituents for the System include, but are not limited to, all materials, equipment and work related to implementing System communications. System communications includes sending and receiving data between components of the System, and monitoring and alarming status of System components. This shall include the supply, installation, and testing of telephonic, radio, and networking components and cabling required for System operation, and components specified in this section. In addition, the System will interconnect and integrate components furnished under other sections of this contract to provide a complete operational System.

E. Work includes fabrication, installation and testing of the control panels shown on the drawings for the control and protection of all motors and controlled equipment in conformance with equipment manufacturer's recommendations and applicable codes.

F. Responsibility for Complete System:

1. 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 be responsible for providing and installing the programmable controller logic program, providing a fully documented back-up electronic copy and printed copy of the controller logic program, and shall participate in the Factory testing and Functional Acceptance Test as specified herein.

G. Definition Of Terms

1. System Integrator: A single firm, pre-selected by the Owner, who shall design and furnish the system, assemble and test the instrument panels, and program PLCs, computers, and other instrument components and provide start-up and training services. The System Integrator is S&B Inc.

2. Contractor: The Contractor, as distinct from the System Integrator, shall install the panels, and other materials furnished by the System Integrator and provide all additional materials and work necessary and thereby, satisfy all requirements that are within the scope of this section.

1.2 Standards

A. The latest adopted revision of the following:

1. NFPA – National Fire Protection Association

a. NFPA No. 70, NEC - National Electrical Code.
b. NFPA No. 79, Electrical Standard for Industrial Machinery.

2. ISA – Instrumentation, Systems, and Automation Society.

3. ICS - NEMA (National Electrical Manufacturer's Association) Industrial Control and Systems including:

4. ICS-1 General Standards for Industrial Control and System.

a. ICS-2 Standards for Industrial Control Devices, Controllers and Assemblies.

b. ICS-3 Industrial Systems.

c. ICS-4 Terminal Blocks for Industrial Control Equipment and Systems.

d. ICS-6 Enclosures for Industrial Controls and Systems.

5. ANSI/IEEE – American National Standards Institute/Institute for Electrical and Electronics Engineers.

6. State and Local codes and ordinances.

7. UL – Underwriter's Laboratory UL Standard 508. (Industrial Control Panels for General Use)

8. NETA – National Electrical Testing Association.

9. NSF - National Sanitation Foundation.

1.3 Under Writers Laboratory (UL) Labeling

A. All panels provided under this section shall be labeled by Underwriters Laboratory (UL), standard 508. Labels shall be provided by an entity that is currently registered and authorized by UL to provide such label.

B. All panels provided under this section shall be acceptable to the State of Oregon and the authority having jurisdiction.

C. All panels and components provided under this section shall conform to the more stringent of the technical specifications, or UL standard 508.

1. Provide documentation necessary to verify that all components, construction methods, and circuits conform to this standard.

D. Contractor shall provide additional design, components, and equipment necessary to meet the requirements of UL standard 508.

E. Contractor shall provide submittals for additional components that are required by UL standard 508, but not specifically listed in this section.

1.4 Submittal Data

A. Post-Contract Award Submittals: In addition to the requirements of other Divisions and Sections of the specifications, the following information shall be provided within 30 days of award.

1. All equipment to be supplied shall be listed followed by descriptive data sheets. The equipment list shall include each component name, manufacturer, model number, a description of the operation, quantity

supplied, and any special setup, operation and maintenance characteristics.

a. Similar components used in the project shall be the product of a single manufacturer.

2. Description and operation of all remote site hardware and the configuration features of the I/O and local control loop characteristics.

3. Catalog information, descriptive literature, wiring diagrams, and shop drawings on all electrical devices, components, panels, and enclosures furnished under this section.

4. Individual data (or specification) sheets shall be provided for all components provided under this section. The purpose of these data sheets is to supplement the generalized catalog information provided by citing all specific features for each specific component (e.g. materials of construction, special options included, calibration data including scale and range, etc.). Each component data sheet shall bear the component name and instrument tag number designation.

5. Shop drawings and catalog material for all control panels and enclosures. Submit a schedule of panel assembly interior and exterior device and exterior equipment nameplates.

6. Panel elementary schematic diagrams of prewired panels. Show all signals, analog and discrete, and all auxiliary devices such as relays, terminals, alarms, fuses, lights, fans, heaters, etc. Diagrams, device designations, and symbols shall be in accordance with NEMA ICS 1-101.

a. Panel mounted devices and wires shall be identified by line number reference. Show line number reference of each relay contact adjacent to each coil.

b. The Contractor shall coordinate the Control Panel Schematics with equipment provided under other sections specified herein. Show correct terminal numbers for the filter control panels, motor controllers, flow meters, valve actuators and devices, pressure transmitter, level transducer and all other equipment and devices connected to this system.

c. Submittals that fail to comply with these submittal requirements will be summarily rejected.

7. Submit all electrical engineering design and calculations required for construction of a complete control system. Size any equipment whose size is not shown on drawings. Submit detailed, typed calculations for transformer, power supply, fuse and circuit breaker and wire sizing. List all loads both running and inrush in tabular form. Assume all devices energized. For each PLC and Telemetry Panel listed herein, submit detailed enclosure thermal management calculations to maintain minimum 55 degree F, and maximum temperature per device and equipment manufacturer's requirements.

8. Submit a separate spare parts list showing quantities of spares per this specification. Include a material suppliers list with names, addresses, and phone numbers of all purchase sources.

B. Start-up, Testing and Training Submittals: In addition to the requirements of other Divisions and Sections of the specifications, the following information shall be provided within 120 days of start-up activities.

1. Test Procedures:

a. The Contractor shall prepare and submit separate detailed descriptions of the test procedures for each testing phase outlined in Part 3 herein, and the proposed report forms to be used for recording the test results. The testing procedures shall be designed by the Contractor to duplicate normal operating and all alarm conditions. Provide separate procedures and forms for each PLC Control Panel, Telemetry Panel, and field device listed herein.

2. Start-Up, Testing, and Training Schedule:

a. Control Panel Factory Test.

b. Control Panel delivery.

c. Control Panel and field device Acceptance Test.

d. Control Panel and field device Functional Test.

e. Control Panel and field device Owner Training. The Contractor shall provide an outline for the training to be provided that covers basic operator training, system maintenance training, and programming training. Identify the course content and the time to be spent on each subject area.

1.5 Operational and Maintenance (O&M) Manuals

A. The Contractor shall provide Operation and Maintenance (O&M) manuals with complete information concerning the operation of the System prior to start-up of the equipment. The O&M manuals shall include information related to diagnosis, down to the module and card replacement level.

B. The manuals shall include all project specific information and shall be furnished in PDF with electronically indexed sections. The O&M Manuals shall contain descriptive material, drawings, and figures bound in appropriate places.

1. The manuals shall include operation and maintenance literature for the entire System and all components provided. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, adjustment, calibration, and maintenance of each component provided.

2. Vendors List: Submit final as-build vendors list as described above in initial submittals. Include this as a separate tab in materials list spreadsheet on a separate work sheet.

3. The manuals shall include data sheets for all significant equipment used in the System. Significant equipment is defined as equipment performing a function other than simple interconnection. The data shall include, as a minimum, the component name, manufacturer, model number, quantity, and any special O&M characteristics.

   a. Factory calibration data sheets shall be included for all transmitters and transducers.

   b. Field calibration data sheets shall be included for all transmitters and transducers.

4. The manuals shall include wiring diagrams for all components provided. These wiring diagrams shall clearly show all terminals, terminal block number designations, and wire numbers. Diagrams, device designations, and symbols shall be in accordance with NEMA ICS 1-101.

5. The manuals shall include final as-built drawings of equipment. These drawings shall include:

a. Layout drawings for each panel shall include overall dimension details for each component and all door mounted operator devices including nameplate designations.

b. Interconnecting wiring diagrams of all equipment installed or connected under this contract.

c. Control loop diagrams showing operation of the System.

d. Deliver two copies each of Operation and Maintenance Manual's and drawings' CD-ROM disks with all as-built changes incorporated with the final copies of the manuals for each panel. Include all drawings, calculation Microsoft Excel files, and Adobe Acrobat pdf files of all cut sheets.

PART 2 PRODUCTS

2.1 General

A. Analog signals shall be 4 to 20 mA DC conforming to the compatibility requirements of ISA Standard S50.1, and shall be Type 2 two-wire, unless otherwise noted. Transmitters shall have a load resistance capability conforming to Class L. Transmitters and receivers shall be fully isolated.

B. Discrete signals are two-state logic signals of two types: control and alarm. Control and alarm signals shall utilize voltage sources as indicated on the drawings. All alarm signals shall open on alarm condition, and have isolated contacts rated for class 2 voltage levels and electronic signals.

C. Nameplates, nametags, and service legends shall be used to identify all major components provided under this section. Major components are defined as components that perform a function other than simple interconnection.

1. Nameplates are defined as engraved rigid laminated plastic plates bearing the entire identifying text or ISA tag number of the component. Nameplates shall be securely mounted under or near a mounted component.

2. Nametags are defined as stamped stainless steel tags, unless otherwise noted, bearing the entire identifying text or ISA tag number of the component. Nametags shall be securely attached to the component.

3. Service legends are defined as engraved rigid laminated plastic legends bearing the entire identifying text or ISA tag number of the component integrally mounted on a panel face mounted instrument.

4. Service legends and panel interior mounted nameplates shall be black with white letters, and letter height shall be minimum 3/16-inch high characters, unless otherwise noted.

5. Panel exterior device nameplates shall be black with white letters, and letter height shall be minimum 3/8-inch high characters.

D. Provide color coded wiring for class 2 (low voltage) wiring, no less than twenty unique wire color combinations or provide wire labels. All class 1 conductors shall have wire labels. These are defined as machine printed heat-shrink tube type labels bearing the entire identifying text of the wire. Wire labels shall be furnished for all wires in each panel assembly provided under this section. Label both ends of wires more than 6 inches in length. Label one end of wires less than or equal to 6 inches in length. Shrink labels in place with lettering in position to be easily read and no more than one (1) inch from the connecting terminal.

E. Terminal markers are defined as machine printed markers bearing the entire identifying text of the terminal. Terminal markers shall be furnished for all terminal blocks, fuse blocks, and grounding blocks provided under this section. Securely mount terminal markers with lettering in position to be easily read.

F. Interposing relays, loop isolators, intrinsically safe barriers, and terminating resistors shall be furnished wherever necessary, as indicated by the instrument and/or installation, regardless of whether they are indicated in the drawings, to perform the functions shown herein and on the drawings.

G. Programming devices and specialty tools shall be furnished where required for the maintenance and/or calibration of components provided under this section.

2.2 Panel Assemblies

A. Panel Assemblies shall be provided where indicated, specified, or required to meet the functional requirements of the System, as specified. Panel Assemblies shall be completely fabricated, instruments installed, and wired in the panel assembly manufacturer's factory. All wiring shall be completed and tested prior to shipment. All external connections shall be by way of numbered terminal blocks.

B. Panel Assembly Electrical

1. Power Distribution

a. Each panel will be provided with one or more 120 V AC, 60-Hz feeder circuits from the associated circuit breaker distribution panel provided under Division 16 – ELECTRICAL unless otherwise shown. On each panel, make provisions for feeder circuit entry and provide circuit breakers, disconnects, and power distribution blocks as required for termination of the wires.

b. Provide a Surge Protective Device with the following characteristics: 120-volt, 15-amp max, 220-volt clamp, indicator light, solid state design, UL Listed.

c. Provide circuit breakers as shown on schematic drawings. Circuit breakers shall be DIN rail mounted type.

d. Provide fuse blocks and fuses as shown on schematic drawings. Fuse blocks shall be DIN rail mounted, finger-safe type.

1) Provide blown fuse indication for all fused circuits.

2. Wiring

a. All electrical wiring shall be in accordance with applicable requirements of Division 16 – ELECTRICAL.

1) Wiring for discrete signal circuits shall be 600-volt class, PVC insulated, stranded copper, and shall be of the size required for the current to be carried, but not smaller than 18 AWG, enclosed in plastic wiring duct unless otherwise noted.

2) Wiring for analog signal circuits shall be 600-volt class, PVC insulated, stranded copper, twisted shielded pairs or twisted shielded triads as required by the application, no smaller than No. 20 AWG, and shall be separated at least 6 inches from any power wiring.

3) Separate AC and DC wiring by a minimum of 6 inches where possible. Where AC and DC wires must be run together with less than 6 inches separation, provide grounded metallic barrier for separation between AC and

DC wires. Where AC and DC wires must cross, make crossings at 90 degrees.

b. All interconnecting wires between panel mounted equipment and external equipment shall be terminated at terminal blocks. All terminal blocks shall have terminal markers.

c. All interconnecting wires between panel mounted equipment and external equipment shall be identified per the requirements of Division 16 – ELECTRICAL.

d. All wires of a panel assembly shall have wire labels per the requirements of this section. This shall be done at all wire terminations including terminal blocks, I-O terminals (even if the number is duplicated on the terminal), and terminations on panel-mounted devices.

C. All major components of the panel assemblies shall be identified with nameplates or service legends per the requirements of this section. Adhesive embossed plastic tape type labels are not acceptable.

D. Crate all panel assemblies with solid plywood sheeting and sufficient blocking and protective material to prevent damage during shipment and storage. Identify the contents of the crate with the full identifying text of the panel assembly, in block letters not less than two (2) inches in height, to allow the contents of the crate to be readily determined without opening the crate.

2.3 Enclosures

A. Enclosures shall be provided as a Panel Assembly component where indicated, specified, or required to meet the functional requirements of the System, as specified.

B. Enclosures shall meet the following minimum specifications, unless otherwise noted.

1. NEMA 12 for indoor locations, NEMA 4X stainless steel for outdoor or below grade locations, NEMA 4X non-metallic for corrosive locations.

2. Minimum metal thickness shall be 14-gauge.

3. All doors shall be rubber gasketed.

4. Wherever practical, enclosures shall be a manufactured item.

5. All enclosures that are to be structurally modified or shop fabricated shall be summarized, and the summary together with catalog cuts and/or shop drawings shall be submitted to the Engineer for approval prior to purchase or fabrication.

6. Enclosures shall be sized, provided with forced air ventilation, or provided with a cooling system to adequately dissipate heat generated by equipment mounted in or on the enclosure. Contractor shall provide heat calculation data to verify a heat rise of less than 30 degrees C.

7. Enclosures over 59 inches in height shall be provided with a door switch and fluorescent tube fixture. Where possible, lamp shall be the same type and size as the facility standard lamp.

8. All surfaces, internal and external, shall be primed and painted in accordance with the following, unless otherwise noted:

    a. Sand panel and remove all mill scale, rust, grease, and oil. Fill all imperfections and sand smooth. Paint panel interior and exterior with one coat of epoxy coating metal primer, two finish coats of two-component type epoxy enamel. Sand surfaces lightly between coats. Dry film thickness shall not be less than 3.0 mils.

    b. Touch up panel after installation.

    c. Paint shall be polyester urethane powder coat, alkyd liquid enamel, or epoxy.

    d. Interior panel color shall be white and exterior panel color shall be RAL5015 blue.

9. Enclosure shall have the following accessories:

    a. Door holder

    b. Fan/Louvers/Vents/Screens, where shown.

    c. Data pocket mounted on the inside of the door.

    d. Provide enclosure manufacturer's quick release latches on all NEMA 4X enclosures.

10. Where shown, Enclosures shall be provided with a heating system to adequately maintain a minimum temperature in the enclosure.

Contractor shall provide heat calculation data to verify a minimum internal temperature of at least 55 degrees F.

2.4 Circuit Breakers

A. General Purpose control panel circuit breakers 1 to 63 amp shall be thermal magnetic UL489 listed devices with a minimum rating of 240VAC, 60Vdc and 10kAIC. Terminals shall be compression clamp with a captive screw and accept wire size #14 to #4 AWG. Trip curves shall be selected to match application and connected device inrush requirements. Circuit breakers shall be available in 1, 2 or 3 pole configuration and accept a common bus bar. Actuator shall be flush with the body of the circuit breaker to prevent accidental operation.

B. All breakers directly connected to main incoming line terminals and feeder and sub-feed breakers shall be rated with interrupting capacities greater than or equal to the available fault current shown on the drawings. Current limiting main breakers may be used in lieu of main breakers for interrupting capacity greater than 10,000 AIC. Sub-feed breakers used in conjunction with current limiting breakers shall be minimum 10,000 AIC rated, and listed to be properly protected by the current limiting main breaker.

2.5 Power Distribution and Grounding Blocks

A. Make internal power wiring connections on enclosed, numbered heavy duty, touch-proof, 600V molded thermoplastic compression clamp terminal blocks. Size terminal blocks for intended purpose, but not less than 30A rated and sized not less than 80% capacity. All control terminals shall mount on standard 35mm DIN rail, torque requirements clearly identified on control panel and wiring diagrams.

B. Make internal ground wiring connections on enclosed, numbered heavy duty, touch-proof, 600V 30A, molded in thermoplastic, compression clamp ground terminal blocks, colored green and yellow, for wires #22 to #10 AWG where block makes contact with the rail at its base. Minimum mounting width 6mm. Mount on standard 35mm DIN Rail.

C. Provide separate incoming ground bus and single point copper ground bus. Connect the shield of each shielded cable to the single point bus.

2.6 Surge Suppressors

A. Surge Suppressors shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the

System, as specified. Surge Suppressors are intended to protect dedicated control equipment such as PLCs, Operator Interface Terminals, and instrumentation from high energy spikes in the electrical supply.

B. Surge Suppressors shall adhere to UL1449 fourth edition specifications and meet the following minimum requirements, unless otherwise noted:

1. 120 VAC single phase input voltage.
2. 47-63 Hz line frequency.
3. 20 Amp continuous rating.
4. All mode protection; L-N, L-G, N-G.
5. 50kA per mode, 20kA Inominal per UL1449-4
6. Form "C" status contact.
7. Response time less than 1 nanosecond.
8. Repetitive impulse: 5000 hits

2.7 Uninterruptible 24Vdc Power Supply

A. The UPS system shall consist of a 24V power supply, 24V UPS and two 12Vdc gel-cell type external batteries. The user shall be able to quickly and easily maintenance the batteries without affect to the RTU operation. The UPS shall be sized to maintain operation of the RTU for a minimum of 8 hours, and be optionally able to increase battery size to reach 72 hours of backup.

1. Power Input: 21-29Vdc, up to 3A reserved for battery charge
2. Power Output: 24Vdc, <10A, 97% efficient
3. Short circuit proof, reverse polarity protected.
4. UL listed
5. -25..+70 °C rated operation
6. Mounts to 35mm DIN rail

2.8 Terminal Blocks

A. Terminal Blocks: Provide terminal blocks for all control conductors entering the control panel, including all spare conductors shown on the Contract Drawing electrical plans and circuit schedule. Make all connections on terminals blocks, inline splices shall not be permitted.

B. Terminal Blocks: Provide test switch terminal blocks for all control panel wiring to field devices and for all PLC I/O. Terminal blocks shall be DIN rail mounted.

C. Fused Terminal Blocks - General: Provide fused terminal blocks where shown on the drawings. Provide neon lamp or LED blown fuse indicator.

2.9 Pilot Devices – Indicating Lights, Selector Switches, Pushbuttons

A. Pilot Devices shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the System, as specified. All Pilot Devices shall meet the following minimum specifications, unless otherwise noted.

1. All pilot devices shall be of heavy-duty, metallic, type 4/13, watertight/oiltight construction. Units shall mount through a 30.5 mm round hole.

2. All pilot devices shall have custom legends as shown. Legends shall be black with white letters, and letter height shall be minimum 3/16-inch high characters.

3. All button and lens colors shall be as shown.

4. All pilot devices shall be equipped with a sufficient number of contact blocks to accomplish the switching functions specified.

B. Indicating lights shall meet the following minimum specifications, unless otherwise noted.

1. All indicating lights shall be 120-volt AC or 24-volt AC/DC, full voltage type with LED lamps.

2. All indicating lights shall be "push-to-test" type, unless a "Lamp Test" pushbutton / PLC output contact is provided and wired to test all units simultaneously.

3. All indicating light lenses shall be plastic.

C. Selector switches shall meet the following minimum specifications, unless otherwise noted.

1. All selector switches shall be knob.

2. Illuminated selector switches shall be 120-volt AC or 24-volt AC/DC, full voltage type with LED lamps where specified.

D. Pushbuttons shall meet the following minimum specifications, unless otherwise noted.

1. All pushbuttons shall be flush type.

2. All emergency stop pushbuttons shall be red color, jumbo mushroom head, push operate / twist release type, with one form C contact, minimum. Emergency stop pushbutton legends shall be red with white letters, and letter height shall be minimum 3/16-inch high characters.

3. Illuminated push buttons shall be 120-volt AC or 24-volt DC, full voltage type with LED lamps where specified.

E. Contractor shall provide to the Owner one complete set of specialty tools required for maintenance of the pilot devices provided, including, but not limited to, lamp removal tools, lens removal tools, button removal tools, mounting wrenches, and retaining nut wrenches.

2.10 Control Power Transformers

A. Control Power Transformers shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the System, as specified. Control Power Transformers shall convert incoming panel AC power to 120 Vac, 60-Hz power and shall be sized to assure that the components being supplied can operate within their required tolerances.

B. Control Power Transformers shall meet the following minimum specifications, unless otherwise noted:

1. Mounted such that dissipated heat does not adversely affect other components.

2. Constructed with a laminated silicon steel core and precision windings.

3. 130°C insulation class, 80°C temperature rise.

4. Connections shall be made via screw terminals.

5. Protected with input and output overcurrent protection, sized per manufacturer.

2.11 Power Supplies

A. Power supplies shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the System, as specified. Power supplies shall convert 120 Vac, 60-Hz power to DC power of the appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that the components being supplied can operate within their required tolerances.

B. Power supplies shall meet the following minimum specifications unless otherwise noted:

1. Mounted such that dissipated heat does not adversely affect other components.

2. Input shall be rated for 82-132 Vac, 47-63 Hz.

3. Output shall be rated ±2% or less with 25 mV ripple phase to phase maximum.

4. Wiring connections shall be made via screw terminals. Solder lugs are not acceptable.

5. Protected against short-circuit, overload, over-voltage, and open-circuit type faults.

6. Sized for the application, with a minimum of 10% spare capacity.

2.12 Relays

A. Auxiliary relays shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the System, as specified. Relays shall be suitable for control, interfacing, and interposing functions.

B. Control Relays shall meet the following minimum specifications unless otherwise noted.

1. Plug-in general purpose, 2PDT minimum, control type relays rated for industrial use.

2. Provide relays with push-to-test-pull-to-lock button and LED.

3. Coil voltage shall match the control circuit voltage.

4. Contacts shall be 5 Amp, 120 volt (resistive) rated.

5. Provide DIN rail mounted relay bases with integrated clip and marking label.

C. Terminal block relays shall meet the following minimum specifications unless otherwise noted:

1. Din-rail general purpose, 2PDT minimum
2. Equipped with a supply voltage indicator light.

3. Coil voltage shall match the control circuit voltage.
4. Contacts shall be 5 Amp, 120 volt (resistive) rated.

2.13 Industrial Limit Switches

A. Provide a Form C contact position switch for industrial application use.

B. Switches shall be rated for use in temperatures ranging from 0^{O}F to 104^{O}F.

C. Switches located inside the reservoir shall be rated NEMA type 6P, switches located in vaults shall be rated NEMA type 6P, limit switches located in pump stations shall be rated NEMA type 4.

D. Limit switch shall have roller lever with snap action return. Actuation lever length shall be as required to accommodate installation but shall be no less than 3-inches.

2.14 Spare Parts

A. Provide the following quantities of spare component listed herein, sealed in original containers and labeled with a model number corresponding to materials list.

1. Two relays of each type and voltage.
2. Two Indicator lamps of each type and color used.
3. Ten fuses of each type.

2.15 Deliverables

A. The Instrumentation and Control and Telemetry System is designed to function as an integral part of the Owner's comprehensive Water Telemetry, Control and Management Reporting System in place at other facilities. This system is designed to allow new facilities to be constructed or existing facilities to be modified and then to be fully integrated as part of this overall system. Products have, therefore, been selected to be fully compatible and when possible, to match existing systems. At the Owner's City Shops, the Master Telemetry Unit and SCDA Systems shall be modified by the System Integrator to accommodate the new facilities specified and indicated in the drawings.

B. The System Integrator shall furnish the following equipment for installation by the Contractor.

1. For location at the Pump Station:

a. Individual instruments and components not part of the above assemblies and to be installed separately by the Contractor as follows:

Tag #	Description	Mfg	Model
GHA-051	Smoke Sensor	System Sensor	BK4WTB
LIT-022	Reservoir Level - 441' zone	Siemens	7MF4033-1CA10-1AC6-Z+A01+B21+J01
LSH-011	Inlet Vault High Water Float	Anchor Scientific	S20NO
LSHH-023	Reservoir High-High Float	Anchor Scientific	GSI20NO
PIT-030	Pump Suction (441' zone) (replaces existing unit)	Measurement Specialties	330S14B0A-020.000-000.000-B1-0030A
ZS-010	Reservoir Primary Hatch	Siemens	3SE03-AR16P / 3SX03-KL201
ZS-041	Pump Station Entry - East	Siemens	3SE03-AR16 / 3SX03-KL201
ZS-010	Pump Station Entry - West	Siemens	3SE03-AR16 / 3SX03-KL201
ZS-021A	Reservoir Primary Hatch	Siemens	3SE03-AR16P / 3SX03-KL201
ZS-021B	Reservoir Secondary Hatch	Siemens	3SE03-AR16P / 3SX03-KL201
ZS-021C	Reservoir Overflow Obs Hatch	Siemens	3SE03-AR16P / 3SX03-KL201

b. Motor Controller / Overload retrofit kit for RVSS motor starters for Pumps 2, 3 and 4 in the Square D MCC. Each of the three kits consists of:

Tag #	Description	Mfg	Model
CB-PT	0.5amp 3P UL489 breaker, 480/277V	Siemens	5SJ4305-7HG42
OL-1	Simocode Pro V PN 110-240V	Siemens	3UF70111AU000
OL-2	Simocode Pro I/V module,63-630A	Siemens	3UF7114-1BA00-0
aux 4i/2q	Simocode Pro 4IN/2Q,110-240V AC	Siemens	3UF7300-1AU00-0
cables	Simocode Pro interconnect cable	Siemens	3UF7932-0AA00-0

c. ProfiNet cable and connectors, 4 cables for connection between each motor controller and the RTU.

d. One S&B Model 6000-P71 RTU Panel Assembly in Nema type 12 enclosure

2. At the City Shops, S&B shall furnish all software and make all system modifications.

2.16 System Description

A. General

1. The Instrumentation, Control and Telemetry system is designed to provide overall control for the pump station.

2. The block diagrams illustrate each of the instrument loops and the major instrument components involved. The System Integrator shall be responsible for the design of the system and developing all software for the PLCs, DMS and GUI Systems.

3. Any equipment or devices shown on the drawings as future are shown for information purposes. No future hardware shall be included as part of this contract.

4. Software shall be provided for the RTU Panel and for the City Shops system. At the RTU Panel, the PLC shall be programmed to provide local automatic as well as supervisory control of the station provided by the City Shops PLC via the communications system. Software is also provided for the Human Machine Interface (HMI) in the RTU Panel. All alarm and control functions are monitored locally on the HMI as well as transmitted to City Shops. Fail safe features shall be included for all operations.

5. At the City Shops, software shall be provided for the Master PLC, and the Graphic User Interface (GUI) computers. The Master PLC software shall provide the remote control and monitor the reservoir and booster station. The GUI computer shall be used to monitor the station and to provide instructions for the Master PLC to control the system. Software for this system addition shall be consistent with the System Integrator's and the Owner's comprehensive telemetry system.

6. The GUI computer shall be used to monitor the station and to provide instructions for the Master PLC to control the system. Software for this system addition shall be consistent with the

System Integrator's and the City's comprehensive telemetry system.

B. Pump Control Strategies

1. The software is included for local automatic control for the pump. Included is sequenced control of the VFD to meet pressure and flow constraints.

2. Remote automatic control for the pump shall include individual start and stop setpoints for the pump, based upon level in the Horton (el 730') reservoir or alternatively, by the 730' pressure zone if Horton is offline. Setpoints shall be entered using the GUI computer at the City Shops and/or using the RTU's HMI.

3. During the construction of the Bolton Reservoir, an additional control algorithm is employed to move water from the 441' zone into the Horton zone using a pressure sustaining algorithm with a primary loop based on flow control. The VFD based pump 1 is used for low demand period flows. The operator will select the flow setpoint based on average day demand for the Horton zone, the setpoint will be modified to a lower rate in proportion of a dropping 441' zone pressure.

4. In the event communications is lost from the City Shops, the station operation will continue operation using the last set of automatic control setpoints. The station does not require continuous communication with the City Shops to maintain pressure and flow delivery requirements.

5. Fail safe pump logic shall include protection against low suction pressure, high discharge pressure, too many starts, coincidental start, and fail to run conditions.

6. Energy efficiency monitoring shall be programmed into the SCADA. This shall include total kW consumed by each motor, cost per hour to operate the motor, and overall station efficiency for the pump based on theoretical horsepower vs applied electrical energy. All values shall be visible at both the City Shops and the station.

PART 3 EXECUTION

3.1 Panels and Panel Mounted Equipment

A. Panels and panel-mounted equipment shall be pre-assembled at the control supplier's factory. No work, other than correction of minor defects or minor transit damage, shall be done to the panels at the job site.

B. Panels shall be mounted where shown. Contractor shall anchor the panels as shown. Provide shims as required to set panels level. Conflicts with other equipment shall be brought to the attention of the Engineer for direction before taking any further action.

C. Panel Assemblies

1. The supplier shall assume single source responsibility for each panel assembly. A panel assembly may include mounting and wiring of relays, motor starters, transformers, and disconnecting means, or other control devices as specified by customer-supplied documentation.

2. The supplier shall provide mounting and wiring of the panel assembly in a NEMA type enclosure as specified.

3. The supplier shall wire all controller inputs and outputs to terminal blocks as specified.

4. The panel assembly shall include fuse blocks as required.

5. All electrical control products within the panel assembly shall be grounded to meet equipment specifications.

6. All cables (with associated plugs, connectors and receptacles) requiring user field installation shall be designed for use in an industrial environment.

7. Upon receipt of the purchase order, but prior to starting the manufacture of any panel assembly, the supplier shall submit drawings, as specified, of all panel assemblies for approval.

8. At the time a panel assembly is shipped, one (1) complete, reproducible copy of the panel assembly drawings shall be provided with the panel assembly.

3.2 Installation

A. Protection During Construction: Throughout this Contract, the Contractor shall provide protection for materials and equipment against loss or damage and from the effects of the weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions.

B. Material and Equipment Installation: Follow manufacturer's installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturer's instructions, and these Contract Documents, follow Engineer's decision, at no additional cost to Owner. Keep copy of manufacturer's instructions on the job site available for review at all times.

C. The Contractor shall bear ultimate responsibility and shall provide for the supply, installation, adjustment, and startup of a complete, coordinated System that shall reliably perform the specified functions.

D. The Contractor shall make all final power and signal connections (hydraulic, pneumatic, and electric) to all elements provided under this section. The Contractor shall verify and certify by written notice to the Engineer, the correctness of final signal connections and the correctness of adjustment for all elements provided under this section and all elements interfaced with the System

E. Cleaning and Touch-up Painting: Keep 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, and 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.

3.3 Electrical Power and Signal Wiring

A. Control and signal wiring in panels shall be restrained by plastic ties or ducts.

1. Hinge wiring shall be double secured at each end with mechanically fastened, not adhesive, tie blocks or straps.

2. Hinge crossings shall be either longitudinal crossings with a minimum length of 12 inches, so that any bending or twisting will be around the longitudinal axis of the wire, or loop crossings with a minimum loop diameter of 6 inches.

3. The entire length of wire in the bend area, (between the tie blocks) shall be protected from abrasion with either convoluted tubing or spiral wrap.

4. Wire bundles that pass through holes shall be protected from abrasion with either grommets or sleeves.

5. Wires that pass across edges of sheet metal shall be protected from abrasion.

B. Arrange wiring neatly, cut to proper length, and remove surplus wire.

C. Use manufacturer's recommended tool with the proper sized anvil for all crimp terminations. No more than two wires may be terminated in a single crimp lug and no more than two lugs may be installed on a single screw terminal.

1. All crimp lugs used in applications with two wires terminated in a single crimp lug shall be rated by the manufacturer for multiple wire use.

D. Wiring shall not be spliced or tapped except at device terminals or terminal blocks.

3.4 Testing, Start-Up, and Training

A. All elements of the System shall be tested to demonstrate that the System satisfies all of the requirements of this Specification.

B. The Contractor shall provide all special testing materials and equipment.

C. The Contractor shall coordinate all of his testing with the Engineer, equipment manufacturer’s representatives and all associated sub-contractors.

D. As a minimum, the testing shall include the following:

1. Factory tests: Prior to shipment, all panel assemblies shall be tested for proper operation at the manufacturer's factory. Results of the factory tests shall be recorded and submitted for approval before shipment of any panel assembly to the project site.

2. Operational Acceptance Tests

a. The objective of these tests are to demonstrate that the System is READY for final operation.

b. The System shall be checked for proper installation, adjustment, and calibration on an “element-by-element” basis to verify that it functions as specified and that all terminations have been made correctly.

c. All discrete element set points shall be adjusted and checked for proper operation (e.g., interlock function, contact closure on rising/falling P.V., etc.).

d. All analog loops shall minimum, 4-20mA analog signals shall be tested at 0, 4, 8, 12, 16, 20, and 24mA.

e. All initial controller tuning constants shall be adjusted to preliminary settings as recommended by the manufacturer.

f. The "Operational Acceptance Tests" shall be completed prior to starting the "Functional Acceptance Test". The actual testing program shall be conducted in accordance with prior approved procedures and shall be documented.

3. Functional Acceptance Tests

a. The objective of these tests are to demonstrate that the System operates correctly and complies with the specified performance requirements. All data points shall be tested by activating the field elements and verifying proper System response. The Contractor shall provide a minimum of (1) day Functional Acceptance Test for each control panel by qualified personnel. One day of testing shall constitute eight (8) hours of on-site work. During this period, the Contractor’s personnel shall operate the System under normal and all alarm conditions to simulate all operating modes of all equipment.

b. A witnessed "Functional Acceptance Test" shall be performed on the System. Each function shall be demonstrated to the satisfaction of the Engineer.

c. Each instrument and final element shall be field calibrated in accordance with the manufacturer’s recommended procedure and then tested in accordance with the Contractor’s approved test procedure. Data shall be entered on the applicable test form at the time of testing. Alarm trips, control trips, and switches shall be set to initial values. Final elements shall be checked for range, dead-band, and speed of response. Any component that fails to meet the required tolerances shall be repaired by the

manufacturer or replaced, and the above tests repeated until the component is within tolerance.

d. Adjust tuning constants as required for proper System operation. Provide final tuning constant information in tabular form for inclusion in the Operation and Maintenance Manuals.

e. Each test shall be witnessed and signed off by the Contractor, the Engineer, and the Owner's representative upon satisfactory completion.

f. The actual testing program shall be conducted in accordance with the prior approved procedures and shall be documented as required.

g. The Contractor shall notify the Engineer, and submit the specified test reports of the "Operational Acceptance Tests," at least 1 week prior to the date of the "Functional Acceptance Test".

E. Provide minimum 4 hours of Owner training. Training shall include panel safety, indicator pushbutton and pilot device operation, troubleshooting, and spare parts inventory.

END OF SECTION

Appendix D

TECHNICAL SPECIAL PROVISIONS TO ODOT/APWA 2015 STANDARD SPECIFICATIONS FOR SKYLINE DRIVE STREET AND STORMWATER IMPROVEMENTS (SCHEDULE D)

TECHNICAL SPECIAL PROVISIONS

WORK TO BE DONE

The Work to be done under Schedule D of the Contract consists of the following Skyline Drive Sidewalk Improvements work within the public right-of-way on the Bolton Reservoir Replacement Project in the City of West Linn:

1. Install, maintain and remove temporary traffic control devices.
2. Install, maintain and remove erosion control measures.
3. Cutting and removing trees.
4. Perform earthwork and grading.
5. Construct retaining wall.
6. Install storm sewer pipes and inlets.
7. Construct aggregate base.
8. Construct ACP pavement.
9. Construct concrete curbs and walks.
10. Install permanent striping.
11. Remove existing permanent signing.
12. Install landscaping.
13. Perform additional and incidental Work as called for by the Specifications and Plans.

APPLICABLE SPECIFICATIONS

The Specifications that are applicable to the Work on this Schedule (Schedule D) is the 2015 edition of the "Oregon Standard Specifications for Construction".

All number references in these Technical Special Provisions shall be understood to refer to the Sections and subsections of the Standard Specifications bearing like numbers and to Sections and subsections contained in these Technical Special Provisions in their entirety.

CLASS OF PROJECT

This is a Local Agency project.

CITY OF WEST LINN, OREGON

TECHNICAL SPECIAL PROVISIONS

FOR

Bolton Reservoir Replacement Project
Schedule D - Skyline Drive Street and Stormwater Improvements
City of West Linn, Clackamas County

PROFESSIONAL OF RECORD CERTIFICATION(s):

Seal w/signature	I certify the Technical Special Provision Section(s) listed below are applicable to the design for the subject project for temporary traffic control, temporary erosion control, drainage, earthwork, roadway, retaining walls, pavements, permanent sign removal and permanent striping. Modified Special Provisions were prepared by me or under my supervision.
 EXPIRES: 12/31/2015	Section 00210, 00220, 00225, 00280, 00290, 00305, 00310, 00320, 00330, 00331, 00340, 00390, 00405, 00415, 00440, 00442, 00445, 00470, 00490, 00495, 0B596, 00610, 00620, 00641, 00730, 00744, 00748, 00749, 00759, 00850, 00851, 00865, 00867, 00905, 01050, 01070, 02010, 02050, 02320, 02450, 02560, 2910
Date Signed: 9/3/15	

CITY OF WEST LINN, OREGON

TECHNICAL SPECIAL PROVISIONS

FOR

Bolton Reservoir Replacement Project
Schedule D - Skyline Drive Street and Stormwater Improvements
City of West Linn, Clackamas County

PROFESSIONAL OF RECORD CERTIFICATION(s):

Seal w/signature	I certify the Technical Special Provision Section(s) listed below are applicable to the design for the subject project for permanent seeding and planting. Modified Special Provisions were prepared by me or under my supervision.
	Section 01030 and 01040
Date Signed: 9/4/15	

TABLE OF CONTENTS FOR TECHNICAL SPECIAL PROVISIONS

SECTION 00210 - MOBILIZATION

Comply with Section 00210 of the Standard Specifications.

SECTION 00220 - ACCOMMODATIONS FOR PUBLIC TRAFFIC

Comply with Section 00220 of the Standard Specifications modified as follows:

00220.02 Public Safety and Mobility - Add the following bullet to the end of the bullet list:

When performing trench excavation or other excavation across or adjacent to a Traffic Lane on a roadway having a pre-construction posted speed of 25 mph or greater, backfill the excavation, install surfacing, and open the roadway to traffic by the end of each work shift. Install a "BUMP" (W8-1-48) sign approximately 100 feet before the backfilled area and a "ROUGH ROAD" (W8-8-48) sign approximately 500 feet ahead of the "BUMP" sign. If this requirement is not met, maintain all necessary lane or shoulder closures and provide additional TCM, including flagging, at no additional cost to the Agency. Do not use temporary steel plating to reopen the roadway.

- Notify all emergency services of all changes to the traffic control prior to completing the change. Notify the Police and Fire of all lane closures.

- When an abrupt edge is created by excavation, protect traffic using the “ABRUPT PAVEMENT EDGE DETAIL” and the “TYPICAL ABRUPT EDGE SIGNING DETAIL” configurations shown on the standard drawings.

- Contractor shall coordinate construction activities with adjacent property owners to maintain driveway access at all times or the satisfaction of the property owner.

00220.40 General Requirements – Add the following to the end of this subsection:

(f) Road Closures – Skyline Drive from Clark Street (STA S20+00) to the high school parking lot driveway (STA S41+40) may be closed from June 13, 2016 to August 12, 2016 if needed for construction. Contractor shall submit a request as part of the traffic control plan and the request must be approved by the City prior to the road closure. A detour plan shall be submitted with the traffic control plan for approval.

A flagger shall be required at each end of the road closure to allow for property owner access in and out of the work zone during shift work. Install “ROAD CLOSED TO THRU TRAFFIC” (R11-4) sign at the end of each work shift. Property owner access to driveways shall be maintained at all times unless otherwise approved.

SECTION 00225 - WORK ZONE TRAFFIC CONTROL

Comply with Section 00225 of the Standard Specifications modified as follows:

00225.02 General Requirements - In the paragraph that begins "Work may be suspended…", replace the sentence that begins "Costs for work performed…" with the following sentence:

Costs for work performed by the Agency may be deducted from monies due the Contractor.

Add the following to the end of this subsection:

Install "ROAD WORK AHEAD" (W20-1-48) signs according to the "TCD Spacing Table" shown on the standard drawings or as modified by the supplemental drawings.

Install beyond each end of the Project, facing outgoing traffic, an "END ROAD WORK" (CG20-2A-24) sign a distance of (A ÷ 2) according to the "TCD Spacing Table" shown on the standard drawings or as modified by the supplemental drawings.

00225.10 General - In the paragraph that begins "Evaluate the condition…", replace the first sentence with the following sentence:

Evaluate the condition of TCD using the criteria shown in the most current version in effect of the American Traffic Safety Services Association (ATSSA) publication titled "Quality Guidelines for Temporary Traffic Control Devices and Features", available from the ATSSA website at www.atssa.com.

00225.11(c-1) Temporary Signs - Replace the bullet that begins "Type 2 riprap geotextile…" with the following bullet:

- Geotextile fabric

00225.41(b-4) Temporary Sign Supports - Replace the bullet that begins "Do not tip over TSS…" with the following bullet:

- Do not tip over any TSS that is exposed to traffic, unless approved by the Engineer or the TSS is protected from traffic by a barrier system.

00225.41(c) Sign Flag Boards and Sign Flags - Replace this subsection, including subsections 00225.41(c-1) and 00225.41(c-2), with the following subsection:

00225.41(c) Sign Flag Boards - Install two sign flag boards, as shown or specified.

SECTION 00280 - EROSION AND SEDIMENT CONTROL

Comply with Section 00280 of the Standard Specifications modified as follows:

00280.42(c) Permanent Stabilization – Add the following to the end of this subsection:

All vegetated areas disturbed by the Contractor’s operations beyond that shown shall be permanently restored to pre-existing conditions or to the satisfaction of the Engineer.

00280.48 Emergency Materials - Add the following paragraphs after the paragraph that begins "Provide, stockpile, and protect...":

Provide and stockpile the following emergency materials on the Project site:

Item	Quantity
Wattles	100 feet
Plastic Sheeting	500 square yards
Sediment Fence	100 feet

SECTION 00290 - ENVIRONMENTAL PROTECTION

Comply with Section 00290 of the Standard Specifications modified as follows:

00290.90 Payment – add the following bullets to the end of this section:

- Orange plastic mesh fence designating the no work zone area

SECTION 00305 - CONSTRUCTION SURVEY WORK

Section 00305, which is not a Standard Specification, is included for this Project by Special Provision.

Description

00305.00 Scope - Provide construction survey work according to the current edition on the date of Advertisement, of the ODOT "Construction Surveying Manual for Contractors". This manual is available on the web at:

http://www.oregon.gov/ODOT/HWY/GEOMETRONICS/Pages/documents.aspx

All survey staking information provided by the Agency is shown on the project plans. Additional information or clarification by the Engineer may be available upon request.

Measurement

00305.80 Measurement - No measurement of quantities will be made for construction survey work.

Payment

00305.90 Payment - The accepted quantities of construction survey work will be paid for at the Contract lump sum amount for the item "Construction Survey Work".

Payment will be payment in full for furnishing all material, equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for any temporary protection and direction of traffic measures including flaggers and signing necessary for the performance of the construction survey work.

No separate or additional payment will be made for preparing surveying documents including but not limited to office time, preparing and checking survey notes, and all other related preparation work.

Costs incurred caused by survey errors will be at no additional cost to the Agency. Repair any damage to the Work caused by Contractor's survey errors at no additional cost to the Agency. The Engineer may make an equitable adjustment, which may decrease the Contract Amount, if the required survey work is not performed.

SECTION 00310 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Comply with Section 00310 of the Standard Specifications modified as follows:

00310.41(a) Removal Work – Add the following at the end of the first paragraph:

The Contractor shall immediately vacuum all saw cutting waste and dispose of it in a legal manner.

SECTION 00320 - CLEARING AND GRUBBING

Comply with Section 00320 of the Standard Specifications modified as follows:

00320.40(a) Clearing Operations – In the paragraph that begins with the sentence “Cut off tree stumps…”, add the following bullets:

- Comply with Section 00290.36 Protection of Wildlife and Wildlife Habitat.

00320.40(b) Preserving and Trimming Vegetation - Replace this subsection with the following subsection:

00320.40(b) Preserving Vegetation and Other Natural Materials:

(1) Within the Work Areas - Avoid injuring vegetation or other natural materials designated to be saved. Preservation of this vegetation includes protection and special care.

(2) Outside the Work Areas - Avoid injuring vegetation or other natural materials. Confine operations which may injure vegetation or other natural materials to the work area or to areas that have already been cleared.

Add the following subsection:

00320.40(c) Tree and Vegetation Trimming - Trim trees according to good tree surgery practices, as directed, and according to the following:

- Do not leave unsound branches of trees in place.
- Trim branches over roadways and bridges to provide at least 20 feet of clearance above the roadway surface.
- Trim branches over walks to provide at least 8 feet of clearance above the walk surface.
- Trim branches that obstruct sight distance at intersections or impair the visibility of signs.

Keep equipment and materials off of the critical root zone as directed.

Remove hazardous, dead, and damaged trees outside the clearing limit as directed.

00320.42 Disposal of Matter - Replace this subsection with the following subsection:

00320.42 Ownership and Disposal of Matter - All matter and debris accumulated from clearing and grubbing operations become the Contractor's property at the place of origin. Dispose of all matter and debris according to 00290.20.

00320.90 Payment - Replace the paragraph that begins "No separate or additional payment…" with the following paragraph:

No separate or additional payment will be made for work zone fencing.

SECTION 00330 - EARTHWORK

Comply with Section 00330 of the Standard Specifications modified as follows:

00330.03 Basis of Performance - Add the following paragraph to the end of this subsection:

Perform all earthwork under this Section on the excavation basis.

00330.41(a-5) Waste Materials - Replace this subsection, except for the subsection number and title, with the following:

Dispose of waste materials according to Section 00235 of these special provisions.

00330.41(a-6) Excavation of Existing Surfaces – Add the following to the end of this subsection:

Remove sidewalk and surfacing as shown on the Plans. Sidewalk and surfacing to be removed shall be cut in neat, straight lines with vertical edges along the limits of pavement removal. The cut lines for removal of asphaltic or cement concrete pavement shall be reviewed and approved by the Engineer in the field before cutting. Demolish and remove

curbs as directed by the Engineer or as shown. Make a vertical saw cut between any existing curb that is to remain and portion that is to be removed. Remove pavement adjacent to the curb as shown on the Plans.

00330.41(a-9) Excavation Below Grade - Delete subsection 00330.41(a-9-c).

00330.42(c-3) Embankment Slope Protection - Add the following paragraph:

Construct the outer 12 inches of embankments with suitable materials to establish slope stabilization through permanent seeding. If suitable material is not available, provide suitable materials from a Contractor-provided source which conforms to the requirements of 00330.11 or 00330.13 and provides favorable conditions for germination of seed and growth of grass.

00330.91(d) General Excavation - Delete the bullet that begins "Includes unsuitable material…" and add the following bulleted items:

- Includes all material within the excavation limits including but not limited to curbs, walks, surfacing, concrete panels, asphalt, aggregate and earth as necessary to excavate to subgrade depth for the proposed roadway, curb and walks as shown on the Plan and in the typical sections.
- Excludes excavation necessary for retaining wall construction.
- Payment for removal of any item outside the limits shown in the Contract must first require written authorization from the Engineer.
- Payment for surfacing removed via cold plane pavement removal will be paid for separately under Section 00620.

00330.92 Kinds of Incidental Earthwork - Add the following bullet to the end of the bullet list:

- Earthwork required for driveways and road approaches. Earthwork for driveways and road approaches will be that which is outside the neat line limits shown on the typical sections.

00330.94 Embankment Basis Payment - Delete the paragraph that begins "Excavation of unstable…".

SECTION 00331 - SUBGRADE STABILIZATION

Comply with Section 00331 of the Standard Specifications.

SECTION 00340 - WATERING

Comply with Section 00340 of the Standard Specifications.

SECTION 00390 - RIPRAP PROTECTION

Comply with Section 00390 of the Standard Specifications modified as follows:

00390.80 Measurement – Add the following to the end of this subsection:

(d) Culvert Embankment Protection – Culvert embankment protection will be measured on a unit basis of locations constructed.

00390.90 Payment – Add the following pay item to the list:

(g) Culvert Embankment Protection..... Each

SECTION 00405 - TRENCH EXCAVATION, BEDDING, AND BACKFILL

Comply with Section 00405 of the Standard Specifications.

SECTION 00415 - VIDEO PIPE INSPECTION

Comply with Section 00415 of the Standard Specifications.

SECTION 00440 - COMMERCIAL GRADE CONCRETE

Comply with Section 00440 of the Standard Specifications modified as follows:

00440.13 Field-Mixed Concrete - Add the following paragraph to the end of this subsection:

Pre-packaged dry blended concrete meeting the requirements of 00440.12 may be used for work items listed in 00440.14(a).

SECTION 00442 - CONTROLLED LOW STRENGTH MATERIALS

Comply with Section 00442 of the Standard Specifications.

SECTION 00445 - SANITARY, STORM, CULVERT, SIPHON, AND IRRIGATION PIPE

Comply with Section 00445 of the Standard Specifications.

SECTION 00470 - MANHOLES, CATCH BASINS, AND INLETS

Comply with Section 00470 of the Standard Specifications.

SECTION 00490 - WORK ON EXISTING SEWERS AND STRUCTURES

Comply with Section 00490 of the Standard Specifications modified as follows:

00490.43 Abandoning Pipe in Place – In the second paragraph that begins “Fill abandoned pipes…”, replace “12 inches diameter” with “6 inches diameter”.

00490.90 Payment – Add the following pay items:

(i) Add or Replace Manhole Adjustment Rings ..... Each

Add the following to the end of this subsection:

Item (i) includes adding or replacing manhole adjustment rings as shown or directed.

SECTION 00495 - TRENCH RESURFACING

Comply with Section 00495 of the Standard Specifications.

SECTION 0B596 - PREFABRICATED MODULAR RETAINING WALLS

Section 0B596, which is not a Standard Specification, is included in this Project by Special Provision.

Description

0B596.00 Scope - This work consists of furnishing and constructing prefabricated modular gravity retaining walls as shown and specified.

0B596.01 Proprietary Prefabricated Modular Walls - Select one of the following preapproved Prefabricated Modular proprietary retaining wall systems for the wall, as shown:

- Ultrablock™ Retaining Wall System with quarried stone face, provided by Ultrablock, Inc., telephone: 1-800-377-3877.

0B596.03 Definitions:

Appurtenances - Traffic barriers, guardrail, fences, non-standard coping, drainage structures, sign supports, lighting supports, sound barriers, foundations, and utilities that are

not part of the retaining wall system but are connected to, resting on, or passing through the retaining wall system.

Alternate Gabion Basket Joint Fasteners - Spiral binders or high tensile locking spring steel clip or clamp-on ring type fasteners specified as an alternate to tie wire for assembling and joining gabion units.

Batter - The slope of the wall facing from vertical that is expressed as degrees or as a ratio of the horizontal change in inches for each 12 inches of vertical change. A vertical face has a zero batter.

Bin Wall - A prefabricated modular gravity retaining wall system type composed of metal or precast concrete modules backfilled with granular structure backfill material.

Crib Wall - A prefabricated modular gravity retaining wall system type composed of interlocking longitudinal and transverse beams made of precast reinforced concrete and backfilled with granular structure backfill material.

Dry Cast Concrete Block Gravity Wall - A prefabricated modular gravity retaining wall system type composed of dry cast concrete blocks without soil reinforcements.

Gabion Gravity Wall - A prefabricated modular gravity retaining wall system type composed of assembled wire baskets that are connected together, filled with specified rock.

Manufacturer - The fabricator having exclusive production rights for a proprietary retaining wall system.

Nonproprietary Retaining Wall System - A retaining wall system that is not patented or trademarked and is shown on the plans.

Piecemark - An alpha-numeric marking that identifies a specific type of retaining wall component. All components with the same piecemark are considered identical. Piecemarks shown on the working drawings identify placement of the component.

Preapproved Proprietary Retaining Wall System - A wall system that is listed in Appendix 15-D of the Geotechnical Design Manual (GDM).

Preapproved Proprietary Retaining Wall System Options - Acceptable preapproved proprietary retaining walls listed in 0B596.01 when proprietary retaining wall systems are required.

Preapproved Proprietary Retaining Wall System Alternates - Acceptable preapproved proprietary retaining walls listed in 0B596.01 when non-proprietary retaining wall systems are shown.

Prefabricated Modular Retaining Wall System - A basic gravity retaining wall system type composed of solid or hollow prefabricated concrete or steel modules. Hollow modules are typically backfilled with granular structure backfill material. Prefabricated modular retaining walls include metal and precast concrete bin, precast concrete crib, gabion, dry cast concrete block, and wet cast concrete block gravity retaining walls.

Proprietary Retaining Wall System - A retaining wall system that is protected by trademark, patent, or copyright and is produced or distributed by a manufacturer having exclusive rights.

Retained Backfill - Unreinforced backfill within a distance of H/2 behind the back of the wall, where H is the total height of the wall excluding the leveling pad or footing.

Retaining Wall System - An engineered system of structural and geotechnical components that restrains a mass of earth. The terms "retaining wall system", "retaining structure", and "retaining wall" are used interchangeably.

Wet Cast Concrete Block Gravity Wall - A gravity retaining wall system type composed of wet cast concrete blocks without soil reinforcements.

0B596.04 Proprietary Retaining Walls - Submit the following at least 30 Calendar Days before beginning construction of proprietary retaining walls:

- Complete stamped working drawings and design calculations prepared by the Manufacturer according to 00150.35.
- Manufacturer's field construction manual.
- Manufacturer's field representative name and qualifications.

Field verify existing ground elevations and bottom of wall elevations before preparing and submitting working drawings.

Obtain the Engineer's written approval before beginning construction of the wall system.

(a) Working Drawings - Working drawings according to 00150.35 are drawings that meet the requirements of the project documents, the AASHTO LRFD Bridge Design Specifications, as modified by the ODOT GDM, and are consistent with the preapproved retaining wall system.

Include the following items in the working drawings, as applicable:

- **General Notes** - Information for design and construction of the retaining wall.
- **Plan View:**
  - Construction centerline and related horizontal curve data.
  - Centerline station and offset to the wall control line or face of wall including the beginning and end points of the retaining wall.
  - Location, type and size of all appurtenances.
  - Location of right-of-way and easement boundaries, staged construction, designated wetlands, and all other highway structures, features, or facilities or other construction constraints.
- **Elevation View:**
  - Wall vertical curve data and wall elevations at a sufficient number of points along the top of wall that defines the top of wall alignment.

- Field verified elevations of original and final ground lines and foundation bearing elevation along face of the wall.
- Vertical dimensions of steps along the wall base (foundation bearing elevation).
- Centerline stations and elevations at the beginning and end of the wall.
- Horizontal offsets.
- Changes in the top of wall slope.
- Layout of prefabricated modular units.
- Architectural treatment.

- **Typical Sections:**

  - Typical sections at intervals of 50 feet or less along the wall.
  - Wall construction limits.
  - Original and final ground lines across typical sections, including roadways, highway structures, and other facilities.
  - Construction centerline stationing at each typical section.

- **Structural and Geometric Details:**

  - Leveling pad details, showing depths and limits of proposed excavation beyond the neat lines of the wall.
  - Prefabricate modular unit details.
  - Final front face architectural details.
  - Final front face batter.
  - Reinforcing bar bend details.
  - Surface and subsurface drainage details for the wall.
  - Prefabricated modular unit construction details at utility and drainage facilities, overhead sign support footings, guardrails, traffic barriers, piles, shafts, or other structures.
  - Maximum inclinations of wall backslope and foreslope.
  - Elevation, slope, and width of wall bench in front of wall.
  - Locations of anticipated shoring.

- **Appurtenances:**

  - Wall appurtenance details needed to construct the wall.
  - Wall appurtenance details that are required but not fully detailed on the plans.

- **Wall Construction Methods and Construction Sequence:**

  - Wall construction methods.
  - Construction sequence.
  - Locations of all shoring.

- **Materials and Quantity Summary List** - All items of each wall.

(b) Design Calculations - Design calculations are calculations that meet the requirements of the project documents, AASHTO LRFD Bridge Design Specifications, as modified by the ODOT GDM, and are consistent with the preapproved retaining wall system, and according to 00150.35.

Include the following items in the design calculations, as applicable:

- **Design Limits:**
  - Structural and geotechnical design input parameters and design assumptions.
  - Wall design loads, load combinations, load factors, and resistance factors for each limit state.
- **Methodology:**
  - Design steps with a detailed design narrative explaining the design and demonstrating how the design meets all applicable design requirements.
  - Explanation of all symbols and variables used in the calculations.
  - A set of hand calculations verifying typical computer generated output.
- **External Stability Calculations** - Calculations showing that the retaining wall system meets external stability requirements, including overturning, sliding, and bearing capacity.
- **Internal Stability Calculations:**
  - Calculations showing that the retaining wall meets internal stability requirements at each level of the wall.
  - Calculations showing adequate structural resistance of prefabricated modular units.
- **Compound Stability** - Calculations showing that the retaining wall meets compound stability requirements.
- **Appurtenances:**
  - Design calculations for wall appurtenances that are required but not fully detailed on the plans.
  - Calculations for all appurtenance load effects on the wall.

Retaining wall design parameters vary and are dependent upon backfill materials used by the Contractor. Manufacturer shall be responsible for determining the needed design parameters required for design and construction of the required walls and must state the assumed values used for design in the submittal calculations:

(c) Manufacturer's Field Construction Manual - A field construction manual according to 00150.37, is prepared by the manufacturer and includes detailed instructions for constructing the retaining wall.

0B596.05 Nonproprietary Retaining Wall Submittals - Submit complete unstamped working drawings according to 00150.35 at least 30 Calendar Days before beginning construction of nonproprietary retaining walls. Field verify existing ground elevations and bottom of wall elevations before preparing and submitting working drawings. Obtain the Engineer's written approval before beginning construction of the wall system.

Materials

0B596.10 General:

(a) Proprietary Retaining Wall Systems - Provide all proprietary retaining wall system components from the same wall manufacturer. If there are conflicts between the Manufacturer's requirements and the Agency's requirements, the Agency's requirements prevail.

(b) Nonproprietary Retaining Wall Systems - Provide materials according to the applicable material Specifications.

(c) Quality Control - Provide quality control according to Section 00165.

0B596.11 Backfill:

(a) Gravel Leveling Pads Backfill - Furnish dense graded 1" - 0 or the 3/4" - 0 aggregate base material for leveling pads meeting the requirements of 02630.10.

(b) Modular Block Core and Drainage Backfill - Furnish 3/4" - No. 4 PCC aggregate material meeting the requirements of 02690.20 (a) through (f).

(c) Gabion Basket Fill - Furnish a durable well graded 4 to 8 inch size rock material meeting the requirements of 00390.11(b).

(d) Granular Structure Backfill - Furnish dense graded 1" - 0 or 3/4" - 0 aggregate base material meeting the requirements of 02630.10 and the following:

(1) Material Passing No. 200 Sieve - The amount of material passing the No. 200 sieve shall not exceed 15 percent by weight. Test according to AASHTO T 27 and AASHTO T 11.

(2) Plasticity Index - The plasticity index of the material passing the No. 40 sieve shall not exceed 6. Test according to AASHTO T 90.

(e) Pipe Drain Backfill - Furnish granular drain backfill material for drainage pipes meeting the requirements of 00430.11.

0B596.12 Concrete:

(a) Cast-in-Place Concrete for Leveling Pads - Furnish commercial grade concrete for leveling pads meeting the requirements of Section 00440.

(b) Precast Concrete Bin Units - Furnish precast concrete bin units with the following properties:

(1) Portland Cement Concrete - Class 4000 - 3/4 structural concrete meeting the requirements of Section 00540.

(2) Casting - Place concrete in each bin unit without interruption and consolidate with an approved vibrator. Use a release agent throughout the casting operation.

(3) Supporting and Curing - Maintain full support, cure the units, and do not strip or remove the forms from the units until the concrete has obtained a minimum compressive strength of at least 1,000 psi.

(4) Finish - Finish the bin unit front face with a general surface finish according to 00540.53(a).

(5) Tolerances - Manufacture units within the following tolerances:

a. Unit Dimensions - Within ± 1/2 inch between diagonals. Within ± 3/16 inch for all other unit dimensions.

b. Unit Face - Smooth formed surfaces within ± 3/32 inch when measured with a 3 foot straight edge. Textured-finished surfaces within ± 3/16 inch when measured with a 3 foot straight edge.

(6) Acceptance of Bin Unit Concrete Strength - Acceptance will be according to 00540.17, except acceptance of concrete strength will be determined based on production sublots. A production sublot will consist of either 10 units or a single day's production, whichever is less. Cast one set of cylinders for each production sublot. The concrete strength of a production sublot will be represented by a single compressive strength test on a cylinder.

(7) Marking - On the rear face of each unit scribe the date of manufacture, the production sublot number, and the piecemark.

(8) Handling, Storage, and Shipping - Do not allow chipping, discoloration, cracks, fractures and connecting device damage during handling, storing, and shipping. Support stored units on firm blocking.

(9) Rejection - Units not meeting the requirements of this subsection will be rejected.

(c) Dry Cast Concrete Blocks - Furnish dry cast concrete blocks with the following properties:

(1) Aggregate, Strength, Freeze-Thaw Durability, Unit Weight, and Water Absorption:

- Aggregate meeting the requirements of ASTM C 33.
- Blocks meeting the requirements of ASTM C 1372.
- The average of three coupons or cores have minimum compressive strength of 4,000 psi as tested according to ASTM C 140.
- Individual coupons or cores have a minimum compressive strength of 3,500 psi as tested according to ASTM C 140.
- A minimum oven-dry unit weight of 125 pcf as tested according to ASTM C 140.
- Test, no longer than 18 months before delivery, freeze-thaw durability of five test specimens made with the same materials, concrete mix design, manufacturing process, and curing method that will be used on the project. At least four of the five test specimens shall have a weight loss of not more than 1 percent of the block's initial weight after 150 freeze-thaw cycles as tested according to ASTM C 1262.
- A maximum water absorption of 1 percent above the water absorption of the sublot of blocks that were produced and passed the freeze thaw test. For the water absorption testing, do not use the same blocks used for the freeze-thaw test.

(2) Portland Cement - Portland cement meeting the requirements of 02010.10.

(3) Blended Hydraulic Cement - Blended hydraulic cement meeting the requirements of 02010.20.

(4) Tolerances - Manufacture within the following geometric tolerances:

- Molded length and width dimensions within ± 1/8 inch of the block manufacturer's nominal length and width dimensions.
- Molded height dimension within ± 1/16 inch of the block manufacturer's nominal height dimension.
- Rear height does not exceed the front height.
- Top and bottom face groove dimensions within the tolerances specified by the manufacturer.

(5) Color - Consistent natural color of dry cast concrete.

(6) Finish – Architectural face (quarried stone) units that when viewed from a distance of 10 feet under diffused light, chips, cracks, and other imperfections are not detectable.

(7) Acceptance of Blocks - Acceptance will be determined on tolerances, visual inspection, compressive strength, water absorption, freeze-thaw durability, and unit weight. Acceptance of compressive strength, water absorption, and unit weight will be based on production sublots. The maximum number of blocks per production sublot is 2,000 blocks. Test blocks at the frequency of one set for each production sublot. Acceptance of freeze-thaw durability will be based on the freeze-thaw testing requirements of 0B596.12(c-1).

(8) Marking - Indicate the date of manufacture and the production sublot number on each sublot of dry cast concrete blocks.

(9) Handling, Storage, and Shipping - Do not allow chipping, discoloration, cracks, or fractures during handling, storing and shipping.

(10) Rejection - Blocks not meeting the requirements of this subsection will be rejected.

(d) Wet Cast Concrete Blocks - Furnish wet cast concrete blocks with the following properties:

(1) Concrete - Commercial grade concrete meeting the requirements of Section 00440.

(2) Marking - The rear face of each block is scribed with the date of manufacture, the production sublot number, and the piecemark.

(3) Color - Consistent natural color of wet cast concrete.

(4) Finish - Smooth face blocks that, when viewed from a distance of 10 feet under diffused light, chips, cracks, and other imperfections are not detectable.

(5) Tolerances - Molded length and width dimensions within 1/4 inch from the manufacturer's dimensions. Molded height dimension within 1/8 inch of the manufacture's dimension.

(6) Handling, Storing, and Shipping - Do not allow chipping, discoloration, cracks, or fractures during handling, storing, and shipping.

(7) Acceptance of Blocks - Acceptability will be determined by tolerances, visual inspection, and concrete strength. Concrete strength will be based on production sublots. A production sublot is 20 blocks or a single day's production, whichever is less. The production sublot will be represented by a single compressive strength sample of one set of cylinders.

(8) Rejection - Blocks not meeting the requirements of this subsection, or any of the following defects will be rejected:

- Honeycombed or open texture concrete.
- Extreme color variation on front face of block.

(e) Precast Concrete Crib Walls - Furnish precast concrete crib walls with the following properties:

(1) Portland Cement Concrete - Furnish Class 4000 - 3/4 structural concrete meeting the requirements of Section 00540.

(2) Color - Consistent natural color of wet cast concrete.

(3) Finish - Smooth crib wall members that, when viewed from a distance of 10 feet under diffused light, chips, cracks, and other imperfections are not detectable.

(4) Tolerances - Manufactured within ± 1/8 inch of the Manufacturer's nominal dimensions.

(5) Handling, Storing, and Shipping - Do not allow chipping, discoloration, cracks, or fractures during handling, storing, and shipping.

(6) Acceptance of Concrete Strength - Acceptance of concrete strength will be determined based on production sublots. A production sublot will consist of either 100 crib wall members or a single day's production, whichever is less. Cast one set of cylinders for each production sublot. The concrete strength of a production sublot will be represented by a single compressive strength test on a cylinder.

(7) Rejection - Crib units not meeting the requirements of this subsection will be rejected.

0B596.13 Steel:

(a) Steel Reinforcement for Concrete - Furnish steel reinforcement for concrete meeting the requirements of Section 00530.

(b) Metal Bin Gravity Walls - Furnish metal bin walls meeting the requirements of Section 02350.

(c) Gabion Baskets - Furnish gabion baskets meeting the requirements of Section 02340.

0B596.14 Geosynthetics:

(a) Geotextile Filter Layer for Subsurface Drainage Systems - Furnish Type 1, Level B, drainage geotextile according to Section 02320.

(b) Geotextile Filter Layer Between Backfill and Gabion Walls - Furnish Type 2, Level B, riprap geotextile according to Section 02320.

(c) Geotextile Filter Layer Between Backfill and Other Prefabricated Modular Walls - Furnish Type 1 or Type 2, Level B, drainage geotextile according to Section 02320.

(d) Modular Block Drainage Fill Geotextile Filter - Furnish Type 1, Level B, drainage geotextile according to Section 02320.

(e) Perforated Drain Pipe Geotextile – Furnish Type 2, Level B, drainage geotextile according to Section 02320.

0B596.15 Drain Pipe:

(a) Perforated Drain Pipe – Furnish perforated drain pipe according to Section 00430.
(b) Subsurface Drain Outlets – Furnish subsurface drain outlets according to Section 00430.

Labor

0B596.30 Quality Control Personnel - Provide technicians with CAgT and CDT certifications.

0B596.31 Manufacturer's Field Representative Qualifications and Duties - Provide a Manufacturer's field representative with the following minimum qualifications:

- Is a licensed professional engineer in the State of Oregon.
- Has been trained and certified by the Manufacture in the construction, installation, and inspection of the selected proprietary retaining wall system.

The times that the Manufacturer's field representative are required to be present or available and the duties of the Manufacturer's field representative are:

- **Preconstruction Conference** - Meet with the Engineer and all contractor supervisory personnel and subcontractors involved in construction of the proprietary retaining wall at the preconstruction conference to discuss methods of accomplishing all phases of work required to construct the proprietary retaining wall.

- **Initial Wall Construction** - Be present at the retaining wall construction site and provide technical assistance to the Contractor and Engineer during all wall construction activities from the beginning of wall construction until at least 10 percent of the total wall length is successfully installed and backfilled to a height of at least 10 feet, or the actual wall height, whichever is less.

  Submit daily field observation reports no later than noon of the next working day. Include the following information in the daily field observation reports:

  - Date of observation.
  - Description all work observed and whether or not the work was acceptable.
  - Documentation of all communications with the Contractor and Engineer.
  - Name and signature.

- **Remaining Wall Construction** - Be available by phone or in person as needed throughout the remaining construction of the proprietary retaining wall to provide technical assistance to the Contractor and Engineer.

- **Final Field Observations** - Conduct a final field observation of the completed retaining wall construction with the Engineer and Contractor. Submit a final field observation report that includes the following information one Calendar Day after the final field observation:

  - Date of observation.
  - Documentation of all retaining wall deficiencies.
  - Recommendation to accept or reject the retaining wall construction.

Provide a stamped final report to the Engineer no later than 10 Calendar Days after the final field observation of the retaining wall. Include the following information in the final report:

- Preconstruction meeting minutes.
- All daily field observation reports.
- Transcripts of all communications with the Contractor and the Engineer during the remaining wall construction phase.
- Final field observation report.

Construction

0B596.40 General:

(a) Proprietary Retaining Walls - Construct proprietary retaining walls according to Agency requirements, Manufacturer's working drawings, and the Manufacturer's Field Construction Manual. If the Manufacturer's working drawings or the Manufacturer's Field Construction Manual conflict with Agency requirements, Agency requirements shall take precedence.

Follow instructions and recommendations of the representative if approved by the Engineer.

(b) Nonproprietary Retaining Walls - Construct nonproprietary retaining walls as shown.

0B596.41 Excavation and Foundation Preparation - Perform excavation and prepare and backfill wall foundations according to Section 00510 and the following:

- Grade the foundation level for a width equal to the width of the wall base plus 1.0 feet on each side. Do not reinforce backfill for over-excavated foundations without prior approval.
- Place backfill material in nearly horizontal layers not more than 8 inches thick. Compact the entire surface of each layer with at least three coverages, using equipment made specifically for compaction. Routing hauling and grading equipment over the surface is not acceptable as adequate compaction.
- Do not construct backfill when the backfill, the foundation, or the embankment on which it would be placed is frozen, or unstable.

0B596.42 Leveling Pads:

(a) Cast-in-Place Leveling Pads - Construct cast in place leveling pads with:

- Unreinforced concrete.
- A width of at least the block front face to block back face plus 12 inches (6 inches on each side of the facing units).
- A thickness of 6 inches ± 1/4 inch.
- A location tolerance of ± 1 inch of the design location.

- A top pad tolerance of ± 1/8 inch of the design elevation.

Cure cast-in-place leveling pads at least 12 hours before placing the wall units.

(b) Gravel Leveling Pads - Construct gravel leveling pads with:

- A width of at least the width of the wall facing plus 12 inches (6 inches on each side of the facing units).
- A thickness of at least 6 inches.
- A location tolerance of ± 1 inch of the design location.
- A top pad tolerance of ± 1/8 inch of the design elevation.

Compact gravel leveling pads in 3 to 4 inch lifts using a minimum of three passes of a walk behind vibratory plate compactor with a gross static weight of not less than 125 pounds and a total compaction static plus dynamic force of not less than 2,000 pounds.

0B596.43 Subsurface Drainage - Install subsurface drainage before constructing walls.

0B596.44 Erecting Walls:

(a) Dry Cast Concrete Block Walls:

(1) Placement - Begin placing the first course of blocks on top of and in full contact with the lowest foundation level of the leveling pad. Level and align all blocks. Lay blocks as close together as possible and parallel to the straight or curved line of the wall face. Place blocks in vertical or battered positions as shown. Level each course block-to-block and front-to-back. Set each block on the blocks below without rocking. Correct high areas by grinding or shimming with approved shims. Do not use shims within 1 inch of the front face. Do not exceed a shim stack thickness of 1/16 inch. Stack all blocks in a running bond pattern with each block spanning the joint below.

Place granular structure backfill with each course of blocks. When shown, place modular block core backfill and drainage fill backfill, and install drainage fill geotextile and shear pins with each course of blocks. Remove all backfill that is on top of the blocks before installing the next course of blocks or soil reinforcements. Attach the top row of dry cast concrete blocks or cap blocks to the underlying blocks with an adhesive from the QPL. Clean the finished exposed wall face of all foreign material deposits.

(2) Tolerances:

- First course of wall blocks located within ± 1/4 inch of the design horizontal alignment.
- Final out of plane concavity or convexity of the front face within ± 3/4 inch in 10 feet.
- Final deviation from the design batter within ± 1 1/4 inch for each 10 feet of wall height.
- Outward leaning batter is zero.

- Each course of blocks within ± 1/16 inch of level when checked with a 4 foot straight edge level.
- Out of plane offset between consecutive rows within 3/4 inch of the planned offset.
- Finished top of wall elevation within ± 1 inch of the design elevation.

(b) Wet Cast Concrete Block Walls:

(1) Placement - Begin placing the first course of blocks on top of and in full contact with the lowest foundation level of the leveling pad. Level and align all blocks. Lay blocks as close together as possible and parallel to the straight or curved line of the wall face. Place blocks in vertical or battered positions as shown. Level and set each block on the blocks below without rocking. Correct high areas by grinding or shimming with approved shims. Do not use shims within 1 inch of the front face. Do not exceed a shim stack thickness of 1/8 inch. Stack all blocks in a running bond pattern with each block spanning the joint below.

Place granular structure backfill with each course of blocks. When shown, place modular block core backfill and drainage fill backfill, and install drainage fill geotextile and shear pins with each course of blocks. Remove all backfill that is on top of the blocks before installing the next course of blocks or soil reinforcements. Clean the finished exposed wall face of all foreign material deposits.

(2) Tolerances:

- First course of wall blocks located within ± 1/4 inch of the design horizontal alignment.
- Final out of plane concavity or convexity of the front face within ± 3/4 inch in 10 feet.
- Final deviation from the design batter within ± 1 1/4 inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Each course of blocks within ± 1/8 inch of level when checked with a 4 foot straight edge level.
- Front-to-back tilting within ± 1/4 inch of the design batter when measured with a straight edge level long enough to span the entire front-to-back distance of the block.
- Out of plane offset between consecutive rows within ± 3/4 inch from the planned offset.
- Finished top of wall elevation within ± 1 inch of design elevation.

(c) Gabion Walls:

(1) General - Select and use:

- The same style of mesh for the gabion panel bases, ends, sides, diaphragms, and lids.

- The same method of joining the edges of a single gabion unit.
- The same method of tying successive gabion units together throughout each structure.

Place riprap geotextile according to Section 00350 and the following:

- Minimum overlap shall be 12 inches.
- Against the back of the gabion wall before placing backfill material.

(2) Assembly - Assemble each style of gabion by rotating the panels into position and joining the vertical edges with tie wire or alternate fasteners.

If twisted wire panels are tied with tie wire, join the selvage vertical edges with alternating single and double loops at 4 inch nominal spacing.

If welded wire panels are tied with tie wire, pass the tie wire through each mesh opening along the vertical edges joint and secure with a half hitch locked loop.

Leave no openings greater than 4 3/4 inches (line dimension) along the edges or at corners of tied or spiral bound gabions of either mesh style. Crimp the edges of spiral binding wire to secure the spiral in place.

If high tensile fasteners are used instead of tie wire, install one fastener in each mesh opening according to the manufacturer's recommendations.

(3) Placement - Set the empty gabions in place and connect each gabion to the adjacent gabion along the top and vertical edges with tie wire or spiral binders. Connect each layer of gabions to the underlying layer along the front, back and sides with tie wire or spiral binders in the same manner as specified for assembly of baskets. Common wall construction will not be allowed.

Before filling each gabion with rock, remove all kinks and folds in the wire fabric and properly align all baskets. Remove all temporary clips and fasteners. The assembled gabion baskets may be placed in tension before filling.

Concurrently with the filling of the baskets, place granular structure backfill around the assembled baskets to the limits shown. Maintain the outside backfill approximately level with the inside fill.

(4) Basket Filling - Place rock by hand or machine. Maintain basket alignment, avoiding bulges, and fill with minimum voids. Provide an exposed rock surface that is smooth, neat appearing, and has no sharp edges projecting through the wire mesh.

Place the rock in layers to allow placement of internal connecting wires in each outside cell of the structure or when directed at the following intervals:

- None required for 1 foot high baskets.
- At the one half point for 1 1/2 foot high baskets.
- At one third points for 3 foot high baskets.

Fill the basket so the lid will bear on the rock when it is closed. Secure the lid to the sides, ends, and diaphragms with tie wire or spiral binders in the same manner as assembling the baskets.

(5) Repairs - During construction, repair and secure all breakage of the wire mesh that results in mesh or joint openings larger than 4 3/4 inches (line dimension). Make repairs using 13 1/2 gauge galvanized tie wire as directed.

Repair damaged PVC coated wire in a manner that provides the same degree of corrosion resistance as the undamaged wire, according to the manufacturer's recommended repair procedures and as approved.

(6) Tolerances:

- First course of gabion units within ± 1/4 inch of the design horizontal alignment.
- Final out of plane concavity or convexity within ± 2 inches in 10 feet.
- Final deviation from the design batter within ± 1 inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Out of plane offset between consecutive rows within ± 1 inch from the planned offset.

(d) Metal Bin and Precast Concrete Bin Walls:

(1) Placement - Begin placing the first course of bin wall units on top of and in full contact with the prepared leveling pad surface. Concurrently with the assembly of the bins, place granular structure backfill within and around the bins of the assembled wall to the limits shown. Maintain the outside backfill approximately level with the inside backfill.

(2) Tolerances:

- First course of units within ± 1/4 inch of the design horizontal alignment.
- Final out of plane concavity or convexity within ± 1 1/4 inches in 10 feet.
- Final deviation from the design batter within ± 1 inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Out of plane offset between consecutive rows within ± 1 inch from the planned offset.

(e) Precast Concrete Crib Walls:

(1) Placement - Begin placing the first course of crib wall units on top of and in full contact with the prepared leveling pad surface. Concurrently with the assembly of the cribs, place granular structure backfill within and around the cribs of the assembled wall to the limits shown. Maintain the outside backfill approximately level with the inside backfill. Fill depressions of stringers and spacers and compact without displacing them from line and batter.

(2) Tolerances:

- First course of units within ± 1/4 inch of the design horizontal alignment.
- Final out of plane concavity or convexity within ± 1 1/4 inches in 10 feet.
- Final deviation from the design batter within ± 1 inch for each 10 feet of wall height.
- Outward leaning batter is zero.
- Out of plane offset between consecutive rows within ± 1 inch from the planned offset.

0B596.45 Geotextile Placement - Install geotextiles according to Section 00350 and as shown.

0B596.46 Drain Pipe Placement - Install drain pipe according to Section 00430 and as shown.

0B596.47 Backfill Placement:

(a) General - Do not misalign wall units or damage wall components when placing backfill material. Remove and replace all misaligned or damaged wall materials at no additional cost to the Agency.

(b) Compaction - Meet the following requirements:

(1) Equipment - Provide the following compaction equipment:

a. Backfill In and Within 3 Feet Behind Wall Units - Walk behind vibratory roller compactor with a single smooth drum, vibratory plate compactor, or rammer/tamper plate compactor; each with a gross static weight of not more than 1,000 pounds and a total compaction static plus dynamic force of not more than 5,000 pounds.

b. Backfill More Than 3 Feet Behind Wall Units - Vibratory roller compactor with a single smooth drum, vibratory plate compactor, or rammer/tamper plate compactor.

(2) Maximum Density and Optimum Moisture Content - Determine maximum density and optimum moisture content of the MSE granular backfill material according to AASHTO T 99 Standard Proctor Method A, with coarse particle correction according to AASHTO T 224.

(3) Moisture Content - Prepare backfill material to within minus 4% to plus 2% of optimum moisture content at the time of compacting. Add water to material that does not contain sufficient moisture and thoroughly mix. Remove excess moisture by manipulation, aeration, drainage, or other means before compacting.

(4) Density:

a. Backfill In and Within 3 Feet Behind Wall Units - Compact to 95% of maximum density using the required number of passes determined according to 0B596.47(b-5-a).

b. Backfill More Than 3 Feet Behind Wall Units - Compact to 95% of maximum density determined according to 0B596.47(b-5-b).

(5) Testing Methods and Frequency:

a. Test Pad Method - Before placing the wall backfill, determine the number of passes necessary to achieve the specified density by constructing a test pad that is at least 5 feet wide, 15 feet long, and 3 feet in final depth. Construct test pad fill in layers no more than 8 inches thick using the same equipment and methods that will be used to compact the wall backfill. Perform at least one density test according to AASHTO T 310 on each test pad layer. Construct and test a new test pad when changes in material occur or different equipment is used during the construction of the wall backfill, except a new test pad is not required for modular block drainage backfill.

b. Nuclear Gauge Method - Test in-place field density according to AASHTO T 310. Test at the frequency required in the ODOT Manual of Field Test Procedures.

(6) Deflection Requirement - Conduct at least one deflection test, witnessed by the Engineer on each compacted layer of backfill according to ODOT TM 158. If the tested layer exhibits yielding, deflection, reaction, or pumping, rework the area to provide acceptable test results before placing the next layer.

Maintenance

0B596.60 Protecting Work - Protect and repair work as follows:

- Do not allow runoff from adjacent areas to enter the wall construction site during construction operations.
- At the end of each day's operation, direct potential runoff away from the wall by sloping the last lift of backfill away from the wall.
- Rework and repair all damaged subgrade areas to the depth where undamaged work is encountered.

Measurement

0B596.80 Measurement - Measurement of retaining walls will be by the square foot of face area installed, as measured by actual face of blocks placed including whole blocks that may be fully or partially buried.

Payment

0B596.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Retaining Wall, Prefabricated Modular Gravity	Square Foot

Payment will be payment in full for furnishing and placing all materials, all required excavation within the wall limits, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for:

- stamped working drawings and design calculations
- manufacturer's representative
- excavation, shoring, leveling pads, and specified backfill
- wall drainage and filter systems
- cast-in-place and precast standard coping

SECTION 00610 - RECONDITIONING EXISTING ROADWAY

Comply with Section 00610 of the Standard Specifications.

SECTION 00620 - COLD PLANE PAVEMENT REMOVAL

Comply with Section 00620 of the Standard Specifications modified as follows:

00620.40(a) General - Replace this subsection, except for the subsection number and title, with the following:

Remove the existing pavement to the depth, width, grade and cross section shown or as directed. The use of a heating device to soften the pavement is not allowed. When removing pavement from bridge end panels, limit the machine forward speed to 2.5 feet per minute.

00620.43 Maintenance Under Traffic - Replace this subsection, except for the subsection number and title, with the following:

Traffic will be allowed on the cold planed surface up to 5 Calendar Days after removing the existing surface. Sweep and clean the cold planed surface before opening to traffic.

Before beginning paving operations, make repairs to the existing cold planed surface as directed. Payment for the repairs will be made according to 00748.90.

Add the following subsection:

00620.44 Cold Planing Operations

All edges remaining after cold plane pavement removal shall be vertical to accept the succeeding full depth asphalt lift. Vertical edges left at the edge of the grinding drum are acceptable. Rounded edges where the face of the grinding drum is terminated are not allowed. Rounded edges shall be ground vertical by saw cutting.

00620.90 Payment – Add the following to the end of this subsection:

Payment includes removal, haul and disposal of cold planed surfacing material. Payment will only be made for those areas shown or as directed by the Engineer. No separate payment will be made if the Contractor elects to remove existing pavement at his own option by cold plane pavement removal.

SECTION 00641 - AGGREGATE SUBBASE, BASE, AND SHOULDERS

Comply with Section 00641 of the Standard Specifications.

SECTION 00730 - EMULSIFIED ASPHALT TACK COAT

Comply with Section 00730 of the Standard Specifications modified as follows:

00730.90 Payment - Replace this subsection, except for the subsection number and title, with the following:

No separate or additional payment will be made for emulsified asphalt tack coat.

SECTION 00744 - ASPHALT CONCRETE PAVEMENT

Comply with Section 00744 of the Standard Specifications modified as follows:

00744.11(a) Asphalt Cement - Add the following to the end of this subsection:

Provide PG64-22 grade asphalt cement for this Project.

00744.42 Tack Coat - Add the following paragraph to the end of this subsection:

Sand seal all joints following the final lift.

Add the following subsection:

00744.46 Preparation of Roadway – All water valves, manholes and catch basins shall be adjusted to finish grade in advance of or during the paving operation. No adjustments shall be made after the paving is completed unless approved by the Engineer prior to paving.

Any tree branches or foliage which will hinder the proper placement of the surfacing shall be removed by the Contractor by pruning and sealing the cut ends, or tying back in a manner approved by the Engineer. The Contractor shall be responsible for trees damaged that are not properly pruned or tied back.

Coordinate construction of driveway transitions with property owners to minimize disruption of access.

Add the following subsection:

00744.47 Preparation of Underlying Surfaces – All bases and foundations on which the pavement is to be constructed shall meet the applicable Specifications and be approved prior to the start of paving. Trim broken or ragged edges to firm material when directed.

Protect all existing structures from the overlay operation and check and clean as necessary after the overlay.

The pavement surface shall be dry prior to the preparation work and paving. Remove existing pavement markers, recessed markers, and pavement legends prior to paving. Remove pavement legends according to 00851.40.

Add the following subsection:

00744.51 Opening Sections to Traffic - Schedule work so that, during the same shift, the surfaces being paved are paved full width and length through the top base course before opening to traffic.

Before beginning wearing course paving operations, make repairs to the existing surface as directed. Payment for the repairs will be made according to 00748.90.

00744.90 Payment - Add the following to the end of this subsection:

Payment includes furnishing and placing temporary asphalt placed to open the roadway to traffic.

SECTION 00748 - ASPHALT CONCRETE PAVEMENT REPAIR

Comply with Section 00748 of the Standard Specifications.

SECTION 00749 - MISCELLANEOUS ASPHALT CONCRETE STRUCTURES

Comply with Section 00749 of the Standard Specifications modified as follows:

00749.92 Method "B" – Complete in Place Basis – Add the following pay items:

(g) Asphalt Berms .....Foot

(h) Asphalt Pedestrian Landings..... Each

Add the following to the end of this subsection:

Item (g) includes asphalt berms placed as shown or directed to assist in conveying surface drainage.

SECTION 00759 - MISCELLANEOUS PORTLAND CEMENT CONCRETE STRUCTURES

Comply with Section 00759 of the Standard Specifications modified as follows:

00759.50(c) Driveways, Walks, and Surfacings – Add the following to the end of this subsection:

The Contractor shall plan joint spacing layout prior to concrete placement. The joint pattern of any pour should consider the width of the concrete placement required by the plans. The maximum joint spacing shall not exceed the dimensions shown. Finish sidewalks in accordance with the scoring pattern and finish type as detailed. Review joint layout with the Engineer for approval prior to pouring.

Broom finish shall not be curved around objects in the concrete, nor shall a broom border be placed around an object in the pavement. The broom finish shall flow through any objects and maintain a consistent pattern through the sidewalk. Joints shall be clean, straight and free from slurry. Where joints intersect, the cross created by the intersecting joints shall be clean and free from slurry. Tool edges around all structures located in the sidewalks and driveways. Provide isolation joint material around structures and seal in accordance with 00585.

Add the following subsection:

00759.55 Protection of Concrete – Protect the freshly poured concrete curbs and sidewalk from vandalism or other damage for a minimum of twenty-four (24) hours or until cured enough to support typical use, whichever is longer. Provide security personnel to guard the fresh concrete during this time. The number of personnel onsite shall be as required to protect the complete amount of concrete placed during the previous 24 hours. Any curb or sidewalk damaged by vandalism or other causes shall be replaced at no cost to the Agency.

All costs associated with protecting the freshly poured concrete shall be incidental to the sidewalk pay items.

00759.90 Payment – Replace the paragraph that reads “Items (e) and (f)” with the following:

Items (e) and (f) include sidewalks ramps and truncated domes.

Add the following paragraph to the end of this subsection:

All costs associated with protecting the freshly poured concrete shall be incidental to the applicable pay item.

SECTION 00850 - COMMON PROVISIONS FOR PAVEMENT MARKINGS

Comply with Section 00850 of the Standard Specifications.

SECTION 00851 - PAVEMENT MARKING REMOVAL

Comply with Section 00851 of the Standard Specifications modified as follows:

00851.40 General - In the paragraph that begins "Remove durable and non-durable…", delete the sentence that begins "Remove durable markings by steel…".

SECTION 00865 - LONGITUDINAL PAVEMENT MARKINGS - DURABLE

Comply with Section 00865 of the Standard Specifications modified as follows:

00865.45 Installation - Add the following paragraph to the end of the bullet that begins "**Method B: Spray Markings**…":

Thermoplastic spray markings may be installed in one application at the total specified thickness if approved by the Engineer and after a successful performance test according to 00865.40. Apply spray markings in two applications if installing yellow colored markings over rumble strips.

SECTION 00867 - TRANSVERSE PAVEMENT MARKINGS - LEGENDS AND BARS

Comply with Section 00867 of the Standard Specifications.

SECTION 00905 - REMOVAL AND REINSTALLATION OF EXISTING SIGNS

Comply with Section 00905 of the Standard Specifications.

SECTION 01030 - SEEDING

Replace this Section with the following Section:

SECTION 01030 – SEEDING

Description

01030.00 Scope – Complete all work under this Section according to Section 02921 in Appendix B.

Measurement

01030.80 Measurement – No measurement of quantities will be made for work performed under this Section.

Payment

01030.90 Payment – No payment will be made under this Section. Payment will be included in payment made for "Landscaping Restoration, Complete" as defined by 01040.90.

SECTION 01040 - PLANTING

Replace this Section with the following Section:

SECTION 01040 – PLANTING

Description

01040.00 Scope – Complete all work under this Section according to Section 02930 in Appendix B.

Measurement

01040.80 Measurement – No measurement of quantities will be made for work performed under this Section.

Payment

01040.90 Payment – The accepted quantities of work performed under this Section will be paid for at the Contract lump sum amount for the item "Landscaping Restoration, Complete".

SECTION 01050 - FENCES

Comply with Section 01050 of the Standard Specifications.

SECTION 01070 - MAILBOX SUPPORTS

Comply with Section 01070 of the Standard Specifications.

SECTION 02010 - PORTLAND CEMENT

Comply with Section 02010 of the Standard Specifications modified as follows:

02010.20 Blended Hydraulic Cement - Replace the paragraph that begins “Blended hydraulic cement…” with the following paragraph:

Blended hydraulic cement shall be either Type IS-Portland blast-furnace slag cement, Type IP-Portland-pozzolan cement, or Type IT-ternary blended cement according to AASHTO M 240, modified as follows:

Add the following paragraph to the end of this subsection:

Furnish blended hydraulic cement from the QPL.

SECTION 02050 - CURING MATERIALS

Comply with Section 02050 of the Standard Specifications modified as follows:

02050.00 Scope - Replace this subsection, except for the subsection number and title, with the following:

This Section includes the requirements for liquid compounds, polyethylene films, and curing blankets used to cover concrete and other surfaces to retain moisture and to cure.

02050.10 Liquid Compounds - In the paragraph that begins "Furnish liquid membrane-forming…", replace "AASHTO C 309" with "ASTM C 309".

02050.40 Liquid Evaporation Reducer Compounds - Delete this subsection.

SECTION 02320 - GEOSYNTHETICS

Comply with Section 02320 of the Standard Specifications modified as follows:

02320.10(c-1-a) Geotextiles - Replace the bullet that begins "Minimum average roll values…" with the following bullet:

- Minimum average roll values for each of the specified properties from the same production run as the delivered material.

02320.20 Geotextile Property Values - Replace Table 02320-1 through Table 02320-6 with the following tables:

Table 02320-1 Geotextile Property Values for Drainage Geotextile [1, 2]

Geotextile Property	ASTM Test Method	Units	Geotextile Property Requirements			
			Type 1		Type 2	
			Woven	Nonwoven	Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	180	115	250	160
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	67	40	90	56
Puncture Strength (minimum)	D 6241	lb	370	220	495	310
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	40	40	40	40
Permittivity (minimum)	D 4491	sec^{-1}	0.5	0.5	0.5	0.5
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	50	50	50	50

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.

[2] Woven slit film geotextiles (geotextiles that are made from yarns of a flat, tape-like character) are not acceptable.

Table 02320-2 Geotextile Property Values for Riprap Geotextile [1, 2]

Geotextile Property	ASTM Test Method	Units	Geotextile Property Requirements			
			Type 1		Type 2	
			Woven	Nonwoven	Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	250	160	315	200
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	90	56	110	80
Puncture Strength (minimum)	D 6241	lb	495	310	620	430
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	40	40	40	40
Permittivity (minimum)	D 4491	sec^{-1}	0.5	0.5	0.5	0.5
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	70	70	70	70

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.

[2] Woven slit film geotextiles (geotextiles that are made from yarns of a flat, tape-like character) are not acceptable.

Table 02320-3 Geotextile Property Values for Sediment Fence [1]

Geotextile Property	ASTM Test Method	Units	Geotextile Property Requirements		
			Supported	Unsupported	
			—	Elongation [2] ≥ 50%	Elongation [2] ≤ 50%
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	90 90	120 100	120 100
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.05	0.05	0.05
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	70	70	70

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.

[2] Measured according to ASTM D 4632.

Table 02320-4 Geotextile Property Values for Subgrade Geotextile (Separation) [1]

Geotextile Property	ASTM Test Method	Units	Geotextile Property Requirements	
			Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	180	113
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	68	41
Puncture Strength (minimum)	D 6241	lb	371	223
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.05	0.05
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	50	50

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.

Table 02320-5 Geotextile Property Values for Embankment Geotextile [1]

Geotextile Property	ASTM Test Method	Units	Geotextile Property Requirements	
			Woven	Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	315	200
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	< 50	≥ 50
Tear Strength (minimum)	D 4533	lb	110	80
Puncture Strength (minimum)	D 6241	lb	620	430
Apparent Opening Size (AOS) (maximum) U.S. Standard Sieve	D 4751	—	30	30
Permittivity (minimum)	D 4491	sec^{-1}	0.02	0.02
Ultraviolet Stability Retained Strength (minimum)	D 4355 (at 500 hours)	%	50	50

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.

Table 02320-6 Geotextile Property Values for Pavement Overlay Geotextile [1]

Geotextile Property	ASTM Test Method	Units	Geotextile Property Requirements
			Nonwoven
Grab Tensile Strength (minimum) Machine and Cross Machine Directions	D 4632	lb	100
Grab Failure Strain (minimum) Machine and Cross Machine Directions	D 4632	%	≥ 50
Asphalt Retention (minimum)	D 6140	oz./sq.ft.	2.8
Melting Point (minimum)	D 276	°F	300

[1] All geotextile properties are Minimum Average Roll Values (MARV). The test results for any sampled roll in a lot shall meet or exceed the values shown in the table.

SECTION 02450 - MANHOLES AND INLET MATERIALS

Comply with Section 02450 of the Standard Specifications modified as follows:

Add the following Subsection:

02450.15 Precast Concrete Catch Basins and Inlets - Furnish precast concrete catch basins and inlet conforming to the requirements of ASTM C 913.

SECTION 02560 - FASTENERS

Comply with Section 02560 of the Standard Specifications modified as follows:

02560.30 Tie Rods and Anchor Bolts - Replace this subsection with the following subsection:

02560.30 Tie Rods, Anchor Bolts, and Anchor Rods:

(a) Steel Tie Rods, Anchor Bolts, and Anchor Rods - Steel tie rods, anchor bolts, and anchor rods shall conform to: AASHTO M 314, Grade 36 or 55; ASTM F 1554, Grade 36 or 55.

(b) High-Strength Tie Rods, High-Strength Anchor Bolts, and High-Strength Anchor Rods - High-strength tie rods, high-strength anchor bolts, and high-strength anchor rods shall conform to: AASHTO M 314, Grade 105; ASTM F 1554, Grade 105; or ASTM A 449, Type 1.

(c) Nuts - Nuts for tie rods, anchor bolts, and anchor rods shall conform to the requirements of the following, or equivalent:

Plain Steel Tie Rods, Anchor Bolts, and Anchor Rods:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade A

Galvanized Steel Tie Rods, Anchor Bolts, and Anchor Rods:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade A, C, D, or DH

Plain Or Galvanized High-Strength Tie Rods, High-Strength Anchor Bolts, and High-Strength Anchor Rods:

- All - Heavy Hex AASHTO M 291 (ASTM A 563), Grade DH

(d) Washers - Washers for anchor bolts shall conform to ASTM F 436, Type 1.

02560.40 Galvanizing and Coating of Fasteners, Tie Rods, and Anchor Bolts - Replace this subsection title with the title "**Galvanizing and Coating:**"

02560.40(a) Galvanizing of Fasteners, Tie Rods, and Anchor Bolts - Replace this subsection with the following subsection:

02560.40(a) Galvanizing of Fasteners, Tie Rods, Anchor Bolts, and Anchor Rods - Hot-dip galvanize fasteners, tie rods, anchor bolts, anchor rods, nuts, and washers according to AASHTO M 111 (ASTM A 123) or AASHTO M 232 (ASTM A 153) as appropriate to the product.

When specified, mechanically galvanize fasteners according to ASTM B 695, Class 50, Type 1.

Match galvanized bolts, tie rods, anchor bolts, and anchor rods with appropriate galvanized nuts for assembly. Ship nuts in the same container consisting of bolts, tie rods, anchor bolts, or anchor rods.

Overtap nuts for galvanized fasteners, galvanized tie rods, galvanized anchor bolts, and galvanized anchor rods according to AASHTO M 291 (ASTM A 563).

Measure the zinc thickness on the wrench flats or top of bolt head of galvanized bolts and on the wrench flats of galvanized nuts.

02560.60(a) Rotational Capacity Test - In the paragraph that begins "Test all high-strength fasteners…", replace the first sentence with the following sentence**:**

Test all high-strength fasteners, except high-strength tie rods, high-strength anchor bolts, and high-strength anchor rods, according to Method 1 or 2 below, as applicable.

02560.60(b) Other Test Requirements - Replace the two paragraphs that begin "Provide three extra high strength bolt assemblies…" and "Provide three extra high strength tie rod and…" with the following two paragraphs:

Provide three high-strength bolt assemblies per size per lot for check testing.

Provide one high-strength tie rod assembly, one high-strength anchor bolt assembly, and one high-strength anchor rod assembly per size per lot for check testing.

SECTION 02910 - SIGN MATERIALS

Comply with Section 02910 of the Standard Specifications modified as follows:

02910.33(d) Nonreflective Black Screened Legend - Replace this subsection, except for the subsection number and title, with the following:

Furnish material for nonreflective black screened legends that is compatible with the sign sheeting, as recommended by the sign sheeting manufacturer.

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

Appendix E

SUPPLEMENTARY INFORMATION

APPENDIX E – SUPPLEMENTARY INFORMATION

TABLE OF CONTENTS

A. "Geotechnical Investigation and Site-Specific Seismic Hazard Study, 4-MG Bolton Reservoir, West Linn, Oregon," prepared by GRI, Inc., (Beaverton, Oregon). TO FOLLOW BY ADDENDUM

B. Existing station record drawings, "Bolton Pump Station Improvements," April 1999 (42 sheets).

C. Conditional Use Permit Staff Report summary and approval criteria excerpt, CUP-15-02/DR 15-06/DR 15-07, July 1, 2015.

CITY OF WEST LINN

Clackamas County, Oregon

Bolton Pump Station Improvements

Volume II – Record Drawings (Contract No. 98–PW–5045)

APRIL 1999

MONTGOMERY WATSON

Portland, Oregon

Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

GENERAL NOTES

1. EXISTING SITE CONDITIONS AND ELEVATIONS SHOWN ON THESE PLANS WERE OBTAINED MOSTLY FROM AVAILABLE RECORDS AND FIELD SURVEYS. NEITHER THE OWNER NOR THE ENGINEER ASSUMES ANY RESPONSIBILITY FOR UTILITIES NOT SHOWN, OR NOT IN LOCATION SHOWN. CONTRACTOR SHALL VERIFY ALL LOCATIONS AND ELEVATIONS AND SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT UTILITY LINES WHETHER SHOWN OR NOT SHOWN.
2. ALL CONSTRUCTION SHALL BE AS DEFINED IN THESE DOCUMENTS AND IN CONFORMANCE WITH THE CITY OF WEST LINN STANDARDS AND THE UNIFORM BUILDING CODE.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL REQUIRED PERMITS BEFORE COMMENCING ANY WORK ON THIS PROJECT.
4. ANY ALTERATION OR VARIANCE FROM THESE PLANS, EXCEPT FOR MINOR FIELD ADJUSTMENTS TO MEET EXISTING CONDITIONS, SHALL FIRST BE APPROVED BY THE ENGINEER. ANY CHANGES TO THESE PLANS SHALL BE DOCUMENTED ON CONSTRUCTION FIELD PRINTS AND TRANSMITTED TO THE ENGINEER UPON COMPLETION OF THE PROJECT.
5. ANY INSPECTION BY THE OWNER, OR FIELD OBSERVATIONS BY THE ENGINEER, SHALL NOT, IN ANY WAY, RELIEVE THE CONTRACTOR FROM AN OBLIGATION TO PERFORM ALL WORK IN COMPLIANCE WITH THE CONTRACT DOCUMENTS AND THE APPLICABLE STANDARDS.
6. LOCATIONS OF EXISTING PIPELINES & UTILITIES WERE OBTAINED FROM AVAILABLE RECORDS. NEITHER THE OWNER NOR ENGINEER ASSUMES ANY RESPONSIBILITY FOR PROPER MATERIAL CALL-OUT OF EXISTING PIPELINES NOR FOR PIPELINES OR UTILITIES NOT SHOWN OR NOT LOCATED WHERE SHOWN. THE CONTRACTOR SHALL FIELD VERIFY PIPE MATERIALS, LOCATIONS, & ELEVATIONS OF ALL EXISTING PIPELINES & UTILITIES BEFORE COMMENCING CONSTRUCTION WORK. THE CONTRACTOR SHALL PROVIDE THE OWNER WITH RECORD INFORMATION ON ALL FIELD VERIFICATION MEASUREMENTS AS SPECIFIED.
7. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING FACILITIES, WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE. ANY FACILITIES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED TO THE OWNER'S SATISFACTION AT THE CONTRACTOR'S EXPENSE.
8. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND OWNER AS SPECIFIED IN ADVANCE OF MAKING ANY CONNECTIONS TO AN ACTIVE PIPELINE OR UTILITY SYSTEM & SHALL RECEIVE THE OWNER'S CONSENT BEFORE PROCEEDING. SEE SPECIFICATIONS.
9. THE CONTRACTOR SHALL NOT UNDULY RESTRICT RESIDENTIAL TRAFFIC NEAR THE PROJECT AREA SEE SPECIFICATIONS.
10. THE HORIZONTAL DATUM "PLANT GRID" IS BASED ON A CONTROL POINT LOCATED AT N. 1000.00 E. 1000.00 SAID POINT IS AN IRON PIPE SET AT THE SOUTHERN MOST RESERVOIR PROPERTY CORNER. (SEE SHEET C-1)
11. THE CONTRACTOR SHALL REVIEW THE GEOTECHNICAL REPORT PREPARED BY CORNFORTH CONSULTANTS INCLUDED WITH THE PROJECT BID DOCUMENTS. THE REPORT OF EXPLORATIONS AND TESTS OF SUBSURFACE CONDITIONS AT THE SITE HAVE BEEN UTILIZED BY THE ENGINEER IN THE PREPARATION OF THE CONTRACT DOCUMENTS. THE CONTRACTOR MAY RELY UPON THE ACCURACY OF THE TECHNICAL DATA CONTAINED IN SUCH REPORTS. HOWEVER, THE INTERPRETATION OF SUCH TECHNICAL DATA, INCLUDING ANY INTERPOLATION OR EXTRAPOLATION THERE-OF, TOGETHER WITH NON-TECHNICAL DATA, INTERPRETATIONS, AND OPINIONS CONTAINED THEREIN OR THE COMPLETENESS THEREOF IS THE RESPONSIBILITY OF THE CONTRACTOR.
12. THE REMOVAL OF UNSUITABLE MATERIAL SHALL BE DONE IN CONSULTATION WITH THE ENGINEER. UNSUITABLE MATERIAL SHALL BE DISPOSED OF OFFSITE BY THE CONTRACTOR AT THE CONTRACTOR'S SOLE EXPENSE. THE CONTRACTOR SHALL USE PROPER WET WEATHER EXCAVATION AND EARTHWORK METHODS TO PROTECT EXISTING SOILS FROM BECOMING UNUSABLE.
13. APPROVED EROSION CONTROL MEASURES SHALL BE TAKEN DURING RAINY WEATHER (ACCORDING TO WASHINGTON COUNTY AND DEQ REQUIREMENTS AND STANDARDS). THE CONTRACTOR SHALL PROVIDE ALL MATERIAL, EQUIPMENT, AND PERSONNEL NECESSARY TO MAINTAIN SUCH EROSION PROTECTION MEASURES. ANY DAMAGE CAUSED BY EROSION SHALL BE CORRECTED BY THE CONTRACTOR AT IT'S OWN EXPENSE.
14. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THE RELOCATION OF BURIED AND OVERHEAD UTILITIES.
15. BEFORE COMMENCING CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY ALL COMPANIES OR AGENCIES WITH UNDERGROUND FACILITIES IN THE PROJECT AREA.
16. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 36 INCHES OF COVER OVER ALL PIPELINES UNLESS OTHERWISE SHOWN OR DIRECTED. SEE DETAIL C-204.
17. THE CONTRACTOR SHALL ADJUST ALL EXISTING VALVE BOXES, PULL BOXES AND MANHOLES TO FINISHED GRADE UNLESS OTHERWISE SHOWN OR DIRECTED. MANHOLES IN OPEN FIELDS SHALL BE SET ONE FOOT ABOVE GRADE. APPROXIMATE RIM ELEVATIONS ARE SHOWN ON DRAWINGS.
18. COORDINATES SHOWN FOR LOCATING STRUCTURES REFER TO THE OUTSIDE FACE OF WALL.

GENERAL YARD PIPING NOTES (SEE SHEET C-3)

GYP1 ALL YARD PIPING MATERIAL SHALL BE AS IDENTIFIED PER THE PIPE SCHEDULE SEE SHEET GM-1.

GYP2 LOCATION FOR YARD PIPING, ARE IDENTIFIED BY COORDINATES, ON THE DRAWINGS.

GYP3 LOCATIONS FOR SMALL YARD PIPING ARE APPROXIMATE AND CAN BE SCALED FROM THE DRAWING FOR LOCATION. UNLESS NOTED OTHERWISE, ALL PIPING SHALL BE INSTALLED WITH A MINIMUM HORIZONTAL CLEARANCE BETWEEN PIPES OF 2'-6". UNLESS NOTED OTHERWISE.

GYP4 ALL DRAINAGE OR GRAVITY FLOW PIPE SHALL MAINTAIN AN AVERAGE SLOPE BETWEEN ELEVATIONS INDICATED ON THE DRAWINGS. THE PIPE MAY BE DEFLECTED TO CLEAR AN INTERFERENCE, IN NO CASE SHALL THE PIPE SLOPE BE LESS THAN 0.0020 FT/FT UNLESS NOTED OTHERWISE.

GYP5 PIPE SHOWN CONCRETE ENCASED UNDER STRUCTURES, SHALL BE CONCRETE ENCASED BEYOND THE STRUCTURE AS SHOWN ON DETAIL S-170.

GYP6 THE CONTRACTOR SHALL PROVIDE SUPPORT FOR ALL CROSSING UTILITIES EXPOSED DURING CONSTRUCTION.

GYP7 THE CONTRACTOR SHALL VERIFY THE TYPE, SIZE AND CONDITION OF EXISTING PIPE BEING CONNECTED TO, PRIOR TO INSTALLING NEW PIPE CONNECTIONS. THE PIPE SHALL BE INSPECTED FOR CORROSION OR OTHER CONDITIONS THAT WOULD PREVENT AN ADEQUATE CONNECTION.

GYP8 LOCATIONS OF EXISTING PIPES ARE APPROXIMATE. CONTRACTOR SHALL VERIFY LOCATIONS PRIOR TO STARTING WORK OR DETAILING SHOP DRAWINGS.

GYP9 UNLESS NOTED OTHERWISE, ALL PIPING SHALL BE INSTALLED IN INDIVIDUAL TRENCHES.

GYP10 PROVIDE A MINIMUM 6" VERTICAL CLEARANCE BETWEEN PIPES UNLESS NOTED OTHERWISE.

GENERAL GRADING NOTES (SEE SHEET C-5)

GG1 ALL SPOT ELEVATIONS, SLOPES AND CONTOURS SHOWN ARE APPROXIMATE LOCATION AND CAN BE SCALED FROM THE DRAWING UNLESS COORDINATES ARE PROVIDED FOR LOCATION. SPOT ELEVATIONS SHOWN JUST OUTSIDE BUILDINGS ARE TO BE LOCATED AT THE EXTERIOR FACE OF WALL, SPOT ELEVATIONS, SLOPES AND CONTOURS LOCATED BY DIMENSIONS, STATIONING, OR IN PROFILE ARE TO BE ESTABLISHED AS SHOWN.

GG2 TRANSITIONS BETWEEN SLOPES SHALL BE SMOOTH AND UTILIZE VERTICAL CURVES UNLESS NOTED OTHERWISE. POSITIVE DRAINAGE AWAY FROM STRUCTURE FOUNDATIONS SHALL BE PROVIDED AT A MINIMUM GRADE OF TWO PERCENT (2%). POSITIVE DRAINAGE ON THE SITE SHALL BE PROVIDED TO THE ROADS OR DRAINAGE STRUCTURES AT A MINIMUM GRADE OF ONE PERCENT (1%).

GG3 FINISHED GRADING SHALL BE SELF DRAINING. NO PONDING OR STANDING WATER SHALL BE ALLOWED.

GG4 MATCH THE TOP OF GRATE ELEVATIONS FOR CATCH BASINS AND AREA DRAINS WITH THE FINISH GRADE. FOR DRAIN PIPE SIZES AND INVERTS, SEE YARD PIPING DRAWINGS.

GG5 ALL UNPAVED AREAS OF THE PUMP STATION SITE ARE TO BE HYDROSEEDED IN ACCORDANCE WITH SPECIFICATION SECTION 02270. OR REPLACE GRASS THAT WAS REMOVED.

LIST OF DRAWINGS

REV	DATE	BY	DESCRIPTION
1	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER — 19427 R. C. E. NO. — 4/23/98 DATE
MONTGOMERY WATSON — 10818 R. C. E. NO. — 4/23/98 DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE
APPROVED ____ DATE

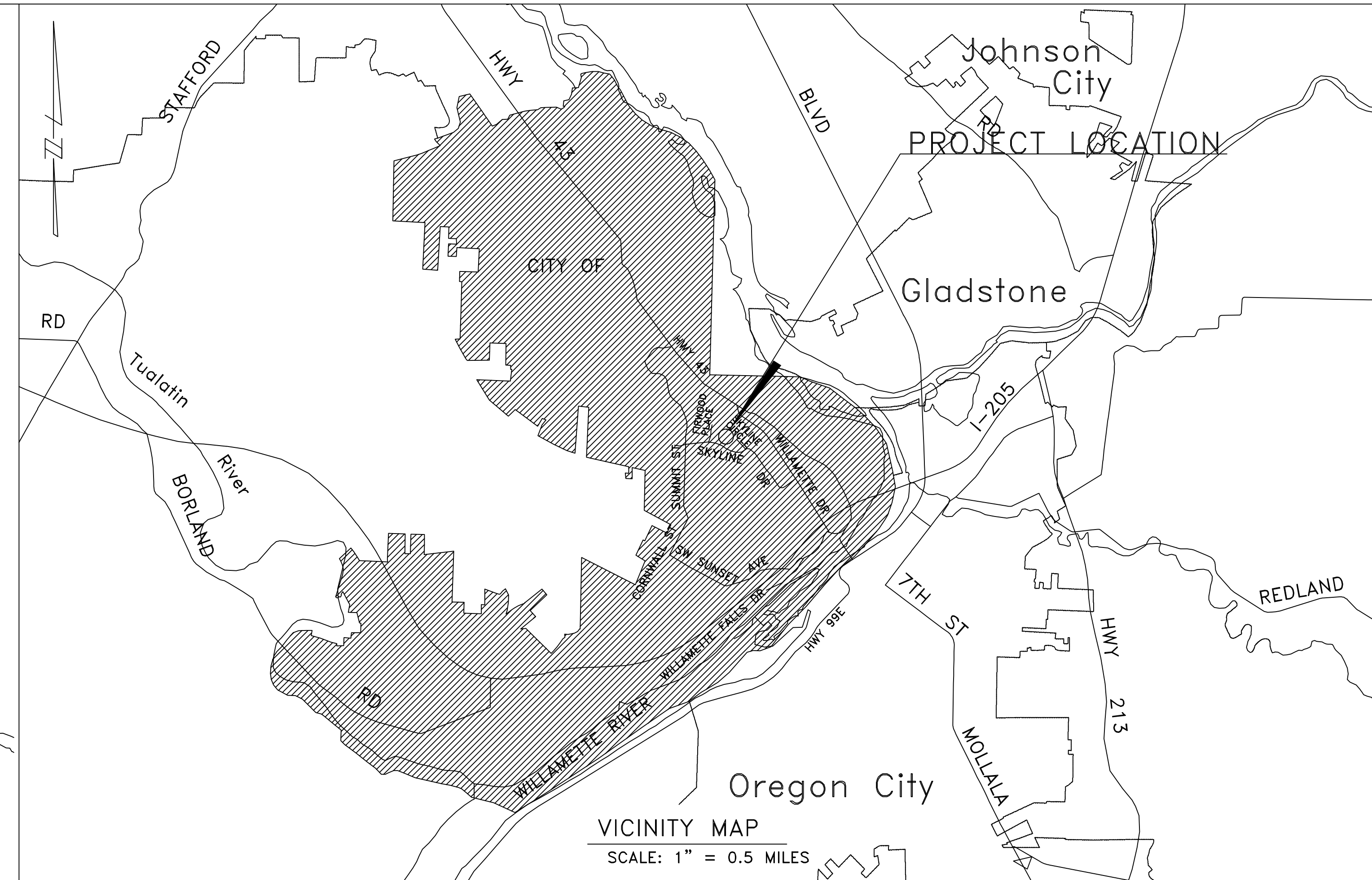
CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
LIST OF DRAWINGS AND GENERAL NOTES

SHEET G-1 OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$

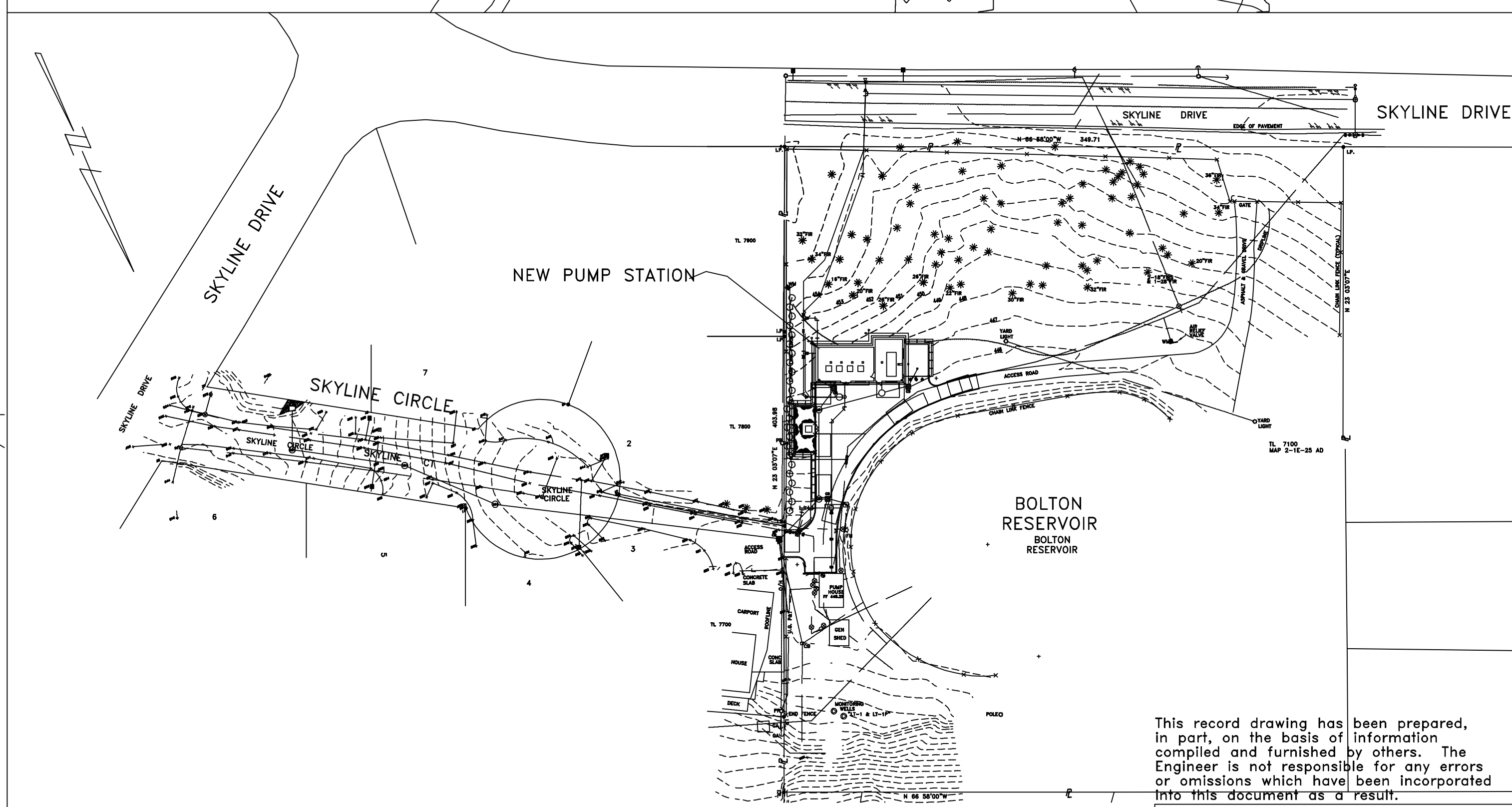
LOCATION MAP

SCALE: 1" = 10 MILES



VICINITY MAP

SCALE: 1" = 0.5 MILES



PROJECT SITE MAP

SCALE: 1" = 60'

This record drawing has been prepared, in part, on the basis of information compiled and furnished by others. The Engineer is not responsible for any errors or omissions which have been incorporated into this document as a result.

RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS
FOR SEAL AND SIGNATURES

FILE: $$

JOB No. 1065073.012580

REV	DATE	BY	DESCRIPTION
RD	4/99	DPR	RECORD DRAWING

SCALE: AS NOTED

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER — R. C. E. NO. 19427 — DATE 4/23/98
MONTGOMERY WATSON — R. C. E. NO. 10818 — DATE 4/23/98

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE
APPROVED ____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
LOCATION MAP, VICINITY MAP AND PROJECT SITE MAP

SHEET G-2 OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

- CAST IRON
- STEEL
- GRAVEL
- CONCRETE
- EARTH
- SAND
- ALUMINUM OR METAL DECKING
- CHECKERED PLATE
- RAILING
- DIRT ROADS (UNIMPROVED)
- FOOT PATHS
- PAINTED LINES
- RAILROAD
- EDGE OF WATER
- EDGE OF SWAMP
- NEW A.C. PAVING
- EXISTING A.C. PAVING
- SIGN
- MAILBOX
- SECTION LINE — SECTION LINE
- R/W LINE — RIGHT OF WAY LINE
- EASEMENT LINE
- ℄ — CENTERLINE
- ℙ — PROPERTY LINE
- NEW STRUCTURE OR FACILITY
- EXISTING STRUCTURE OR FACILITY
- FUTURE STRUCTURE OR FACILITY
- NEW FENCE
- EXISTING FENCE
- NEW PIPELINE (CIVIL SHEETS)
- NEW PIPELINE (CIVIL SHEETS) 10" DIA. AND SMALLER
- 8" RW — EXISTING UTILITY TO BE REMOVED OR ABANDONED AS NOTED
- 4" GM — EXISTING GAS MAIN W/SIZE CALLOUT
- 12" W — EXISTING POTABLE WATER MAIN W/SIZE CALLOUT
- 8" RW — EXISTING RAW WATER MAIN W/SIZE CALLOUT
- UG ELEC — EXISTING UNDERGROUND ELECTRIC CABLE
- 8" SS — EXISTING SANITARY SEWER MAIN W/SIZE CALLOUT
- 8" FM — EXISTING FORCE MAIN W/SIZE CALLOUT
- 30" SDR — EXISTING STORM DRAIN W/SIZE CALLOUT
- UG TEL — EXISTING UNDERGROUND TELEPHONE CABLE
- UG CTV — EXISTING UNDERGROUND CABLE T.V.
- XXX — FUTURE UTILITY W/SIZE CALLOUT
- LD — TRAFFIC SIGNAL LOOP DETECTOR
- W — EXISTING WATER METER AND BOX
- E — EXISTING ELECTRIC JUNCTION BOX
- SS — EXISTING SANITARY SEWER MANHOLE
- T — EXISTING TELEPHONE JUNCTION BOX
- C — EXISTING CABLE T.V. JUNCTION BOX
- PS — EXISTING PUMP STATION

- MINOR CONTOUR LINE, EXISTING GRADE
- 20 — MAJOR CONTOUR LINE, EXISTING GRADE
- 123.20 — FINISHED ELEVATION
- (123.20) — EXISTING ELEVATION
- TOP / TOE — CUT OR FILL SLOPE TO BE CONSTRUCTED
- SHRUB
- TREE
- PINE TREE
- FIRE HYDRANT AND VALVE
- COMBINATION POWER/TELEPHONE POLE
- COMBINATION POWER/TELEPHONE POLE W/LIGHT
- SIGNAL LIGHT POLE (TRAFFIC AND RAILROAD)
- STREET LIGHT POLE
- GUY WIRE
- MH — MANHOLE
- PCOTG — PRESSURE CLEANOUT TO GRADE
- WCO / WCO — WALL CLEANOUT
- FCO / FCO — FLOOR CLEANOUT
- COTG / COTG — CLEANOUT TO GRADE
- BLOW OFF ASSEMBLY
- HUB DRAIN
- FLOOR DRAIN
- FLOOR SINK
- SOIL BORING
- BENCH MARK
- HORIZONTAL AND VERTICAL CONTROL POINT
- CHANGE IN PIPING MATERIAL
- ∅ — ROUND OR DIAMETER
- SQUARE
- @ — AT
- ∠ — ANGLE
- 24" RW–RCP — PIPE SIZE, FLUID ABBREVIATION AND TYPE OF PIPE
- 42" RW — PIPE CALLOUT (SEE PIPING SCHEDULE)
- ME-2 — EQUIPMENT NUMBER (SEE EQUIPMENT SCHEDULE)
- BACKWATER VALVE
- BACKFLOW PREVENTER

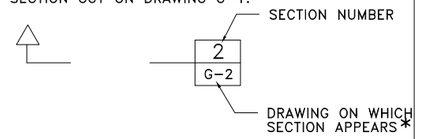
- GATE VALVE, BURIED WITH VALVE BOX
- BUTTERFLY VALVE, BURIED WITH VALVE BOX
- ECCENTRIC PLUG VALVE, BURIED WITH VALVE BOX
- LUBRICATED PLUG VALVE, BURIED WITH VALVE BOX
- GATE VALVE
- BUTTERFLY VALVE OR DAMPER
- ECCENTRIC PLUG VALVE
- LUBRICATED PLUG VALVE
- GLOBE VALVE
- BALL VALVE
- DIAPHRAGM VALVE
- CHECK VALVE
- PRESSURE REGULATING VALVE
- BACK–PRESSURE VALVE
- M / P — MOTOR OPERATOR FOR VALVES (M = ELECTRIC, P = PNEUMATIC)
- T — TEMPERATURE CONTROL VALVE
- S — SOLENOID VALVE
- MULTIPORT VALVE – 3 WAY
- MULTIPORT VALVE – 4 WAY
- FLOAT OPERATED VALVE
- NEEDLE VALVE
- PRESSURE RELIEF VALVE
- ANGLE VALVE
- HOSE BIBB (H/B)
- B — BUBBLER LEVEL CONTROL
- CENTRIFUGAL OR TURBINE PUMP OR FAN
- METERING PUMP
- PROGRESSING CAVITY, POSITIVE DISPLACEMENT PUMP
- BLOWER OR COMPRESSOR
- INJECTOR OR EDUCTOR
- F/A — FLAME ARRESTER
- AIR VACUUM AND AIR RELEASE ASSEMBLY
- THERMOMETER
- PIPE ANCHOR

- T — ROOM THERMOSTAT
- G — PRESSURE GAUGE
- G — PRESSURE GAUGE WITH DIAPHRAGM SEAL
- S — PRESSURE SWITCH
- S — PRESSURE SWITCH WITH DIAPHRAGM SEAL
- FLANGED FITTING
- WELDED FITTING
- MECHANICAL–TYPE FITTING (GROOVED)
- SCREWED, SOCKET–WELD, BELL AND SPIGOT OR HUBLESS FITTING
- SLEEVE–TYPE COUPLING
- FLANGED ADAPTER COUPLING
- FLANGED ADAPTER – SET SCREW TYPE
- EXPANSION JOINT
- MECHANICAL TYPE COUPLING
- FLEXIBLE COUPLING
- UNION
- QUICK DISCONNECT COUPLER
- CAPPED END OR PLUGGED END
- BLIND FLANGE
- REDUCER OR INCREASER
- CUT PIPE
- STRAINER
- DRAIN
- FLOW TUBE
- M M — MAGNETIC METER
- D M — DENSITY METER
- P M — PROPELLER METER
- S M — SONIC METER
- ORIFICE PLATE AND FLANGES
- ROTAMETER
- T — CONDENSATE TRAP
- PIPE SUPPORT (IN PLAN ONLY)
- CB — CATCH BASIN
- PULSATION DAMPENER
- EXPANSION CHAMBER WITH RUPTURE DISC
- RUPTURE DISC
- FG / X — FLOW SIGHT GLASS

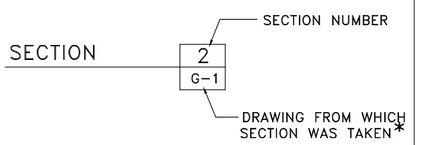
SECTION AND DETAIL IDENTIFICATION

SECTION IDENTIFICATION

(1) SECTION CUT ON DRAWING G–1:

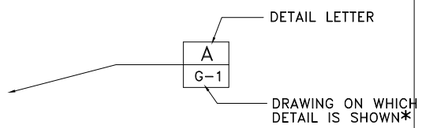


(2) ON DRAWING G–2 THIS SECTION IS IDENTIFIED AS:

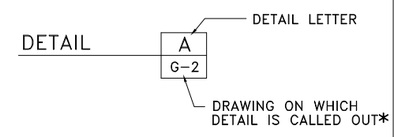


DETAIL IDENTIFICATION

(1) DETAIL CALL–OUT ON DRAWING G–2 AS:

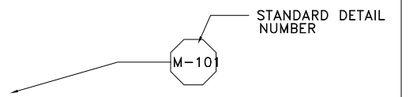


(2) ON DRAWING G–1 THIS DETAIL IDENTIFIED AS:

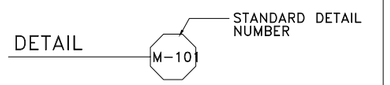


STANDARD DETAIL IDENTIFICATION

(1) DETAIL CALL–OUT ON PLAN OR SECTION:



(2) ON DRAWING THIS DETAIL IDENTIFIED AS:



*NOTE: IF PLAN AND SECTION (OR DETAIL CALL–OUT AND DETAIL) ARE SHOWN ON SAME DRAWING, DRAWING NUMBER IS REPLACED BY A LINE.

NOTES:

(1) ELECTRICAL SYMBOLS SHOWN ON ELECTRICAL SHEETS.
(2) FOR WELDING SYMBOLS, USE AMERICAN WELDING SOCIETY STANDARD SYMBOLS. SEE AMERICAN INSTITUTE OF STEEL CONSTRUCTION MANUAL.
(3) INSTRUMENTATION SYMBOLS SHOWN ON INSTRUMENTATION SHEETS.

This record drawing has been prepared, in part, on the basis of information compiled and furnished by others. The Engineer is not responsible for any errors or omissions which have been incorporated into this document as a result.

RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
60	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER — R. C. E. NO. 19427 — DATE 4/23/98

MONTGOMERY WATSON — R. C. E. NO. 10818 — DATE 4/23/98

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE
APPROVED ____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
SYMBOLS

SHEET G–3 OF 40 SHEETS

A	AIR
AAN	AMERICAN ASSOCIATION OF NURSERYMEN
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
AB	ANCHOR BOLT
ABBR	ABBREVIATION
ABS	ABSOLUTE TEMPERATURE
AC	ACTIVATED CARBON, ASPHALTIC CONCRETE, OR ALTERNATING CURRENT
A/C	AIR CONDITIONING
ACOUS	ACOUSTIC OR ACOUSTICAL
ACI	AMERICAN CONCRETE INSTITUTE
ACP	ASPHALTIC CONCRETE PAVEMENT OR ASBESTOS CEMENT PIPE
ADA	AMERICANS WITH DISABILITIES ACT
ADJ	ADJUSTABLE
AER	AERATION
AGA	AMERICAN GAS ASSOCIATION
AGC	ASSOCIATED GENERAL CONTRACTORS OF AMERICA
AIA	AMERICAN INSTITUTE OF ARCHITECTS
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AISI	AMERICAN IRON AND STEEL INSTITUTE
AL	ALUMINUM OR ALUM
ALUM	ALUMINUM
AMB	AMBIENT
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE (FORMERLY A.S.A.)
API	AMERICAN PETROLEUM INSTITUTE
APPD	APPROVED
APPROX	APPROXIMATE
APWA	AMERICAN PUBLIC WORKS ASSOCIATION
ARCH	ARCHITECTURAL
ASA	AMERICAN STANDARDS ASSOCIATION (NOW ANSI)
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ASSY	ASSEMBLY
AT	ACOUSTICAL TILE
ATM	ATMOSPHERE
AVAR	AIR VACUUM AND AIR RELEASE VALVE
AVG	AVERAGE
AWPA	AMERICAN WOOD PRESERVERS ASSOCIATION
AWS	AMERICAN WELDING SOCIETY
AWWA	AMERICAN WATER WORKS ASSOCIATION
BC	BEGIN CURVE, BOLT CIRCLE OR BETWEEN CENTERS
BCR	BEGIN CURB RETURN
BD	BOARD
BF	BLIND FLANGE
BFP	BACK FLOW PREVENTER
BHP	BRAKE HORSEPOWER
BLDG	BUILDING
BLD FLG	BLIND FLANGE
BLK	BLACK OR BLOCK
BLKG	BLOCKING
BM	BEAM OR BENCH MARK
BO	BLOW-OFF ASSEMBLY
BOD	BIOCHEMICAL OXYGEN DEMAND
BOT	BOTTOM
BPV	BACK PRESSURE VALVE
BRK	BRICK
B & S	BELL AND SPIGOT
BSMT	BASEMENT
BT	BOLT
BTU	BRITISH THERMAL UNIT
BV	BUTTERFLY VALVE
BVC	BEGIN VERTICAL CURVE
BWV	BACK WATER VALVE
C	CENTIGRADE
CAB	CABINET
CABO	COUNCIL OF AMERICAN BUILDING OFFICIALS
CAP	CAPACITY
CB	CATCH BASIN OR CHALK BOARD
CC	CENTER TO CENTER
CD	CEILING DIFFUSER
CLR	CLEAR
CEM	CEMENT
CER	CERAMIC
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHEM	CHEMICAL
CHG	CHANGE
CHK V	CHECK VALVE
CHKD PL	CHECKERED PLATE
CI	CAST IRON
CJ	CONSTRUCTION JOINT
CL	CHLORINE GAS, CHLORINATOR, CHAIN LINK, CLEARANCE OR CENTERLINE
CLG	CEILING
CLOS	CLOSET
CLR	CLEAR
CM	CENTIMETER
CML & C	CEMENT MORTAR LINED AND COATED
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COL	COLUMN
CONC	CONCRETE OR CONCENTRIC
COND	CONDENSER OR CONDENSATE
CONN	CONNECTION
CONSTR	CONSTRUCTION OR CONSTRUCT
CONT	CONTINUED OR CONTINUOUS
CONTR	CONTRACTOR
COMP	COMPRESSOR
COTG	CLEAN-OUT TO GRADE
CPLG	COUPLING
CPVC	CHLORINATED POLYVINYL CHLORIDE
CRSI	CONCRETE REINFORCED STEEL INSTITUTE
CS	CAUSTIC SODA OR CAST STEEL
CT	CERAMIC TILE
CTSK	COUNTERSUNK
CTR	CENTER
CU	COPPER OR CUBIC
CYL	CYLINDER

d	PENNY
DBL	DOUBLE
DC	DIRECT CURRENT
DET	DETAIL
DEQ	DEPARTMENT OF ENVIRONMENTAL QUALITY
DF	DRINKING FOUNTAIN OR DOUGLAS FIR
DG	DOOR GRILLE
DI	DUCTILE IRON
DIA	DIAMETER
DIAG	DIAGONAL
DIAPH	DIAPHRAGM
DISCH	DISCHARGE
DISP	DISPENSER
DN	DOWN OR DECANT
DO	DISSOLVED OXYGEN
DR	DOOR OR DRAIN
DS	DRENCH SHOWER AND EYE WASH, OR DOWNSPOUT
DWG	DRAWING
DIFF	DIFFUSER OR DIFFERENTIAL
E	EAST
EA	EACH
EB	EXPANSION BOLT OR ANCHOR
EC	END CURVE
ECC	ECCENTRIC
ECR	END CURB RETURN
EF	EACH FACE OR EXHAUST FAN
EFF	EFFLUENT
EG	EXHAUST GRILLE OR EXISTING GRADE
EL	ELEVATION
ELEC	ELECTRICAL OR ELECTRONIC
ENG	ENGINE
EPA	ENVIRONMENTAL PROTECTION AGENCY
EPT	ETHYLENE PROPYLENE
ENCL	ENCLOSURE
ENT	ENTRANCE
EQ	EQUAL
EQUIP	EQUIPMENT
EVAP	EVAPORATOR
EVC	END VERTICAL CURVE
EW	EACH WAY OR EYE WASH
EXH	EXHAUST
EX-HY	EXTRA HEAVY
EXIST	EXISTING
EXP JT	EXPANSION JOINT
EXT	EXTERIOR OR EXTENSION
EXTR	EXTRUDED
F	FAHRENHEIT OR FINISH
FABR	FABRICATION, FABRICATE OR FABRICATED
FAI	FRESH AIR INTAKE
FB	FLAT BAR, FLOOR BEAM OR FIELD BOOK
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDR	FEEDER
FE	FIRE EXTINGUISHER OR FINAL EFFLUENT
FEM	FEMALE (PIPE THREAD)
FF	FLAT FACE, FAR FACE OR FINISHED FLOOR
F TO F	FACE TO FACE
FG	FINISHED GRADE
FH	FIRE HYDRANT
FHWA	FEDERAL HIGHWAY ADMINISTRATION
FIG	FIGURE
FIN	FINISHED
FIX	FIXTURE
FL or FLL	FLOWLINE OR FLOOR
FLEX	FLEXIBLE
FLOCC	FLOCCULATOR OR FLOCCULATION
FLG	FLANGE OR FLOORING
FLGD	FLANGED
FLR	FLOOR
FM	FACTORY MUTUAL (LAB. APPROVED)
FMH	FLEXIBLE METAL HOSE
FND	FOUNDATION
FOC	FACE OF CONCRETE
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOW	FACE OF WALL
FPC	FLEXIBLE PIPE COUPLING
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FR	FRAME
FS	FAR SIDE, FLOOR SINK, FINISHED SURFACE, FORGED STEEL
FRP	FIBERGLASS REINFORCED PLASTIC
	FROTH SPRAY OR FACTOR OF SAFETY
FT	FEET OR FOOT
FT. LB	FOOT-POUND
FTG	FOOTING
FUT	FUTURE
FWPS	FINISHED WATER PUMP STATION
FXD	FIXED
GA	GAGE OR GAUGE
GAL	GALLON
GALV	GALVANIZED
GEN	GENERAL OR GENERATOR
GFA	GROOVED FLANGE ADAPTER
GI	GALVANIZED IRON
GL	GLASS
GL/BM	GLUE LAMINATED BEAM
GLV	GLOBE VALVE
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GRD	GRADE OR GROUND
GR BRK	GRADE BREAK OR GRADE CHANGE
GRTG	GRATING
GV	GATE VALVE
GYP	GYPSUM

HB	HOSE BIBB
HDR	HEADER
HDW	HARDWARE
HEX	HEXAGONAL
Hg	MERCURY
HGR	HANGER
HGT	HEIGHT
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HP	HORSEPOWER, HIGH PRESSURE OR HIGH POINT
H/P	HIGH POINT
HR	HEATING RETURN OR HOUR
HTG	HEATING
HTR	HEATER
H & V	HEATING AND VENTILATING
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HWL	HIGH/WATER LEVEL
HWD	HARDWOOD
HWO	HANDWHEEL OPERATED
HV	HORIZONTAL AND VERTICAL CONTROL POINT
HYD	HYDRAULIC OR HYDRANT
ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH
INFL	INFLUENT
IN. LB	INCH-POUND
INSL	INSULATION OR INSULATED
INSTR	INSTRUMENT
INT	INTERIOR
INV	INVERT ELEVATION
IP	IRON PIPE
IPS	IRON PIPE SIZE
IRRG	IRRIGATION
ITE	INSTITUTE OF TRAFFIC ENGINEERS
IR	IRON ROD
JAN	JANITOR
JT	JOINT
K	KELVIN, KILO OR KARAT
KG	KILOGRAM
KM	KILOMETER
KV	KILOVOLT
KW	KILOWATT
KWH	KILOWATT HOUR
LP	LOW POINT
L	LITER OR LENGTH
LAB	LABORATORY
LAM	LAMINATED
LAV	LAVATORY
LB	POUND
LDG	LANDING
LEV	LEVEL
LG	LENGTH OR LONG
LT	LEFT OR LIGHT
LWL	LOW WATER LEVEL
LWR	LOWER
M	METER OR MALE (PIPE THREAD)
MAG	MAGNETIC
MAN	MANUAL
MACH	MACHINE
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MECH	MECHANICAL
MED	MEDIUM
MEMB	MEMBRANE
MFR	MANUFACTURER
MFR'D	MANUFACTURED
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MI	MALLEABLE IRON
MICRON	1/1,000,000 METER
MIL	MILITARY, 1/1,000 INCH
MIN	MINIMUM OR MINUTE
MIR	MIRROR
MISC	MISCELLANEOUS
MK	MARK
MO	MOTOR OPERATED OR MASONRY OPENING
MOD	MODEL
MS	MOP SINK
MTC	MECHANICAL-TYPE COUPLING
MTD	MOUNTED
MTG	MOUNTING
MTL	MATERIAL OR METAL
MTR	MOTOR
N	NORTH
NACE	NATIONAL ASSOCIATION OF CORROSION ENGINEERS
NBS	NATIONAL BUREAU OF STANDARDS
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NF	NEAR FACE
NG	NATURAL GRADE OR NATURAL GAS
NLMA	NATIONAL LUMBER MANUFACTURER'S ASSOCIATION
NIC	NOT IN CONTRACT
NO	NUMBER OR NORMALLY OPEN
NOM	NOMINAL
NPS	NOMINAL
NPT	NATIONAL PIPE THREAD
NRS	NON-RISING STEM
NS	NEAR SIDE
NTS	NOT TO SCALE

OC	OVER-CROSSING OR ON CENTER
OD	OUTSIDE DIAMETER OR OVERALL DIMENSION
ODOT	OREGON DEPARTMENT OF TRANSPORTATION
OF	OVERFLOW OR OUTSIDE FACE
OFF	OFFICE
OH	OVER HEAD
OPER	OPERATOR OR OPERATING
OPNG	OPENING
ORS	OREGON REVISIED STATUTES
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OSHD	OREGON STATE HIGHWAY DIVISION
OS & Y	OUTSIDE SCREW AND YOKE
OWG	OIL, WATER, GAS
OZ	OUNCE
P/S	POLE AND SHELF
P	POLE, PAGE OR PIPE
PART	PARTITION
PAVMT	PAVEMENT
PB	POLYBUTYLENE
PC	PRIMARY CLARIFIER OR PORTLAND CEMENT
PCA	PORTLAND CEMENT ASSOCIATION
PCC	PORTLAND CEMENT CONCRETE
PCOTG	PRESSURE CLEANOUT TO GRADE
PDOT	PORTLAND DEPARTMENT OF TRANSPORTATION
PE	PLANT EFFLUENT, POLYELECTROLYTE POLYMER OR POLYETHYLENE
PG	PRESSURE GAGE
pH	HYDROGEN ION CONCENTRATION
PI	PLANT INFLUENT OR POINT OF INTERSECTION
PL	PLATE, PROPERTY LINE OR PLACE
PLAS	PLASTER OR PLASTIC
PLYWD	PLYWOOD
PNEU	PNEUMATIC
PNL	PANEL
PM	PRESSED METAL
PP	POWER POLE OR POLYPROPYLENE
PLT	PLANT
PPD	POUNDS PER DAY
PPH	POUNDS PER HOUR
PPM	PARTS PER MILLION
PR	PAIR
PRCT	PRECAST
PREFAB	PREFABRICATED
PRESS	PRESSURE
PRV	PRESSURE REGULATING, RELIEF OR REDUCING VALVE
PS	PRESSURE SWITCH OR PUMP STATION
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
PT	PAINT
PTDF	PRESSURE TREATED DOUGLAS FIR
PTFE	POLYTETRAFLUOROETHYLENE (TEFLON*)
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVDF	POLYVINYLIDENE FLUORIDE (KYNAR*)
QT	QUARRY TILE
QTY	QUANTITY
R	RADIUS, RISER, RETURN OR RATE OF SLOPE
RAG	RETURN AIR GRILLE
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN, ROUND, OR ROAD
RDWD	REDWOOD
RECIRC	RECIRCULATED
RED	REDUCER OR REDUCING
REF	REFERENCE OR REFER
REG	REGULATING
REIN	REINFORCE OR REINFORCED
RE-STL	REINFORCING STEEL
REQD	REQUIRED
RESIL	RESILIENT
REV	REVISION
RFG	ROOFING
RF	ROOF OR RAISED FACE
RM	ROOM
RO	ROUGH OPENING
RPM	REVOLUTIONS PER MINUTE OR REINFORCED PLASTIC MORTAR
RR	RAILROAD
RS	RISING STEM
RT	RIGHT
RTP	REINFORCED THERMOSETTING PLASTIC
R/W	RIGHT OF WAY
RW	RAW WATER OR REDWOOD
RWL	RAINWATER LEADER
S	SOUTH, SCUM, SINK, SECOND OR SLOPE
SA	SAMPLE
SBR	STYRENE BUTADIENE (RUBBER)
SC	SPARE CHEMICAL OR SECONDARY CLARIFIER
SCD	SCREWED
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SDR	STORM DRAINS
SEC	SECONDARY
SECT	SECTION
SER	SERIES
SETT	SETTLING
SH	SHOWER
SHT	SHEET OR SHELF
SHTG	SHEATHING
SIM	SIMILAR
SL	SLUDGE OR SLOPE
SOLN	SOLUTION
SLDG	SLIDING
SP	STATIC PRESSURE
SPECS	SPECIFICATIONS
SPECF	SPECIFIED
SQ	SQUARE

SS	SANITARY SEWER, STAINLESS STEEL OR SERVICE SINK
SSU	SECONDS SAYBOLT UNIVERSAL
STA	STATION
STC	SLEEVE-TYPE COUPLING
STD	STANDARD
STL	STEEL
STM	STEAM
STN	STAINLESS
STN STL	STAINLESS STEEL
STRUCT	STRUCTURAL OR STRUCTURE
SUCT	SUCTION
SV	SOLENOID VALVE
SWK	SIDEWALK
SWR	SIDEWALL REGISTER
SYM	SYMMETRICAL OR SYMBOL
SYS	SYSTEM
T	THERMOSTAT, TREAD OF STAIR, TANGENT OR TOP
TB	TACK BOARD, THRUST BLOCK
T & B	TOP AND BOTTOM
TBE	THREAD BOTH ENDS
TBM	TEMPORARY BENCH MARK
TBR	TO BE REMOVED OR RELOCATED (SEE SPECS.)
TC	TOP OF CURB
TEMP	TEMPERATURE OR TEMPORARY
T & G	TONGUE AND GROOVE
THK	THICK OR THICKNESS
THR	THRESHOLD
THR'D	THREADED
TK	TANK
TOE	THREAD ONE END
TOL	TOILET
TP	TELEPHONE POLE OR TELEGRAPH POLE
TRANS	TRANSITION OR TRANSMITTER
TS	TOP OF STRUCTURE
TSB	TOP SET BASE
TV	THERMOSTATIC VALVE OR TELEVISION
TW	TOP OF WALL OR THERMOMETER WELL
TYP	TYPICAL
UB	UNION BONNET
UBC	UNIFORM BUILDING CODE
UC	UNDER-CROSSING
UG	UNDERGROUND
UGC	UNDERGROUND CONDUIT
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORIES, INC.
UR	URINAL
USASI	UNITED STATES OF AMERICA STANDARDS INSTITUTE
V	VACUUM, VALVE, VERTICAL, VENT, VOLT OR VOLUME
VAR	VARIES OR VARIABLE
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
VOL	VOLUME
VTC	VENT TO CEILING
VTR	VENT THROUGH ROOF
VWC	VINYL WALL COVERING
W	WATER, WEST OR WASTE
W/	WITH
WC	WATER COLUMN OR WATER CLOSET
WCO	WALL CLEANOUT
WD	WOOD
WDW	WINDOW
WH	WATER HEATER
WI	WROUGHT IRON
W/O	WITHOUT
WOG	WATER, OIL OR GAS WORKING PRESSURE
WP	WATER PROOFING
WS	WATER SURFACE
WSTP	WATER STOP
WT	WEIGHT
WWM	WELDED WIRE MESH
WWP	WATER WORKING PRESSURE
WWPA	WESTERN WOOD PRODUCTS ASSOCIATION
XS	EXTRA STRONG
XXS	DOUBLE EXTRA STRONG
YD	YARD
YR	YEAR
Z	ZERO OR ZONE
ZN	ZINC

NOTES:

1. ADDITIONAL PIPING ABBREVIATIONS SHOWN ON SHEET GM-1
2. ELECTRICAL ABBREVIATIONS SHOWN ON SHEET E-1
3. ADDITIONAL ABBREVIATIONS CONFORM TO ANSI STANDARD ABBREVIATIONS Z32. 2.3

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

REV	DATE	BY	DESCRIPTION
RD.	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER 19427 4/23/98
R. C. E. NO. DATE
MONTGOMERY WATSON 10818 4/23/98
R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE
APPROVED _____ DATE

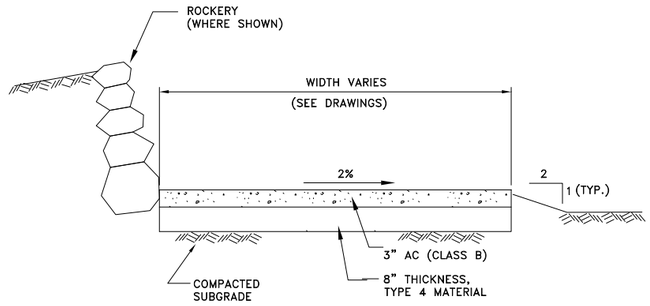
CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
ABBREVIATIONS

SHEET G-4 OF 40 SHEETS

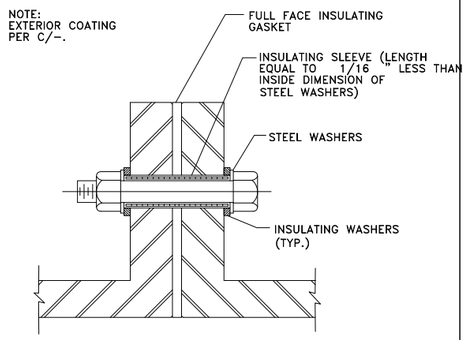
Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

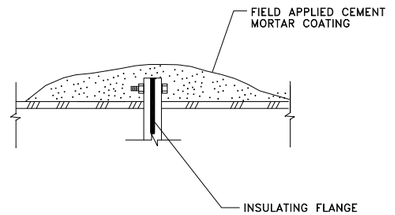
JOB No. 1065073.012580



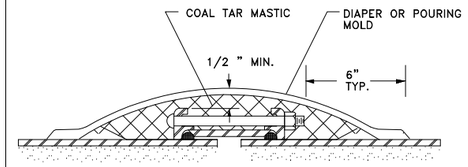
ASPHALT ROADWAY — A, VAR.



INSULATING FLANGE JOINT — B, M-1



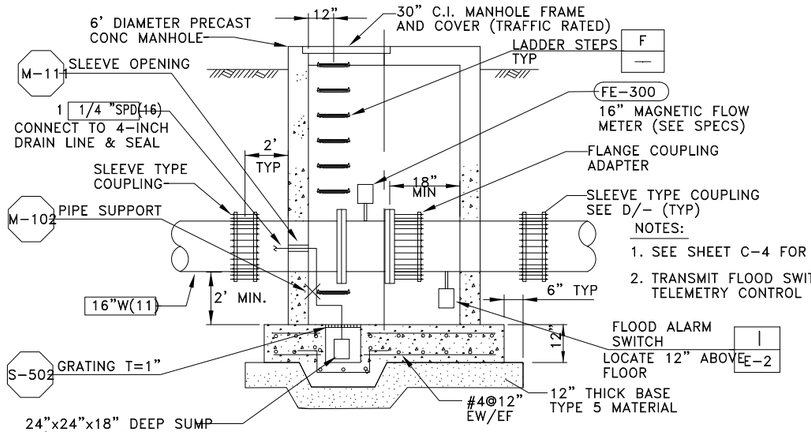
INSULATING JOINT COATING — C, –



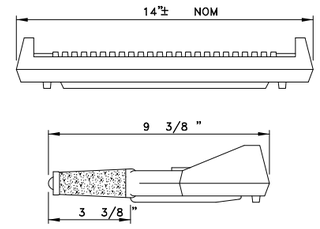
NOTE:

1 PROVIDE COATING FOR ALL BURIED SLEEVE COUPLINGS PER THIS DETAIL.

SLEEVE COUPLING COATING — D, VAR.



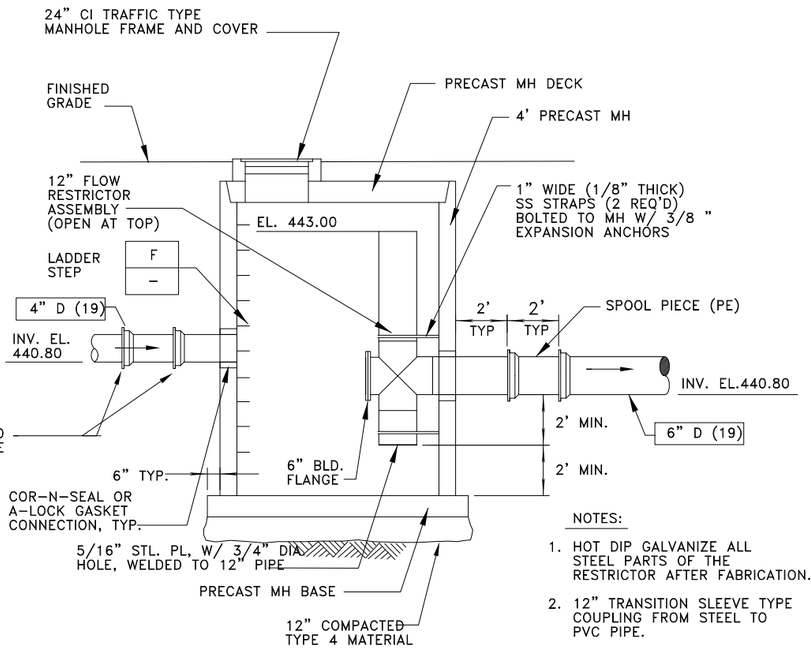
FLOW METER AND VAULT — E, VAR



NOTES:

1. PLASTIC: ALL STEPS SHALL MEET THE REQUIREMENTS OUTLINED IN ASTM D-4101 UNDER TYPE II.
2. STEPS SHALL BE REINFORCED WITH A DEFORMED 1/2 " REINFORCING BAR. MATERIAL IS GRADE 60 AND CONFORMS TO ALL REQUIREMENTS OF ASTM A-615.
3. STEPS SHALL BE INSTALLED AT 12" OC. SOCKET VOIDS SHALL BE FILLED WITH NON SHRINK GROUT.
4. STEP SHALL BE PRESS FIT MANHOLE STEPS, BOWCO INDUSTRIES, MODEL 93813 OR APPROVED EQUAL.

LADDER STEP — F, VAR



NOTES:

1. HOT DIP GALVANIZE ALL STEEL PARTS OF THE RESTRICTOR AFTER FABRICATION.
2. 12" TRANSITION SLEEVE TYPE COUPLING FROM STEEL TO PVC PIPE.

FLOATABLE MATERIAL SEPERATOR — G, VAR

NOTES:

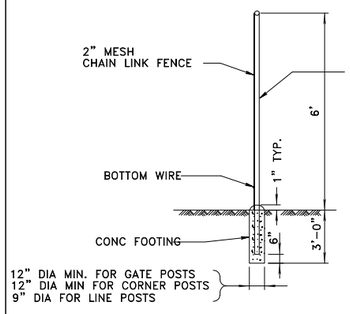
1. SEE SHEET C-4 FOR ADDITIONAL DATA.

SPECIFICATIONS

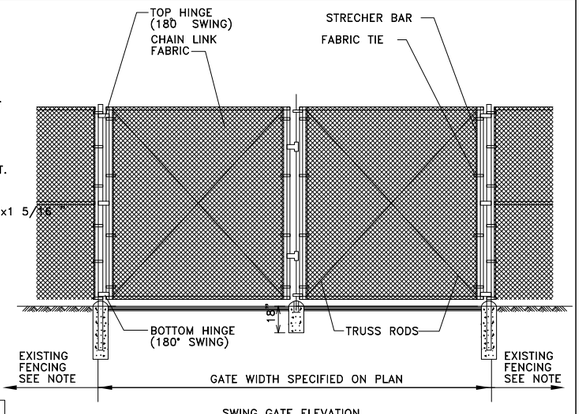
BARBED WIRE:	2 STRANDS OF NO. 12 1/2 STEEL WIRE W/ 4 POINT BARBS.
FABRIC:	NO.9 GALV. STEEL WIRE, 2" MESH.
FABRIC TIES:	NO. 9 GALV STEEL WIRE SPACED 14" APART ON POSTS AND 24" APART ON RAILS.
CORNER POST:	3" O.D. PIPE, 5.79#/FT.
LINE POSTS:	2.25" H – COLUMN SECTION, 4.1#/FT. OR STD. WEIGHT 2 1/2 " O.D. PIPE, 3.65#/FT.
SWING GATE POSTS:	4" O.D. PIPE, 9.1#/FT.
TOP RAIL & BRACES:	1 5/8 " O.D. PIPE, 2.27#/FT. OR 1 1/2 "x1 5/16" H – COLUMN SECTION, 2.00#/FT.
BOTTOM WIRE:	COIL SPRING WIRE 7 GA.
ALL FENCING MATERIALS:	TO BE HOT DIPPED GALV AFTER FABRICATION

NOTE:

REMOVE EXISTING FENCING, MAN GATE AND POSTS AS REQUIRED TO INSTALL NEW GATE.



ELEVATION



SWING GATE ELEVATION

GATE AND FENCE DETAIL — H, C-5

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
RD	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER — R. C. E. NO. 19427 — DATE 4/23/98
MONTGOMERY WATSON — R. C. E. NO. 10818 — DATE 4/23/98

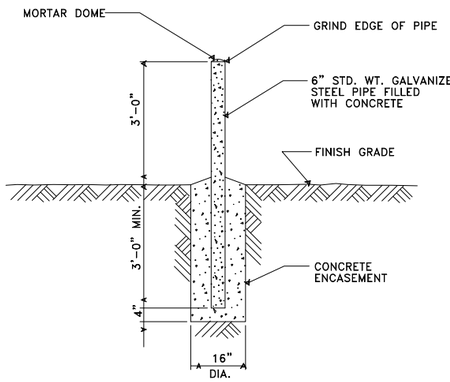
MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE _____
APPROVED _____ DATE _____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
CIVIL DETAILS – I

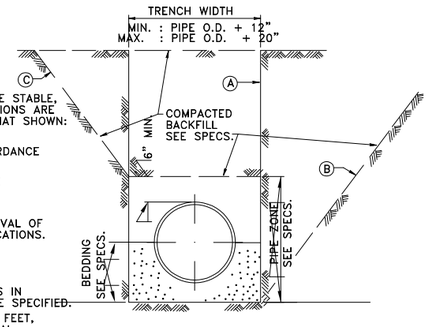
SHEET GC-1 OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$

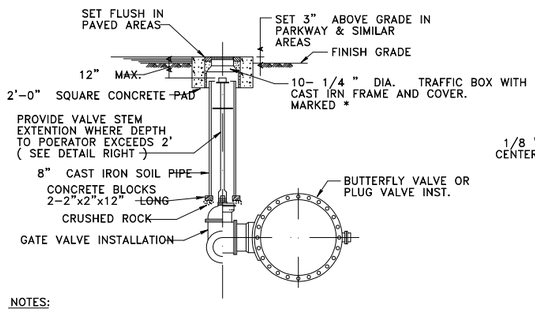


GUARD POST DETAIL — C-130

1. ALTERNATIVE TRENCH SECTIONS (A,B, AND C) ARE FOR USE ONLY WHERE STABLE, COMPACT SOIL CONDITIONS EXIST. WHERE BOULDERS OR LARGE OBSTRUCTIONS ARE ENCOUNTERED, THE TRENCH SECTIONS MAY BE WIDER & DEEPER THAN THAT SHOWN:
   - A. VERTICAL TRENCH WALLS – SECTION
     1. THE NEED FOR PROTECTIVE SYSTEMS SHALL BE DETERMINED IN ACCORDANCE WITH THE STATE STANDARDS AND REGULATIONS.
     2. PROTECTIVE SYSTEMS SHALL BE DESIGNED AND BUILT IN ACCORDANCE WITH APPLICABLE STATE STANDARDS AND REGULATIONS.
   - B. SLOPING TRENCH WALLS – SECTION
     1. SLOPING TRENCH WALL SECTION SHALL NOT BE USED WITHOUT APPROVAL OF ENGINEER, UNLESS SPECIFICALLY DESIGNATED ON PLANS OR SPECIFICATIONS.
     2. UNSUPPORTED SLOPING TRENCH WALLS SHALL NOT BE STEEPER THAN ALLOWED BY APPLICABLE SAFETY STANDARDS AND REGULATIONS.
   - C. COMBINATION OF VERTICAL AND SLOPING TRENCH WALLS – SECTION
     1. TRENCH DEPTHS NOT EXCEEDING 5 FEET SHALL HAVE VERTICAL WALLS IN PIPE ZONE UNLESS OTHERWISE APPROVED, BY ENGINEER, OR WHERE SPECIFIED.
     2. FOR TRENCHES WITH COMBINED WALLS AND ANY DEPTH EXCEEDING 5 FEET, DESIGN CALCULATIONS BY A REGISTERED CIVIL ENGINEER AND APPROVAL BY GOVERNING AGENCY OF SUPPORTED METHODS ARE REQUIRED.
2. WHERE WET, UNSTABLE OR RUNNING SOIL IS ENCOUNTERED, A SYSTEM SHALL BE DESIGNED AND BUILT IN ACCORDANCE WITH APPLICABLE SAFETY STANDARDS AND REGULATIONS TO PROTECT EMPLOYEES AND PREVENT CAVE INS.



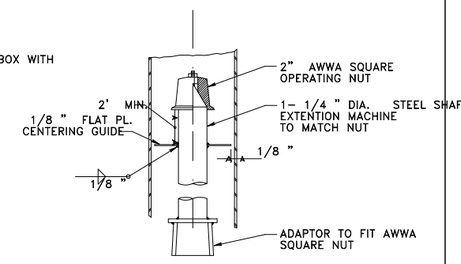
TYPICAL TRENCH SECTION — C-204



NOTES:

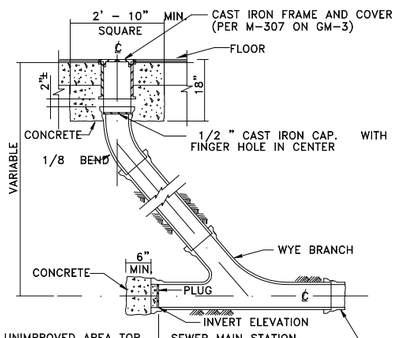
PROVIDE PROTECTIVE COATING TO EXTERIOR SURFACE OF VALVE BODY IN ACCORDANCE WITH SPECS.

FOR LUBRICATED PLUG VALVE, EXTEND LUBRICATION LINE TO GRADE PER MANUFACTURES INSTRUCTIONS.



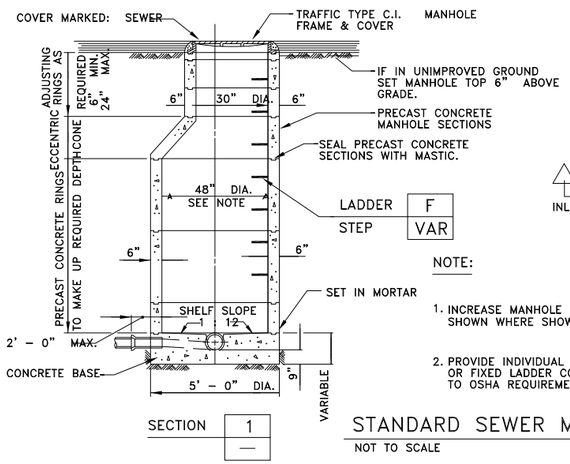
VALVE STEM EXTENSION

BURIED VALVE INSTALLATION — C-215



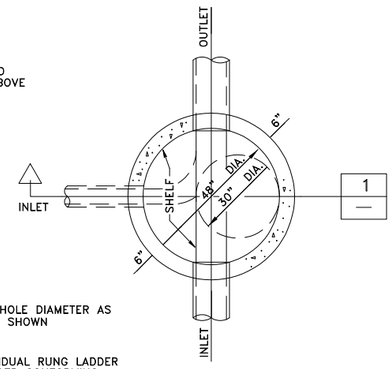
NOTE:
1. IF IN UNIMPROVED AREA TOP SHALL BE 6" ABOVE GRADE.
2. SEE PLAN FOR STATION AND INVERT ELEVATION. PIPE AND FITTINGS SHALL BE OF THE SAME MATERIAL AS THE MAIN LINE SEWER.

SEWER CLEANOUT (INSIDE) — C-408 MOD.



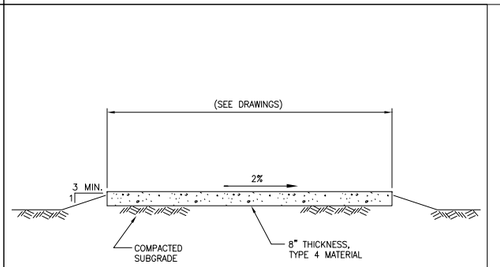
SECTION 1 —

NOTE:
1. INCREASE MANHOLE DIAMETER AS SHOWN WHERE SHOWN
2. PROVIDE INDIVIDUAL RUNG LADDER OR FIXED LADDER CONFORMING TO OSHA REQUIREMENTS.

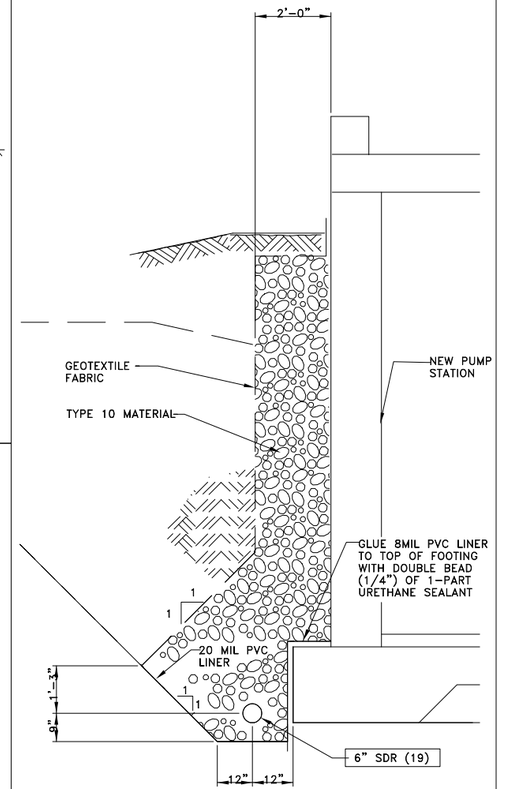


SECTIONAL PLAN

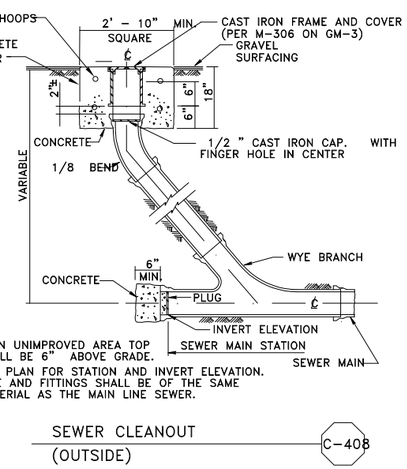
STANDARD SEWER MANHOLE W/ECCENTRIC CONE — C-402
NOT TO SCALE



GRAVEL BASE — D — C-5
N.T.S.

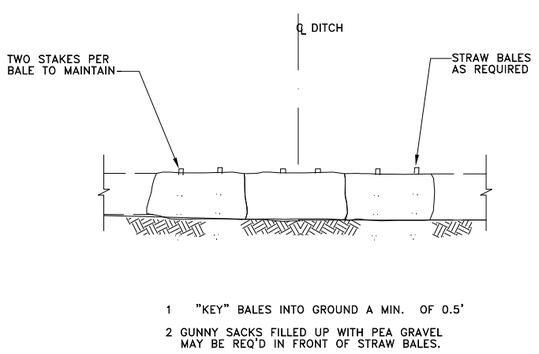


PUMP STATION PERIFERAL DRAIN — C — C-4



NOTE:
1. IF IN UNIMPROVED AREA TOP SHALL BE 6" ABOVE GRADE.
2. SEE PLAN FOR STATION AND INVERT ELEVATION. PIPE AND FITTINGS SHALL BE OF THE SAME MATERIAL AS THE MAIN LINE SEWER.

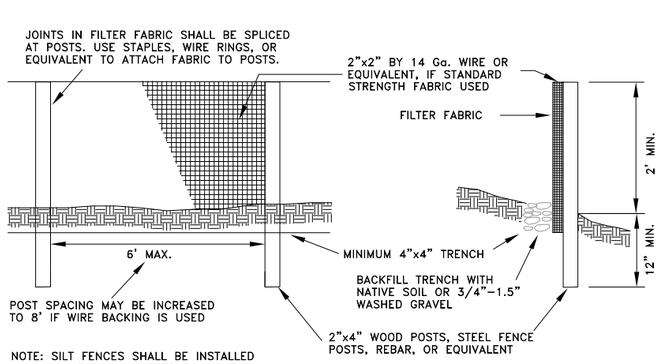
SEWER CLEANOUT (OUTSIDE) — C-408



1 "KEY" BALES INTO GROUND A MIN. OF 0.5'

2 GUNNY SACKS FILLED UP WITH PEA GRAVEL MAY BE REQ'D IN FRONT OF STRAW BALES.

STRAW BALE BARRIER — A — C-1



NOTE: SILT FENCES SHALL BE INSTALLED ALONG CONTOUR WHENEVER POSSIBLE

SILT FENCE — B — C-1

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RECORD DRAWING
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FILE: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

REV	DATE	BY	DESCRIPTION
RD.	4/99	DPR	RECORD DRAWING

SCALE: NONE

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DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER — 19427 R. C. E. NO. — 4/23/98 DATE

MONTGOMERY WATSON — 10818 R. C. E. NO. — 4/23/98 DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
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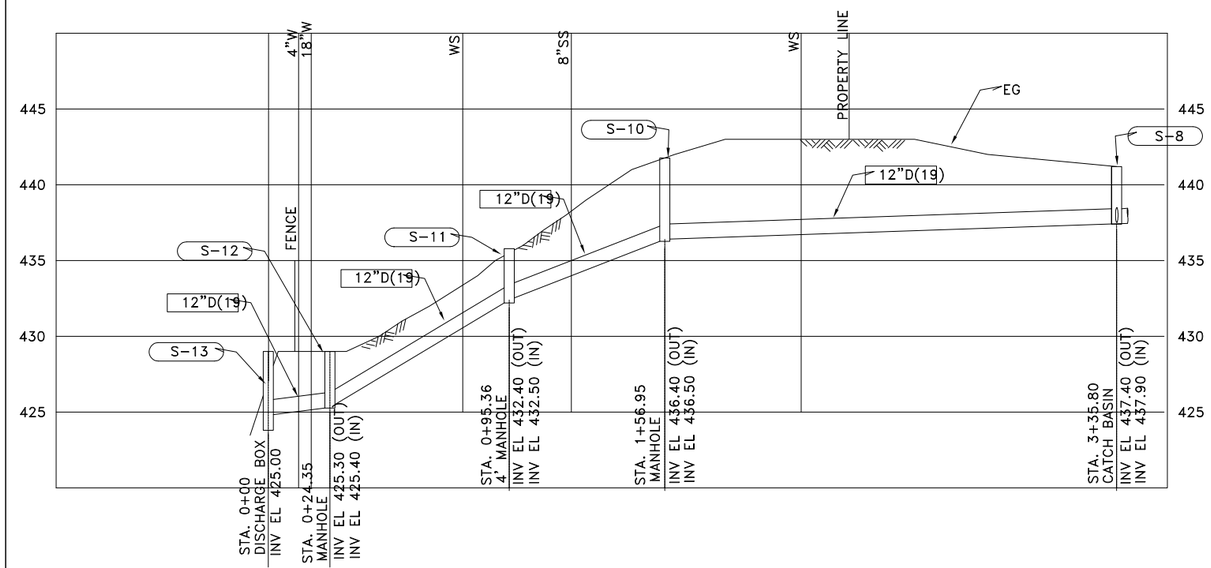
CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
CIVIL DETAILS – 2

SHEET GC-2 OF 40 SHEETS

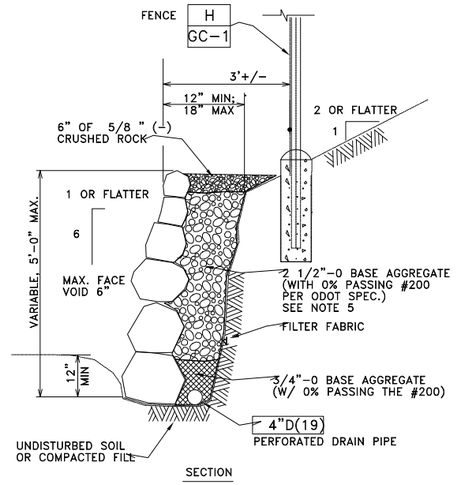
Plot Date/Time: $$$$date$$$$ $$time$$



PROFILE NO. 1

SCALE: 1" = 5' VERT
1" = 30' HORIZ.

NOTES:
1. SEE SHT C-4 FOR ADDITIONAL DATA.



SECTION

NOTES:

1. ROCK FACINGS SHALL BE CONSTRUCTED BY INTERLOCKING THE ROCKS SO THAT EACH ROCK IS IN CONTACT WITH AT LEAST TWO OTHER ROCKS WITH EACH ROCK HAVING A MINIMUM OF THREE BEARING SURFACES PER ROCK.
2. THE DENSITY OF ROCK MATERIAL SHALL BE A MINIMUM OF 160 POUNDS PER CUBIC FOOT. THE SIZE CATEGORIES FOR ROCK SHALL BE AS FOLLOWS:

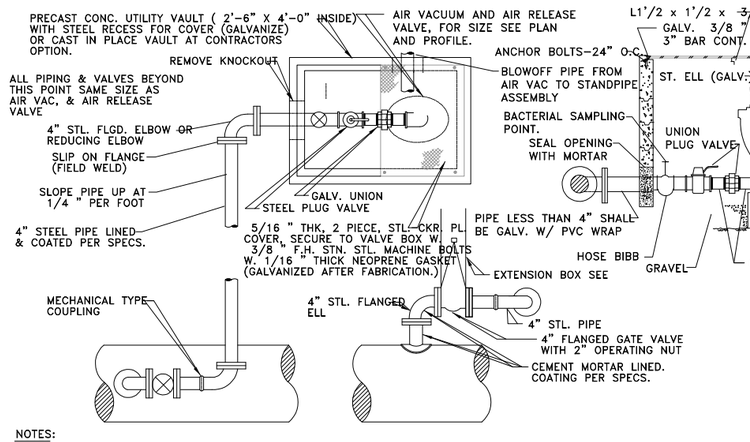
SIZE	APPROXIMATE WEIGHT	MINIMUM DIMENSION	APPROXIMATE VOLUME
ONE-MAN ROCK	160 TO 400 LB	12 INCHES	1.75 CF
TWO-MAN ROCK	500 TO 800 LB	13 INCHES	4 CF
THREE-MAN ROCK	900 TO 1,200 LB	16 INCHES	6.6 CF
FOUR-MAN ROCK	1,300 TO 1600 LB	18 INCHES	9 CF

3. ROCKS LESS THAN 1 CUBIC FOOT IN VOLUME OR WEIGHING LESS THAN 160 POUNDS SHALL NOT BE USED.
4. THE CONTRACTOR SHALL USE ROCK SIZES AS SET FORTH IN THE ABOVE TABLE AND SHALL INSURE A DISTRIBUTION OF ROCK SIZES WITH THE LARGEST ROCKS ON THE BOTTOM AND PROGRESSIVELY SMALLER ROCKS ON TOP.
5. CHINK VOIDS IN THE ROCKERY 3" DIA. OR GREATER WITH SUITABLY SIZED ROCK FRAGMENTS. CHINKING SHALL BE PLACED ON THE BACK SIDE OF THE WALL.

ROCKERY

N.T.S.

A
C-5



DETAIL OF STANDPIPE ASSEMBLY

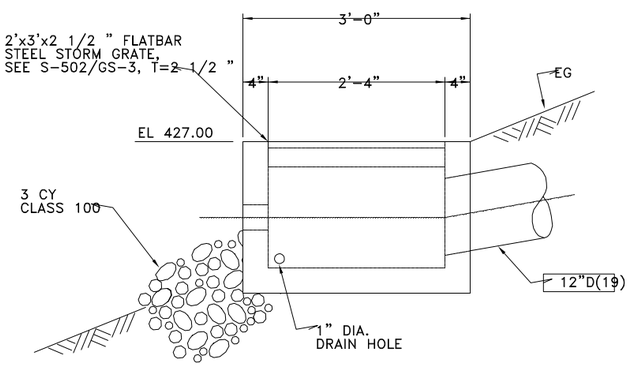
NOTES:

1. ALL FERROUS SURFACES OF PIPE AND APURTENANCES TO BE PROVIDED WITH PROTECTIVE COATINGS PER SPECS.
2. PROVIDE STAINLESS STEEL NUTS, BOLTS AND WASHERS TO BURIED FLANGES AND COUPLINGS, EXCEPT FOR NON-METALLEC WASHERS TO BE PROVIDED AS PART OF INSULATING FLANGE SET.

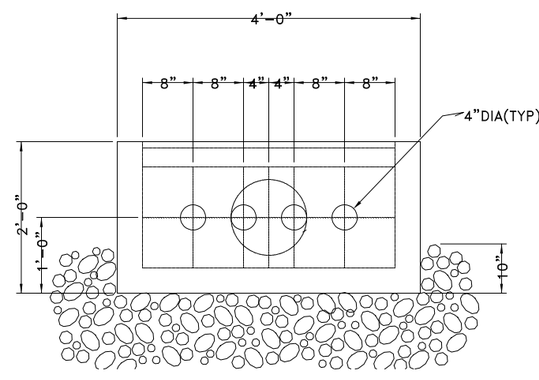
AIR/VAC ASSEMBLY

N.T.S.

C-220



SIDE VIEW



END VIEW

DISCHARGE BOX

N.T.S.

B
C-2

NOTES:
1. SEE SHT C-4 FOR ADDITIONAL DATA S-13
2. CONCRETE SHALL BE CLASS 3000, MINIMUM.
3. REINFORCE BOX W/#4 BARS @ 12" EW CENTERED IN ALL CONCRETE.

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RECORD DRAWING
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FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

REV	DATE	BY	DESCRIPTION
RD	4/99	DPR	RECORD DRAWING

SCALE: AS NOTED

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER 19427 R. C. E. NO. 4/23/98 DATE
MONTGOMERY WATSON 10818 R. C. E. NO. 4/23/98 DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE
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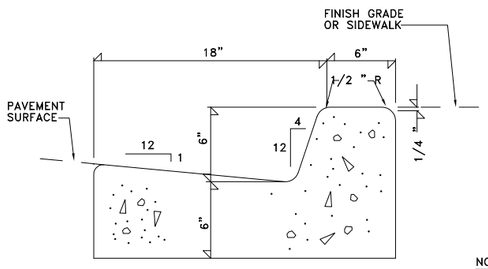
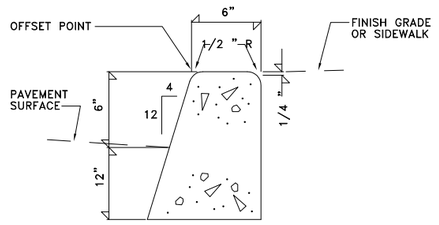
CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
CIVIL DETAILS – 3

SHEET
GC-3
OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$



CONCRETE CURB AND GUTTER

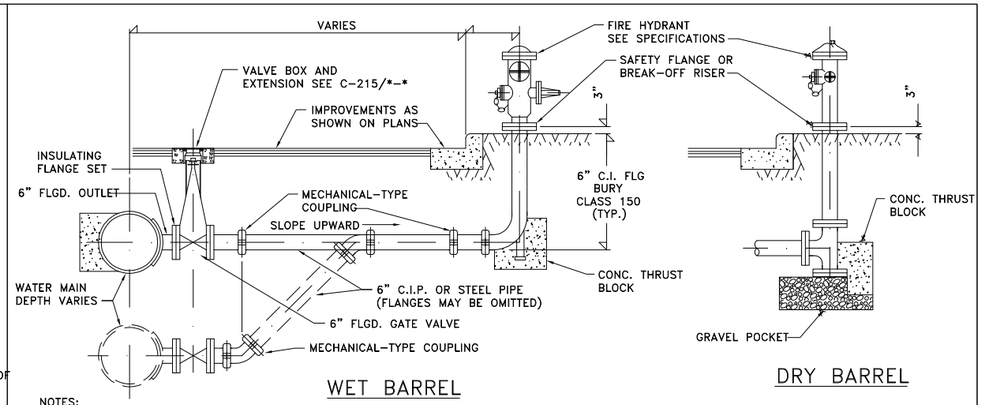


CONCRETE CURB

NOTE:

1. EXPANSION JOINTS OF ONE – HALF INCH RIGID BITUMINOUS MATERIAL SHALL BE PLACED AT ALL B.C.'S AND AT MAXIMUM 50 – FEET SPACING.
2. ALL EXPOSED SURFACES OF CURB SHALL BE GIVEN A MORTAR BRUSH COAT CONSISTING OF ONE PART PORTLAND CEMENT, ONE PART SAND PER SACK OF CEMENT, AND THEN TROWELED SMOOTH.

CONCRETE CURB AND GUTTER C-105



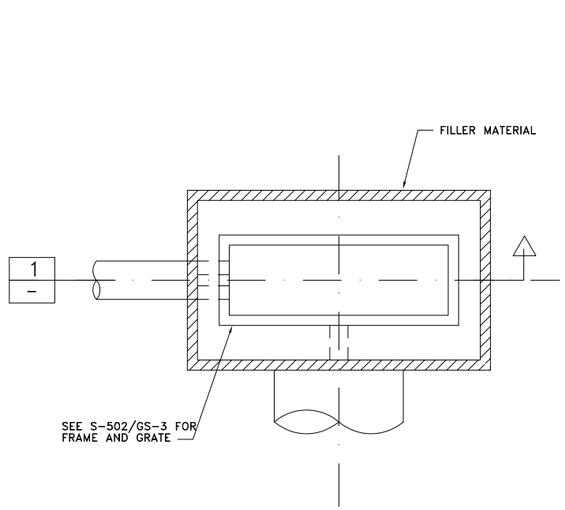
WET BARREL

DRY BARREL

NOTES:

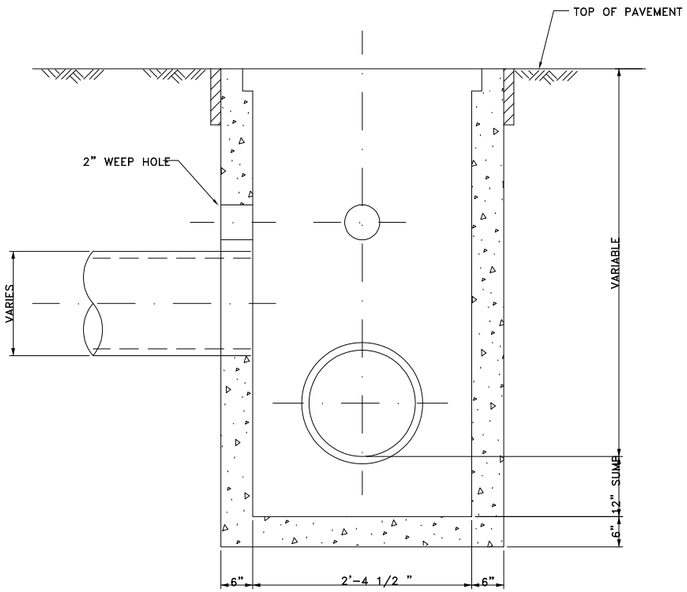
1. ALL FERROUS SURFACES OF PIPE AND APPURTENANCES TO BE PROVIDED WITH PROTECTIVE COATINGS PER SPECIFICATIONS.
2. PROVIDE STAINLESS STEEL NUTS, BOLTS, AND WASHERS TO BURIED FLANGES AND COUPLINGS, EXCEPT FOR NON-METALLIC WASHERS TO BE PROVIDED AS PART OF INSULATING FLANGE SET.
3. DRY BARRELL REQUIRED.

FIRE HYDRANT LATERAL C-222



PLAN

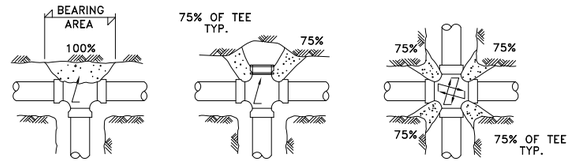
NOTE: DETAIL SHOWN IS CITY OF WEST LINN STANDARD.



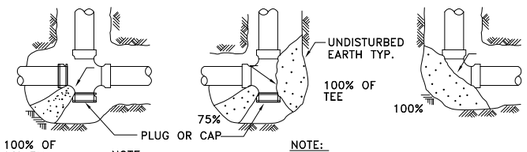
SECTION 1 –

CATCH BASIN A C-4

N.T.S.



PLANS



NOTE:
ARROWS ( ) INDICATE THRUST DIRECTION

NOTE:
FIGURE (100%) AT THRUST BLOCK INDICATES PERSENT OF TOTAL THRUST TO BE APPLIED FOR BEARING AREA.

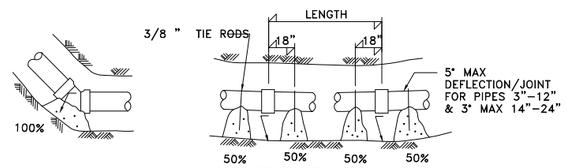
THRUST PER PSI OF WATER PRESSURE AT VARIOUS FITTINGS				
PIPE SIZE	DEAD END OR TEE	90° ELBOW	45° ELBOW	22 1/2° ELBOW
4	19	27	15	7
6	39	55	30	15
8	67	94	51	26
10	109	154	84	43
12	155	218	119	61
14	210	296	161	82
16	275	383	209	106
18	351	494	269	137
20	434	611	333	169
24	623	878	478	244

EXAMPLE:
8-INCH 90° ELBOW, PRESSURE=200lb./SQ.FN.
FROM TABLE: THRUST=94 x 200=18,800 lb.
ASSUME BEARING STRENGTH OF SOIL=2000 lb./SQ.FT.

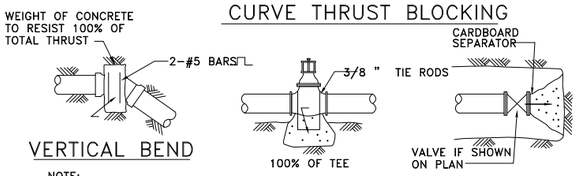
$\frac{18,800}{2000}$ =9.4 SQ.FT AREA FO BEARING REQUIRED FOR THRUST BLOCK

SIDE THRUST PERM 100 lb./SQ.IN.PRESSURE PER DEGREE OF DEFLECTION			
PIPE SIZE	SIDE THRUST–lb.	PIPE SIZE	SIDE THRUST–lb.
4	35	14	377
6	72	16	486
8	122	18	665
10	197	20	790
12	278	24	1150

MULTIPLY THRUST BY DEGREE OF DEFLECTION TO OBTAIN TOTAL THRUST



CURVE THRUST BLOCKING



VERTICAL BEND

VALVE

DEAD–END

NOTE:
CONC. FOR THRUST BLOCKS TO BE 2000 P.S.I

NOTES:

1. IN USING THE ABOVE TABLES, USE THE MAXIMUM INTERNAL PRESSURE ANTICIPATED (i.e. HYDROSTATIC TEST PRESSURE, POSSIBLESURGE PRESSURE DUE TO PUMP SHUT–OFF, ETC.
2. SEE SOILS REPORT FOR BEARING STRENGTH OFSOIL. IN THE ABSENCE OF A SOILS REPORT, AN AVERAGE SOIL (SPADABLE MEDIUM CLAY) CAN BE ASSUMED TO HAVE A BEARING STRENGTH OF 2000 P.S.F.
3. THRUST BLOCKS ARE NOT REQUIRED ON P.V.C. PIPE WITH SOLVENT WELDED JOINTS.

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CONCRETE THRUST BLOCKS FOR CAST IRON, ASBESTOS CEMENT AND P.V.C. PIPE C-224

RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
60	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER 19427 4/23/98
R. C. E. NO. DATE

MONTGOMERY WATSON 10818 4/23/98
R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
CIVIL DETAILS – 4

SHEET GC–4 OF 40 SHEETS

JOB No. 1065073.012580

FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

SITE BENCH MARK
IRON PIPE S.E. PROPERTY CORNER
N 1000.000
E 1000.000
ELEVATION = 456.42

SKYLINE DRIVE

SKYLINE CIRCLE

SKYLINE CT

SITE BENCH MARK
N 1000.000
E 1000.000

N 1014.701
E 965.422

N 1024.096
E 943.326

N 1027.593
E 970.739

N 1040.730
E 950.998

N 1076.680
E 1015.759

N 1071.676
E 1027.713
TL 7900

EXIST. WATER SERVICE
TO BE REMOVED

BASIS OF BEARING
N 23 03'07"E 403.98

N 1110.462
E 1014.177

N 1140.045
E 943.845

N 1178.180
E 924.308

NEW
PUMP
STATION
(SEE SHT C-2)
TL 7800

N 1218.406
E 1092.784
EL 443.40
(IRON PIPE)

EXISTING
PUMP
STATION
(SEE RECORD DWGS)
TL 7700

N 1292.013
E 1119.952

N 1301.592
E 1099.560

EXISTING TRANSFORMERS
AND POWER FEED
(TO BE REMOVED BY OTHERS)

N 1371.721
E 1158.184

EXIST. 6"PW(11)
TO BE ABANDONED
FOLLOWING INSTALLATION
OF 16" PIPE
(SEE SHT C-2)

SKYLINE DRIVE

N 1140.717
E 756.411

N 1147.204
E 741.264

N 1223.879
E 773.381

N 1244.056
E 725.975

EXIST. 6" VALVE
TO BE PERMANENTLY
CLOSED AND CAPPED
UPON ABANDONMENT

N 1214.105
E 794.288

N 1251.520
E 792.577

WORK LIMITS

SILT FENCE — B / GC-2

EXISIT OH ELEC TO BE REMOVED
BY UTILITY CO. (SEE ELEC DWGS)

PROTECT EXISTING
14" WATER PIPE

EXIST STAIRWAY
TO BE REMOVED
AND REPLACED
W/SHIPS LADDER

BOLTON
RESERVOIR

A / GC-2 — STRAW BALE BARRIER

TL 7100
MAP 2-1E-25 AD

STAGING AREA

N 1357.390
E 836.149

N 1379.749
E 781.821

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS
FOR SEAL AND SIGNATURES

REFERENCE NOTES:

(1) CONSTRUCTION LIMITS ARE 5 FEET OUTSIDE OF CURVE SHOWN ON GRADING PLANS.

TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) NOTES

1 – CONSTRUCTION RELATED EQUIPMENT AND VEHICLES SHALL BE CLEANED AT A SPECIALLY PREPARED CLEANING PAD AWAY FROM THE THE CONSTRUCTION SITE. ALL WATER FROM THE CLEANING OPERATION SHALL BE COLLECTED AND PREVENTED FROM DRAINING TO SURFACE WATERS.

2 – ALL BALLAST, WOOD CHIPS OR OTHER APPROVED MATERIAL USED FOR THE SURFACING OF THE STAGING STORAGE AREA SHALL BE REMOVED AND DISPOSED OF AT THE COMPLETION OF WORK, RESTORATION OF GROUND SURFACE SHALL BE COMPLETED IMMEDIATELY AFTER REMOVAL OF MATERIAL.

3 – ANY EXPOSED SOILS SHALL BE STABILIZED TO REDUCE EROSION. CONTRACTOR SHALL USE METHODS SUCH AS SILT FENCING, STRAW BALES, JUTE MATTING, PVC SHEETING AND HYDROSEEDING OR OTHER MEANS AS DIRECTED BY THE ENGINEER TO PREVENT EROSION DURING CONSTRUCTION.

4 – THE BOUNDARIES OF THE WORK LIMITS DEFINED ON THESE PLANS SHALL BE CLEARLY FLAGGED BY THE CONTRACTOR IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED WORK LIMITS SHALL BE PERMITTED UNLESS APPROVED BY THE ENGINEER. THE FLAGGING SHALL BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF THE CONSTRUCTION

5 – THE TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) FACILITIES MUST BE CONSTRUCTED IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO INSURE THAT SEDIMENT LADEN WATER DOES NOT VIOLATE APPLICABLE WATER STANDARDS.

6 – THE TESC FACILITIES ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD. THESE TESC FACILITIES SHALL BE UPGRADED (E.G. RELOCATION OF DITCHES AND SILT FENCES, ETC.) AS NEEDED FOR UNEXPECTED CONDITIONS AND STORM EVENTS.

7 – THE TESC FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTION.

8 – ANY AREA STRIPPED OF VEGETATION WHERE NO FURTHER WORK IS ANTICIPATED FOR A PERIOD OF 15 DAYS SHALL BE IMMEDIATELY STABILIZED WITH THE APPROVED TESC METHODS (E.G. SEEDING, MULCHING, NETTING, EROSION BLANKETS, ETC.).

9 – AS A MINIMUM, A 12" DEEP LAYER OF WOOD CHIPS SHALL BE PROVIDED WITHIN THE WORK LIMITS OVER NATIVE SOIL DURING TRENCHING OR OTHER CONSTRUCTION ACTIVITIES PERFORMED WITHIN THE DRIP LINE OF THE SITE FIR GROVE. WOOD CHIPS SHALL BE REMOVED TO A MAXIMUM DEPTH OF 2 INCHES UPON COMPLETION OF WORK WITHIN FIR GROVE DRIP LINE.

REV	DATE	BY	DESCRIPTION
ED.	4/99	DPR	RECORD DRAWING

SCALE: 1" = 30'

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER — 19427 — 4/23/98 (R. C. E. NO. — DATE)
MONTGOMERY WATSON — 10818 — 4/23/98 (R. C. E. NO. — DATE)

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
DEMOLITION AND TEMPORARY EROSION SEDIMENT CONTROL PLAN

SHEET C-1 OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

CONNECT TO EXISTING 6"W(11) – EAST

PLUG AND ABANDON EXISTING 6"W(11) – WEST

6"x90°

6"W(11)

V–21

16" TEE

16"W(11)

SEE E/C–2A

N 989.192
E 940.440

N 1000.000
E 1000.000

16"W(11)
(SEE NOTE 1)

SEE B/C–2A

CONNECT TO 16"W
N 1103.441
E 1031.040

SEE A/C–2A

N 1031.853
E 1348.215

S–13
STA. 0+00

12"D(19)

SEE SHT GC–3 FOR PROFILE NO. 1

SKYLINE DRIVE

SKYLINE CIRCLE

SKYLINE CT

S–12
STA. 0+24.35
N 1054.267
E 1357.729

S–11
STA. 0+95.36
N 1090.738
E 1296.801

S–10
STA. 1+56.95
N 1135.216
E 1254.202

N 1218.406
E 1092.784
EL 443.40

S–8
STA. 3+35.80

4"D(19)

S–9
STA. 4+02.94
(NOT FOUND PIPE DELETED)
N 1371.721
E 1158.184

PUMP STATION
SEE SHT M–1

SEE C/C–2A

N 1112.492
E 659.736

SKYLINE DRIVE

FIRE HYDRANT C–222

16"W(11)

16"x6"RED

THRUST BLOCK
SEE C224/GC–4

16"CROSS W/BF AND THRUST BLOCK ON WEST BRANCH

16" TEE

CONNECT TO EXIST. 14" W

CONNECT TO EXIST. 14" W W/SLEEVE TYPE CPLG SEE D/GC–1

14"W(11)

V–20

16"x14"RED

THRUST BLOCK

SEE D/C–2A

FOR NEW YARD PIPING IN THIS AREA SEE SHT C–3

BOLTON RESERVOIR

FOR NEW DRAINAGE PIPING IN THIS AREA SEE SHT C–4

FOR NEW GRADING, PAVING AND LANDSCAPING IN THIS AREA SEE SHT C–5

SHEET NOTES:

1. INSTALL 16" WATER PIPE WITH 3' MINIMUM TYPICAL COVER, SLOPE AS REQUIRED TO KEEP PIPE CONSTANTLY RISING FROM CONNECTION TO PUMP STATION PIPING TO THE CONNECTION TO THE EXISTING 14" PIPE.
2. PROVIDE ALL TRAFFIC CONTROL AND TEMPORARY PAVEMENT SURFACING AS REQUIRED TO MAINTAIN TRAFFIC. KEEP ONE LANE OPEN AT ALL TIMES.
3. PROTECT ALL TREES NOT SHOWN FOR REMOVAL, DO NOT CUT ROOTS OVER 1" IN DIAMETER. USE MINIMUM TRENCH WIDTH INSIDE FIR GROVE DRIPLINE.
4. INSTALL FITTINGS AND SPECIALS FOR 16" PIPE AS REQUIRED AND SHOWN TO CONNECT TO THE EXISTING PIPING.
5. SEE SHT G–1 FOR GENERAL NOTES.
6. SEE SHT C–4 FOR MH, CB AND OTHER DRAINAGE STRUCTURE ELEVATIONS.

REFERENCE NOTES:

(1) REMOVE TREE
(2) INSTALL FIRE HYDRANT W/GATE VALVE & BOX (SEE C–222/GC–4)
(3) ABANDON EXISTING 6" CI PIPE, CLOSE VALVES AND PLUG CUT PIPE ENDS AS REQ'D. REMOVE EXISTING FIRE HYDRANT.
(4) CONNECT EXIST CB TO NEW CB W/4"PVC PIPE, PLUG EXIST 4" DRAIN (WEST)
(5) CONTRACTOR SHALL POTHOLE AND VERIFY EXIST PIPELINE ELEVATIONS AT ALL CROSSINGS AND ADJUST DRAIN PIPE PROFILE AS REQUIRED (TYP).
(6) 16"x16"x45 DEG BEND
(7) 16"x16"x22 1/2 DEG BEND

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
RD.	4/99	DPR	RECORD DRAWING

SCALE: 1" = 30'

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER 19427 4/23/98 (R. C. E. NO. DATE)
MONTGOMERY WATSON 10818 4/23/98 (R. C. E. NO. DATE)

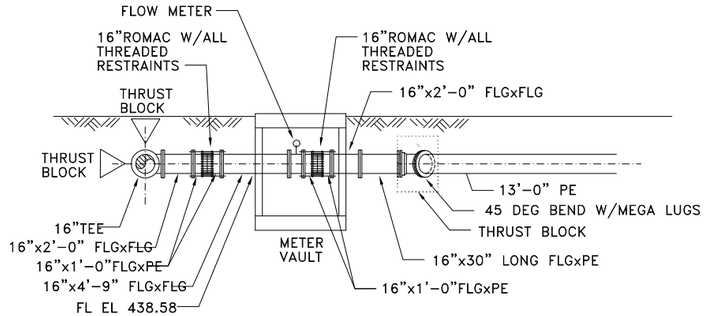
MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
OFFSITE PIPING PLAN

SHEET C–2 OF 40 SHEETS

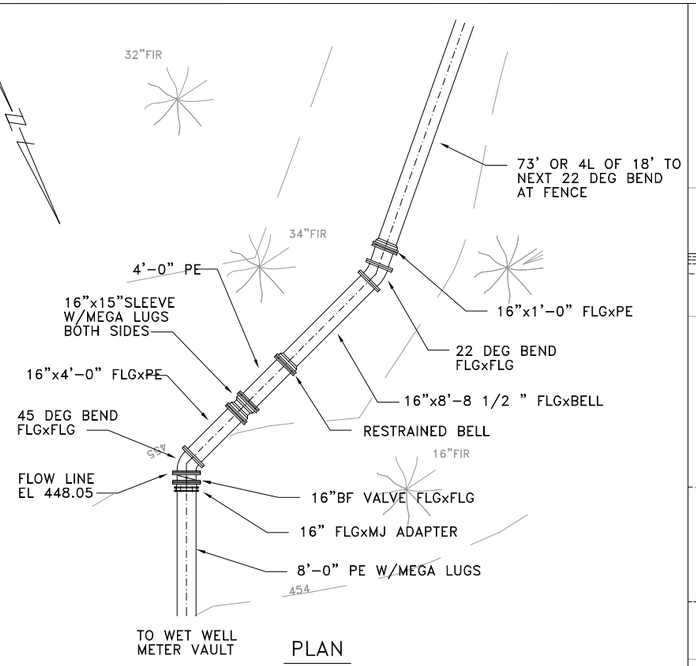
Plot Date/Time: $$$$date$$$$ $$time$$



NOTE:
FROM CENTER OF TEE TO CENTER OF FLOW METER IS 10'-3"

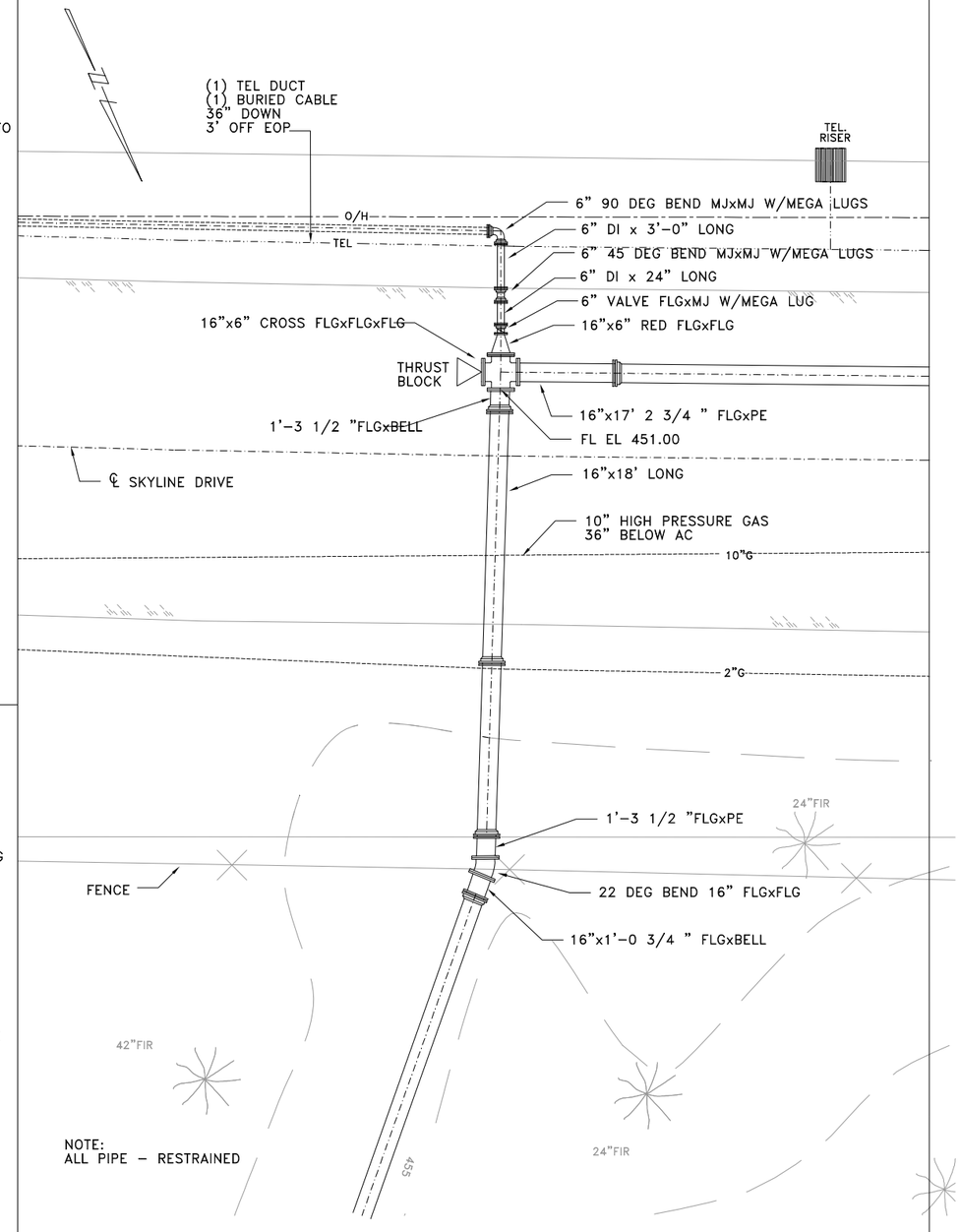
SECTION
(LOOKING EAST)

METER VAULT PIPING | A | C-2
SCALE: 3/8 " = 1' - 0"



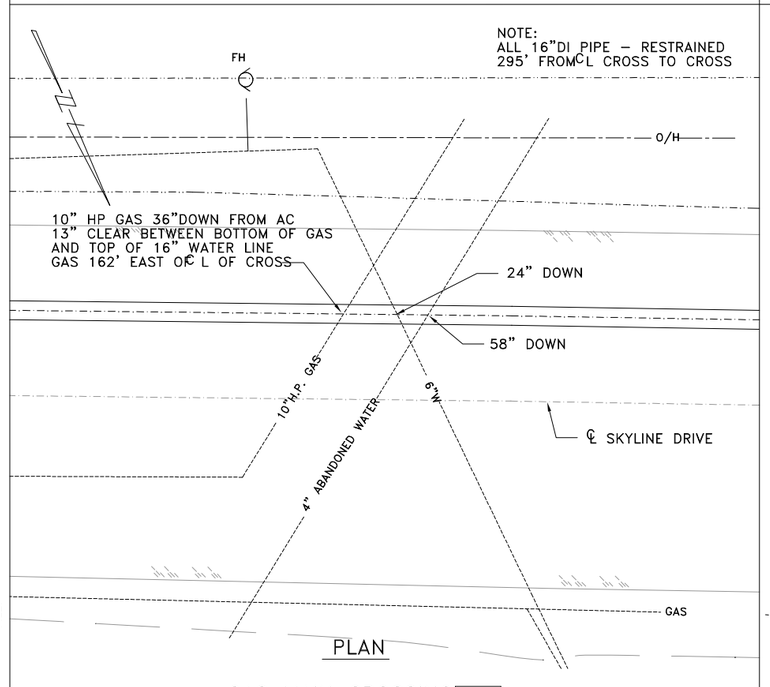
PLAN

PIPING SOUTH OF METER VAULT | B | C-2
SCALE: 3/8 " = 1' - 0"



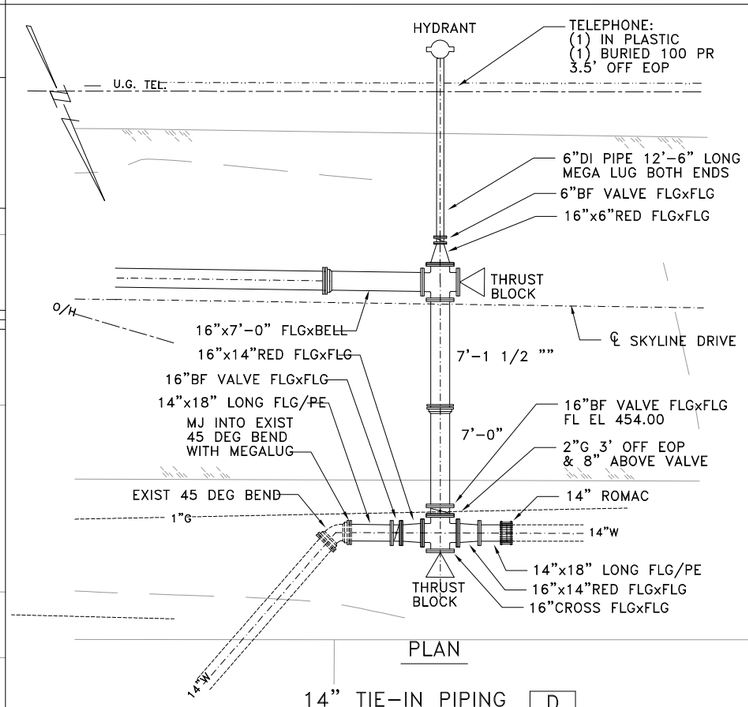
PLAN

6" TIE-IN PIPING | E | C-2
SCALE: 3/8 " = 1' - 0"



PLAN

GAS MAIN CROSSING | C | C-2
SCALE: 3/8 " = 1' - 0"



PLAN

14" TIE-IN PIPING | D | C-2
SCALE: 3/8 " = 1' - 0"

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

FILE: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

REV	DATE	BY	DESCRIPTION
60	4/99	DPR	RECORD DRAWING

SCALE: 3/16 " = 1' - 0"

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER — R. C. E. NO. 19427 — DATE 4/23/98
MONTGOMERY WATSON — R. C. E. NO. 10818 — DATE 4/23/98

MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE _____
APPROVED _____ DATE _____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PIPING DETAILS

SHEET C-2A OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

SHEET NOTES:

1. SEE SHT G-1 FOR GENERAL NOTES AND ADDITIONAL YARD PIPING NOTES.
2. CONTRACTOR SHALL VERIFY ALL UTILITY CROSSING AND CONNECTION ELEVATIONS AND LOCATION PRIOR TO PIPE SUBMITTAL.
3. CONTRACTOR SHALL COORDINATE ALL CONNECTIONS AND SHUT-OFFS WITH CITY OF WEST LINN STAFF PRIOR TO MAKING THE CONNECTIONS.
4. SEE SHT C-4 FOR THE DRAINAGE PLAN AND SHT C-5 FOR SITE GRADING PLAN.
5. ALL YARD PIPING SHALL BE RESTRAINED JOINT PIPE.
6. COORDINATE INTERTIE TO EXISTING PUMP STATION 18" SUCTION LINE WITH CITY STAFF. VERIFY LOCATION AND ELEVATION PRIOR TO ORDERING PIPE.
7. INSTALL VERTICAL FITTINGS (SEE 1/-) AS NEEDED TO CONNECT EXISTING 18" WATER PIPE TO NEW 24" SUCTION PIPE, ALL RESTRAINED.

REFERENCE NOTES:

(1) PENETRATION OF EXISTING PUMP STATION WET WELL WALL SEE SHT GM-4.
(2) INSTALL 16" PIPE WITH 3 FEET OF COVER (TYPICAL) SEE SHEET C-2 FOR ALIGNMENT.
(3) 24"x24"x45 DEGREE BEND
(4) 16"x16"x16" TEE
(5) 24"x24"x18" TEE (18" LEG VERTICAL)
(6) 18"x18"x18" TEE MJ W/ MEGALUG SERIES 1100 RESTRAINT.
(7) 18"x18"x18" TEE MJ W/ MEGALUG SERIES 1100 RESTRAINT (MECH PLUG DEAD LEG).
(8) CONTRACTOR TO ROUTE PIPE TO FIT THIS SECTION, FITTINGS AS NECESSARY FOR VERT & HORIZ ALIGNMENT
(9) THRUST BLOCK SEE C-224/GC-4.

TL 7800

FOR CONTINUATION SEE SHT C-2

SEE B/C-2A (2) 16"W(11)
V-14
C-215 BURIED VALVE
E GC-1 METER VAULT
FE-300 I.P.
16"W(11) I.P.
CHAIN LINK FENCE
PUMP STATION (SEE SHT M-1)
(4) N 1123.692 E 1039.636 I.E. 439.00
BF AND TB
V-12
16"W(11)
CB
1"PW(24)
CB
403.98 O/H
N 23°03'07" E
18"W(11) SEE NOTE 7
(7)
BF
SEE B/C-3A (8) 18"W(11) EL 436.00
V-18
3 APPLE TREES
4"W
18"W
I.R.
EDGE OF PAVEMENT
RIM= 441.2 IE= 439.4
ACCESS ROAD
(6) N 1225.936 E 1086.985
I.E. 427.00(+/-) SEE NOTE 6
SEE A/C-3A
(9) 14"W
CONCRETE SLAB V-19
ROMAC CPLG (TYP)
14"W 8"WPUMP
N 1257.264 (1) E 1077.267 I.E. 427.75
18"W
GATE
CB
FH
V-17
SLEEVE TYPE CPLG (TYP)
24"W(11)
45 DEG BEND
24" WATER PIPE STRUCTURAL CONNECTION TO EXISTING PUMP STATION (SEE SHT GM-4) SEE C/C-3A
N 1165.334 (3) E 1029.291 I.E. 427.75
24"W(11)
N 1169.701 (3) E 1040.099 I.E. 427.75
24"W(11)
N 1219.538 (5) E 1061.253 I.E. 427.75
1 / -
14"W
YARD LIGHT
ACCESS ROAD
CHAIN LINK FENCE
16"FIR 20"FIR 26"FIR 22"FIR 9"FIR 15"OAK 32"FIR 30"FIR
454 453 452 451 450 449 448 447 446 445 443 442
5/8" REBAR
842 837 835 834 833 832 831 830 829 828 827 826 825 824 823 822 821 820 819 818 817 816 815 814 813 812 811 810 809 808 807 806 805

AIR/VAC ASSEMBLY C-215
FS
3' TYP
90 DEG BEMD-MJ (W/SERIES 1100 MEGALUG RESTRAINT)
18"W(11)
18"W(11)
EL 427.75
24"W(11)
24" x 24" x 18" TEE (FLG)

SECTION 1 / –
SCALE: 1" = 5'

BOLTON RESERVOIR

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
RD	4/99	DPR	RECORD DRAWING

SCALE: 1" = 10'

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

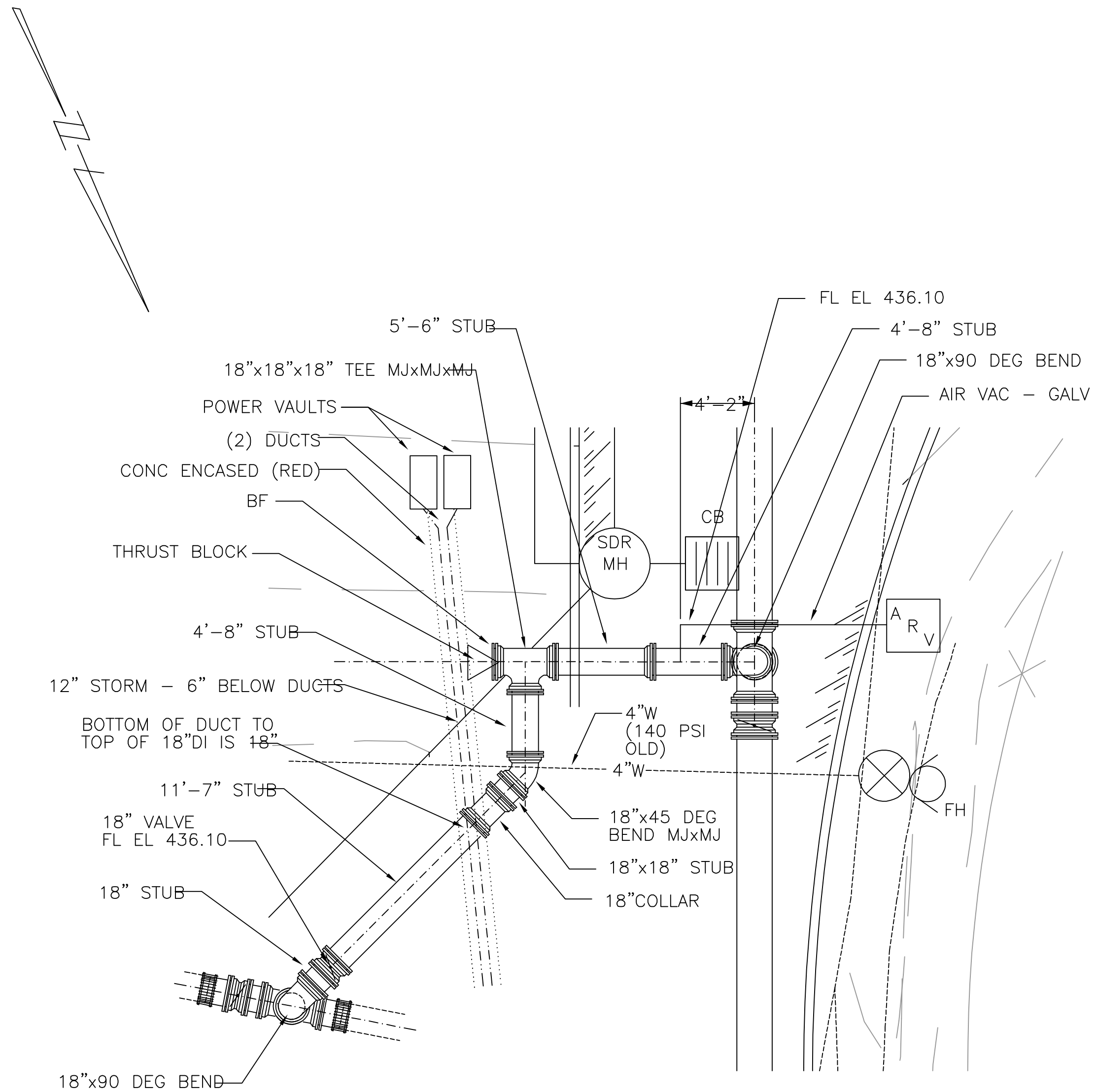
SUBMITTED
PROJECT ENGINEER R. C. E. NO. 19427 DATE 4/23/98
MONTGOMERY WATSON R. C. E. NO. 10818 DATE 4/23/98

MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE _____
APPROVED _____ DATE _____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
YARD PIPING PLAN

SHEET C-3 OF 40 SHEETS

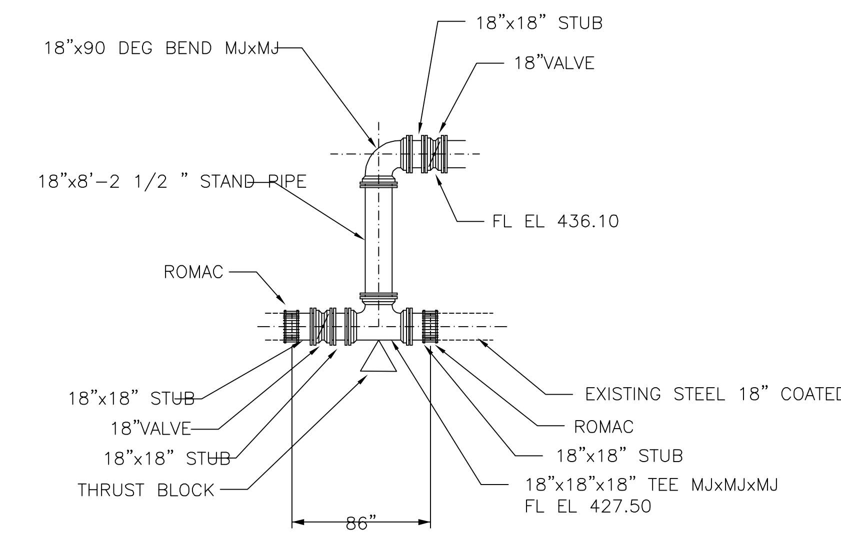


NOTE:
ALL PIPE - RESTRAINED MEGA LUG

PLAN

18" TIE-IN PIPING | B / C-3
SCALE: 3/8 " = 1' - 0"

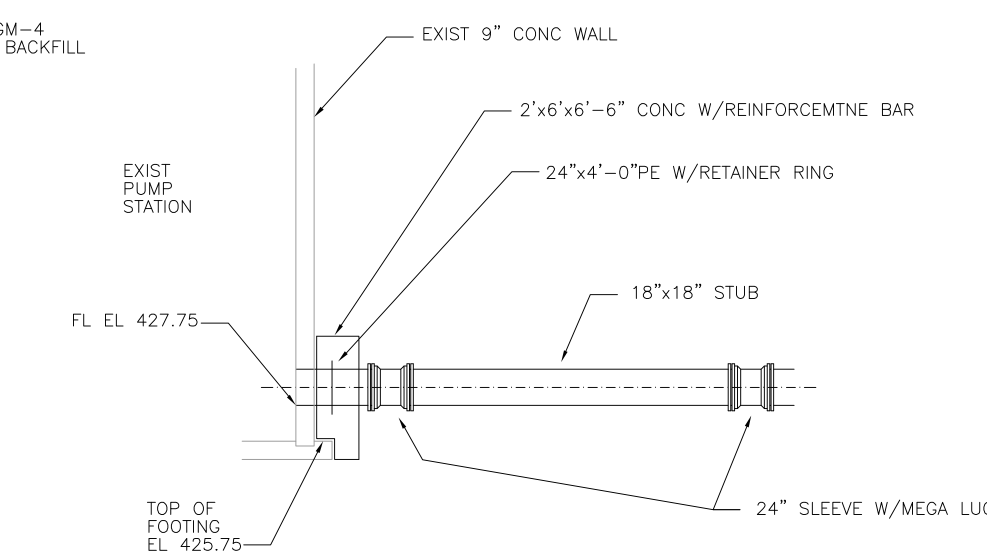
NOTE:
ALL NEW PIPE DI - RESTRAINED JOINT MEGA LUG



SECTION
(LOOKING EAST)

18" TIE-IN PIPING | A / C-3
SCALE: 3/8 " = 1' - 0"

NOTE:
1.) SEE SHT GM-4
2.) ALL ROCK BACKFILL



SECTION
(LOOKING EAST)

WET WELL | C / C-3
SCALE: 3/8 " = 1' - 0"

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
RD	4/99	DPR	RECORD DRAWING

SCALE: 3/16 " = 1' - 0"

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER R. C. E. NO. 19427 DATE 4/23/98
MONTGOMERY WATSON R. C. E. NO. 10818 DATE 4/23/98

MONTGOMERY WATSON
Portland, Oregon

APPROVED ________ DATE
APPROVED ________ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PIPING DETAILS

SHEET C-3A
OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

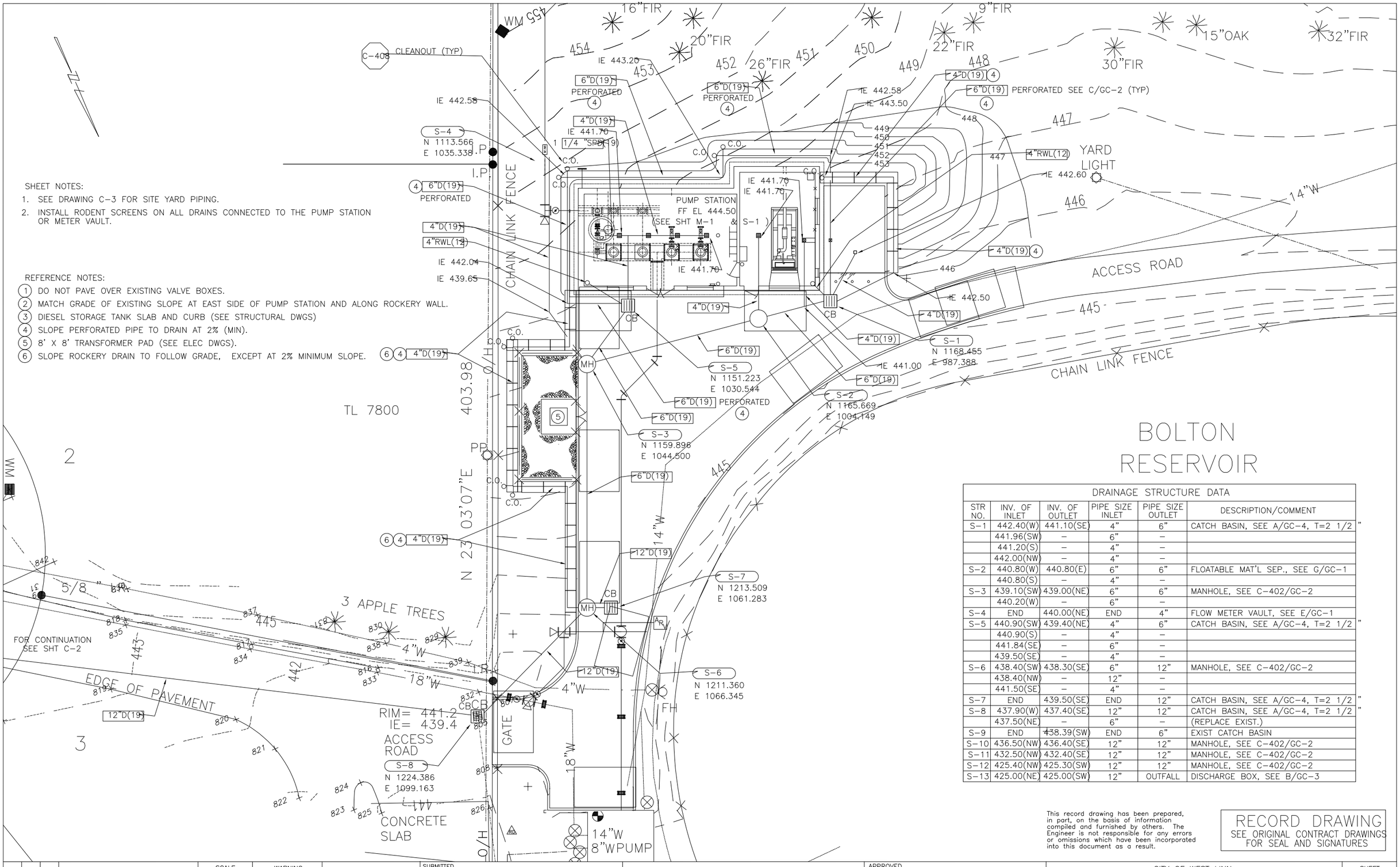
JOB No. 1065073.012580

SHEET NOTES:

1. SEE DRAWING C-3 FOR SITE YARD PIPING.
2. INSTALL RODENT SCREENS ON ALL DRAINS CONNECTED TO THE PUMP STATION OR METER VAULT.

REFERENCE NOTES:

(1) DO NOT PAVE OVER EXISTING VALVE BOXES.
(2) MATCH GRADE OF EXISTING SLOPE AT EAST SIDE OF PUMP STATION AND ALONG ROCKERY WALL.
(3) DIESEL STORAGE TANK SLAB AND CURB (SEE STRUCTURAL DWGS)
(4) SLOPE PERFORATED PIPE TO DRAIN AT 2% (MIN).
(5) 8' X 8' TRANSFORMER PAD (SEE ELEC DWGS).
(6) SLOPE ROCKERY DRAIN TO FOLLOW GRADE, EXCEPT AT 2% MINIMUM SLOPE.



BOLTON RESERVOIR

DRAINAGE STRUCTURE DATA

STR NO.	INV. OF INLET	INV. OF OUTLET	PIPE SIZE INLET	PIPE SIZE OUTLET	DESCRIPTION/COMMENT
S-1	442.40(W)	441.10(SE)	4"	6"	CATCH BASIN, SEE A/GC-4, T=2 1/2 "
	441.96(SW)	–	6"	–	
	441.20(S)	–	4"	–	
	442.00(NW)	–	4"	–	
S-2	440.80(W)	440.80(E)	6"	6"	FLOATABLE MAT'L SEP., SEE G/GC-1
	440.80(S)	–	4"	–	
S-3	439.10(SW)	439.00(NE)	6"	6"	MANHOLE, SEE C-402/GC-2
	440.20(W)	–	6"	–	
S-4	END	440.00(NE)	END	4"	FLOW METER VAULT, SEE E/GC-1
S-5	440.90(SW)	439.40(NE)	4"	6"	CATCH BASIN, SEE A/GC-4, T=2 1/2 "
	440.90(S)	–	4"	–	
	441.84(SE)	–	6"	–	
	439.50(SE)	–	4"	–	
S-6	438.40(SW)	438.30(SE)	6"	12"	MANHOLE, SEE C-402/GC-2
	438.40(NW)	–	12"	–	
	441.50(SE)	–	4"	–	
S-7	END	439.50(SE)	END	12"	CATCH BASIN, SEE A/GC-4, T=2 1/2 "
S-8	437.90(W)	437.40(SE)	12"	12"	CATCH BASIN, SEE A/GC-4, T=2 1/2 "
	437.50(NE)	–	6"	–	(REPLACE EXIST.)
S-9	END	438.39(SW)	END	6"	EXIST CATCH BASIN
S-10	436.50(NW)	436.40(SE)	12"	12"	MANHOLE, SEE C-402/GC-2
S-11	432.50(NW)	432.40(SE)	12"	12"	MANHOLE, SEE C-402/GC-2
S-12	425.40(NW)	425.30(SW)	12"	12"	MANHOLE, SEE C-402/GC-2
S-13	425.00(NE)	425.00(SW)	12"	OUTFALL	DISCHARGE BOX, SEE B/GC-3

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: 1" = 10'

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER R. C. E. NO. 19427 DATE 4/23/98
MONTGOMERY WATSON R. C. E. NO. 10818 DATE 4/23/98

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
DRAINAGE PLAN

SHEET C-4 OF 40 SHEETS

Plot Date/Time: $$$$$date$$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

SHEET NOTES:

1. SEE SHEET G-1 FOR GENERAL AND GRADING NOTES.
2. SEE SHEET C-3 FOR YARD PIPING PLAN AND SHEET C-4 FOR DRAINAGE PLAN.
3. CONTRACTOR SHALL PROVIDE SUBMITTAL WITH ENGINEERS STAMP FOR ROCKERY WALLS.
4. MAINTAIN A MINIMUM OF 2 FT. OF COVER OVER THE EXISTING 14" PIPE.
5. RESEED ALL DISTURBED AREAS WITH GRASS SEED PER SPECS. PLACE 4" THICK LAYER OF TOP SOIL OVER AREA TO BE SEEDED PRIOR TO SEEDING.

REFERENCE NOTES:

(1) 8' X 8' X 8" CONCRETE PAD W/ #4 BAR AT 12" CC FOR TRANSFORMER (BY OTHERS)
(2) MATCH GRADE OF EXISTING SLOPE AT EAST SIDE OF PUMP STATION AND ALONG ROCKERY WALL.
(3) DIESEL STORAGE TANK SLAB AND CURB (SEE STRUCTURAL DWGS). TOP OF SLAB EL. 444.55
(4) TOP OF ULTRA BLOCKS TO MATCH EXISTING GRADE
(5) TOP OF ULTRA BLOCKS TO MATCH NEW FINISH GRADE
(6) MATCH GRADE AT CONNECTION POINTS
(7) SET TOP OF FILL LINE AT EL. 454.00 AROUND PUMP STATION
(8) PLANT RHODODENDRONS W/TRIANGULAR SPACING 4 FT. ON CENTER. BASED ON AVAILABILITY, SELECT VARITIES FROM AMONG THE FOLLOWING: TRUDE WEBSTER, JEAN MARIE, DiMONTAGUE, PINK PEARL, CINTHIA OR CORNUBIA. RHODODENDRONS SHALL BE 5 GAL SIZE.

TL 7800

TYPICAL (8)
I.P
I.P.
CHAIN LINK FENCE
PUMP STATION
FF EL 444.70
(SEE SHT M-1 & S-1)
OVERLAND FLOW
2:1 TYP
YARD LIGHT
ACCESS ROAD
TRANSITION (SLOPE VARIES)
CHAIN LINK FENCE
ASPHALT ROADWAY
GUARD POST (3 EA.)
C-130
MH
AV
CB
FH
BREAKLINE (TYP.)
SLOPE VARIES
2% TYP.
ELECTRIC TRANSFORMER (BY OTHERS)
PP
H GC-1 GATE AND FENCE
B GC-3 GRAVEL BASE
A GC-3 ROCKERY
N 23°03'07"E 403.90'
3 APPLE TREES
5/8"
4"W
18"W
14"W
8"W PUMP
EDGE OF PAVEMENT
CONCRETE SLAB
GATE
CURB AND GUTTER TYP
C-106
RIM= 441.2
IE= 439.4
ACCESS ROAD
1%
1.5%

N 1178.156	E 945.335
N 1167.356	E 973.342, 444.46 FS
N 1165.177	E 988.712, 444.50 FS
N 1176.668	E 993.589, 444.38 FS
N 1186.636	E 946.933
N 1143.524	E 1039.723, 444.50 FS
N 1181.547	E 1014.130, 444.25 FS
N 1183.791	E 980.318, 444.38 FS
N 1172.980	E 1052.227, 444.18 FS
N 1175.791	E 980.329, 444.38FS
N 1185.255	E 1023.309, 444.18 FS
N 1189.114	E 1011.534, 444.33 FS
N 1195.551	E 1040.844, 443.66 FS
N 1192.462	E 1019.986, 444.28 FS
N 1201.440	E 1035.334, 443.74 FS
N 1212.710	E 1059.190, 443.12 FS
N 1216.164	E 1070.557, 445.20 FS
N 1217.843	E 1053.053, 443.20 FS
N 1222.258	E 1094.587
N 1224.111	E 1090.226, 443.50 FS
N 1239.264	E 1094.918, 443.50 FS
N 1241.672	E 1067.629, 443.50 FS
N 1236.057	E 1100.453
N 1238.546	E 1074.993, 443.42 FS
N 1250.809	E 1092.387, 443.80 FS
N 1258.318	E 1074.695, 443.80 FS

CURVE DATA:

	RADIUS	DELTA	RADIUS POINT NORTH	RADIUS POINT EAST
(A)	95.00	66.92	1279.79	980.18
(B)	5.00	111.01	1170.49	969.24
(C)	15.00	90.00	1210.30	1084.36
(D)	5.00	90.00	1243.87	1094.87
(E)	172.00	11.18	1348.64	977.30

BOLTON RESERVOIR

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: 1" = 10'

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN D.P. RAMER
CHECKED B.D. TEEL

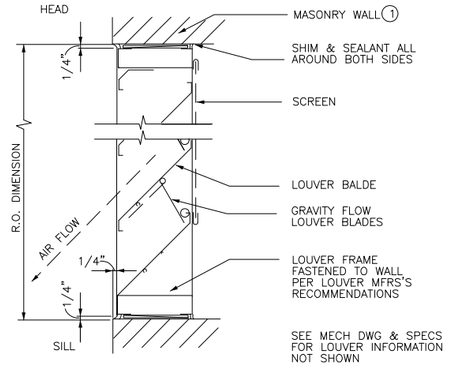
SUBMITTED
PROJECT ENGINEER — 19427 — 4/23/98 (R. C. E. NO. — DATE)
MONTGOMERY WATSON — 10818 — 4/23/98 (R. C. E. NO. — DATE)

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
GRADING, PAVING AND LANDSCAPE PLAN

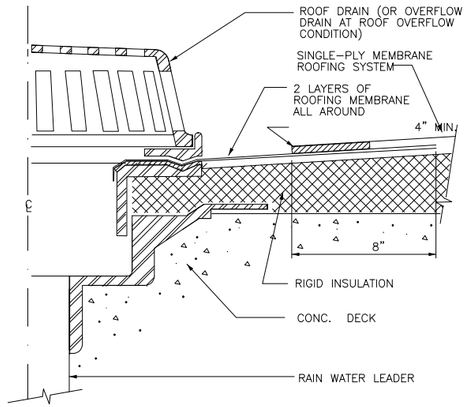
SHEET C-5 OF 40 SHEETS



(1) CONC CONDITION SIMILAR, INSTALL BEHIND OPENING CHAMFER

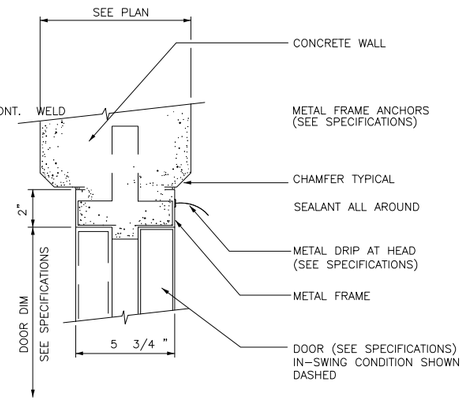
LOUVER W/ BACKFLOW DAMPER (JAMB SIMILAR) — A-114

SCALE: 3"=1'-0"



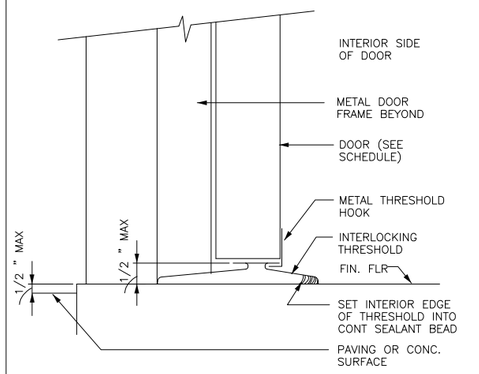
ROOF DRAIN (ROOF OVERFLOW SIM.) — A-790

SCALE: 3" = 1'- 0"



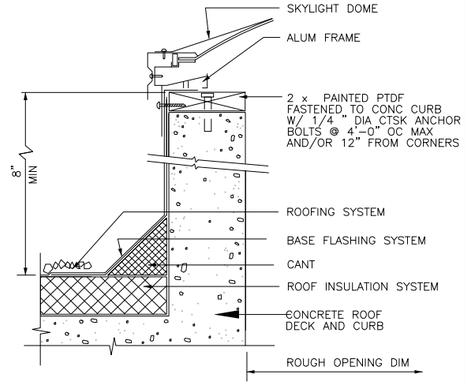
HEAD AT CONCRETE WALL (JAMB SIMILAR) — A-810

SCALE: 3"=1'-0"



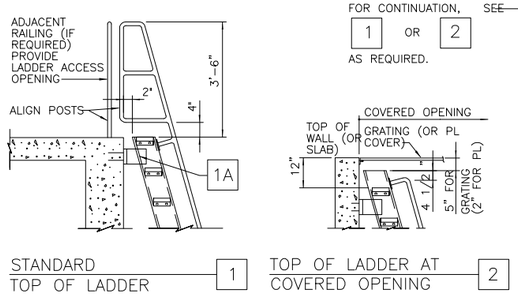
INTERLOCKING THRESHOLD (IN-SWING DOOR) — A-827

N.T.S.



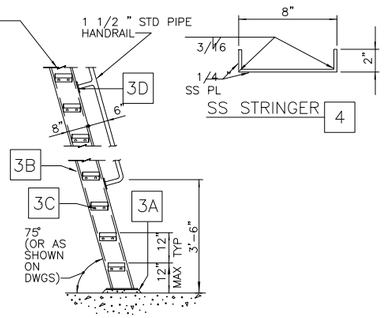
SKYLIGHT @ CONC DECK ROOF — A-900

SCALE: 3" = 1'- 0"



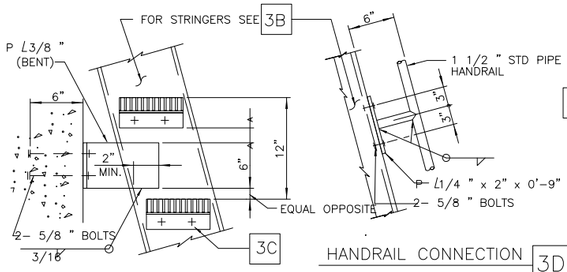
STANDARD TOP OF LADDER — 1

TOP OF LADDER AT COVERED OPENING — 2



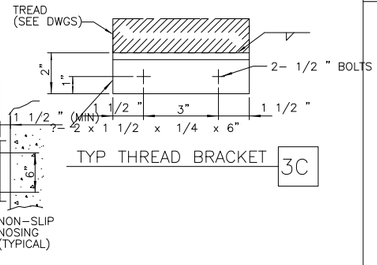
SHIPS LADDER — 3

SS STRINGER — 4



TYPICAL LADDER BRACKET — 1A

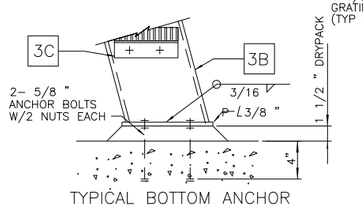
3B STRINGERS
- ALUM LADDER: C8 X 6.48
- GALVANIZED STL LADDER: C8 X 11.5
- STAINLESS STEEL LADDER: PROVIDE FABRICATED CHANNELS PER DET 4



HANDRAIL CONNECTION — 3D

TYP THREAD BRACKET — 3C

TYPICAL STEP



TYPICAL BOTTOM ANCHOR DETAIL — 3A

ALUMINUM SHIPS LADDER — S-513
W/SS FASTENERS

STAINLESS STEEL SHIPS LADDER — S-514
W/SS FASTENERS

GALVANIZED STEEL SHIPS LADDER — S-515
W/GALV FASTENERS

REV 010196

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED MW STD
DRAWN J. TEHANEY
CHECKED C. LINDOW

SUBMITTED
PROJECT ENGINEER 19427 R. C. E. NO. 4/23/98 DATE
MONTGOMERY WATSON 10818 R. C. E. NO. 4/23/98 DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
GENERAL ARCHITECTURAL DETAILS

SHEET GA-1 OF 40 SHEETS

Plot Date/Time: $$$$$date$$$$ $$time$$

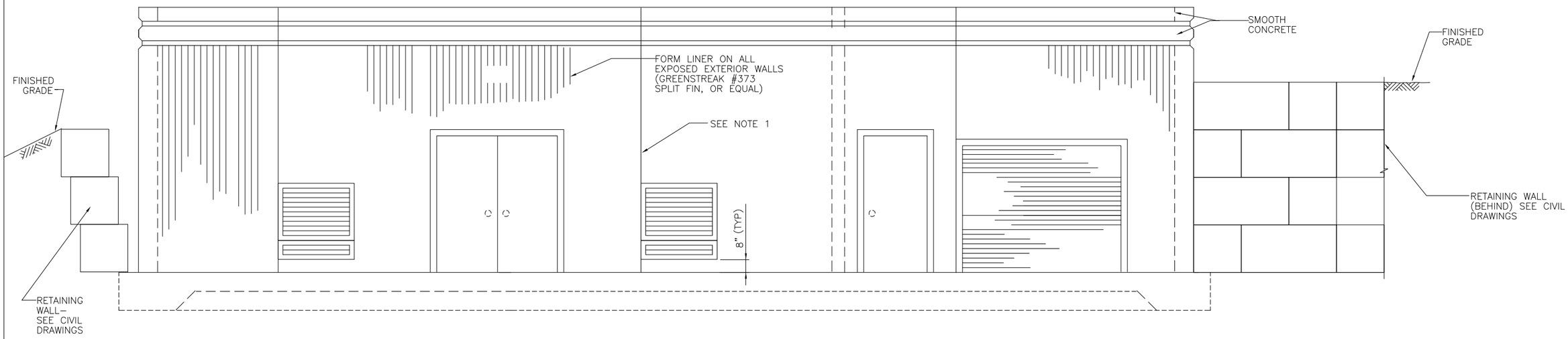
FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.012580

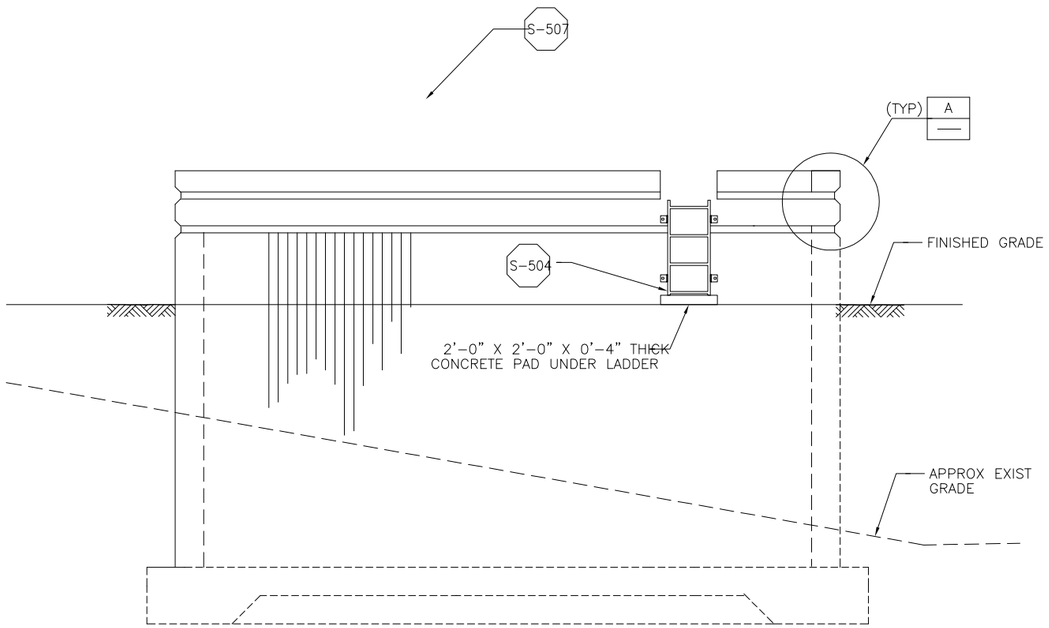
NOTES:

1. SAWCUT 1/2 " DEEP @ 3 LOCATIONS IN NORTH AND SOUTH WALLS AS SHOWN. LOCATE SAWCUT IN FORMLINER INDENTATIONS.

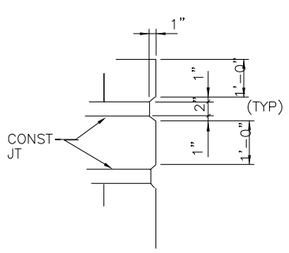
   USE S-13 AT SOUTH WALL ONLY.



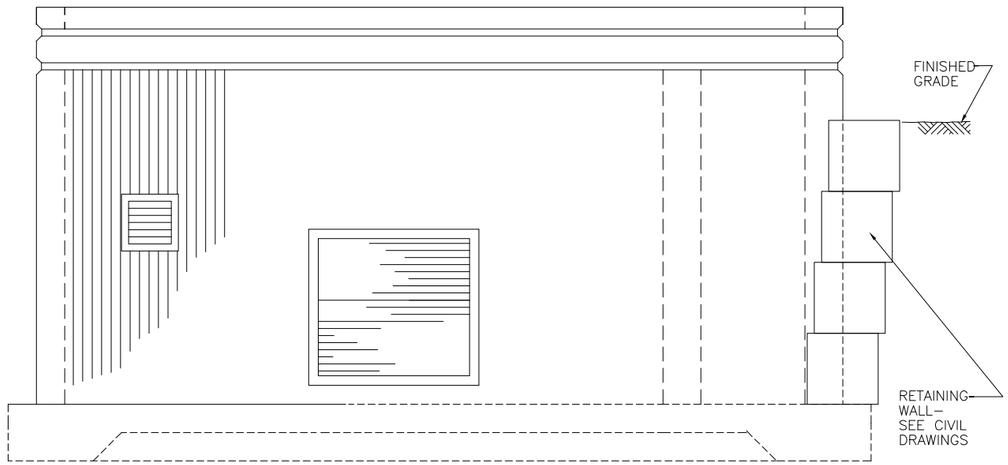
NORTH ELEVATION



EAST ELEVATION



DETAIL A



WEST ELEVATION

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RECORD DRAWING
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REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: 3/8 " = 1'

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED J. TEHANEY
DRAWN J. TEHANEY
CHECKED C. LINDOW

SUBMITTED
PROJECT ENGINEER 19427 R. C. E. NO. 4/23/98 DATE
MONTGOMERY WATSON 10818 R. C. E. NO. 4/23/98 DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE
APPROVED _____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PUMP STATION ELEVATIONS

SHEET A-1 OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.013584

GENERAL NOTES

GENERAL

STRUCTURAL DIMENSIONS CONTROLLED BY OR RELATED TO MECHANICAL OR ELECTRICAL EQUIPMENT SHALL BE COORDINATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

MECHANICAL AND ELECTRICAL EQUIPMENT SUPPORTS, ANCHORAGES, OPENINGS, RECESSES AND REVEALS NOT SHOWN ON THE STRUCTURAL DRAWINGS BUT REQUIRED BY OTHER CONTRACT DRAWINGS, SHALL BE PROVIDED FOR PRIOR TO PLACING CONCRETE.

STRUCTURAL DRAWINGS SHALL BE USED IN COORDINATION WITH MECHANICAL, ELECTRICAL, ARCHITECTURAL, CIVIL DRAWINGS AND SHOP DRAWINGS PROVIDED BY MANUFACTURES OF EQUIPMENT.

STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ON THE COMPLETED STRUCTURES. DURING CONSTRUCTION, THE STRUCTURES SHALL BE PROTECTED BY BRACING AND BALANCING WHEREVER EXCESSIVE CONSTRUCTION LOADS MAY OCCUR.

UNLESS OTHERWISE SHOWN, ON ALL STRUCTURAL DRAWINGS THE FINISH GRADE AROUND STRUCTURES IS SHOWN THUS ////////// ,INDICATING EITHER GROUND SURFACE, TOP OF CONCRETE SLAB OR AC PAVEMENT. FOR DETAILS OF FINISH SURFACES SEE CIVIL AND ARCHITECTURAL DRAWINGS.

STRUCTURAL

DESIGN IN ACCORDANCE WITH THE 1994 EDITION OF THE UNIFORM BUILDING CODE, EXCEPT WHERE OTHER APPLICABLE CODES OR THE FOLLOWING NOTES ARE MORE RESTRICTIVE.

LOCATION OF ALL CONSTRUCTION JOINTS SHALL BE AS SHOWN ON THE DRAWINGS OR APPROVED BY THE ENGINEER. ALL CONSTRUCTION JOINTS LOCATED ON THE DRAWINGS OR REQUIRED FOR CONSTRUCTION, BUT NOT SHOWN ON THE DRAWINGS, SHALL HAVE A 6" FLATSTRIP WATERSTOP, IF IN MEMBERS IN CONTACT WITH WATER. IN ADDITION, JOINTS IN ALL SLABS COVERED WITH WATER, SHALL HAVE BOTH A 6" FLATSTRIP WATERSTOP AND A SEALANT GROOVE.

STRUCTURAL STEEL

STEEL CONSTRUCTION SHALL CONFORM TO THE SPECIFICATIONS AND STANDARDS AS CONTAINED IN THE LATEST EDITION OF THE AISC STEEL CONSTRUCTION MANUAL.

ALL STRUCTURAL SHAPES, BARS, PLATES AND SHEETS SHALL BE OF STEEL MEETING ASTM A-36 SPECIFICATIONS.

ALL WELDING SHALL BE BY THE SHIELDED ARC METHOD AND SHALL CONFORM TO AWS CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION. QUALIFICATIONS OF WELDERS SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS FOR STANDARD QUALIFICATION PROCEDURE OF THE AWS.

CONCRETE (EXCEPT PRECAST CONCRETE)

UNLESS OTHERWISE NOTED OR SPECIFIED, ALL STRUCTURAL CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI IN 28 DAYS.

REINFORCEMENT STEEL SHALL BE DEFORMED BARS CONFORMING IN QUALITY TO THE REQUIREMENTS OF ASTM A-615, "SPECIFICATIONS FOR DEFORMED BILLET-STEEL BARS FOR CONCRETE REINFORCEMENT", GRADE 60

ALL DETAILING, FABRICATION AND PLACING OF REINFORCING BARS, UNLESS OTHERWISE INDICATED, SHALL BE IN ACCORDANCE WITH ACI-315, "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES", LATEST EDITION.

TOLERANCES IN PLACING REINFORCEMENT SHALL BE:

3/8 INCH FOR MEMBERS WITH D < 8 INCHES
1/2 INCH FOR MEMBERS WITH D > 8 INCHES

DOWELS, PIPE, WATERSTOPS AND OTHER INSTALLED MATERIALS AND ACCESSORIES SHALL BE HELD SECURELY IN POSITION WHILE CONCRETE IS BEING PLACED.

UNLESS OTHERWISE INDICATED, ASIDE FROM NORMAL ACCESSORIES USED TO HOLD REINFORCING BARS FIRMLY IN POSITION, THE FOLLOWING SHALL BE ADDED:

A) IN SLABS #5 RISER BARS AT 36 INCHES OC MAXIMUM TO SUPPORT TOP REINFORCING BARS.

B) IN WALLS WITH 2 CURTAINS #3 U OR Z SHAPE SPACERS AT 6 FEET OC EACH WAY.

METAL CLIPS OR SUPPORTS SHALL NOT BE PLACED IN CONTACT WITH THE FORMS OR THE SUBGRADE. CONCRETE BLOCKS (OR DOBIES) SUPPORTING BARS ON SUBGRADE SHALL BE IN SUFFICIENT NUMBERS TO SUPPORT THE BARS WITHOUT SETTLEMENT, BUT IN NO CASE SHALL SUCH SUPPORT BE CONTINUOUS.

DOWELS SHALL BE WIRED OR OTHERWISE HELD IN POSITION. THEY SHALL NOT BE SHOVED INTO FRESHLY PLACED CONCRETE.

UNLESS OTHERWISE INDICATED ON THE DRAWINGS, LAPS OF REINFORCEMENT SHALL BE AS SHOWN ON DETAIL S-143.

LOCATE TWO 3/4 INCH GALVANIZED RICHMOND ROCKET INSERTS, HOHMANN & BARNARD OR EQUAL, STRADDLING CENTERLINE OF EQUIPMENT OVER ALL PUMPS, METERS OR OTHER MECHANICAL UNITS OF MORE THAN 100 LBS, FOR INSERTING LIFTING EYES IF NOT OTHERWISE INDICATED.

REINFORCING BARS AND ACCESSORIES SHALL NOT BE IN CONTACT WITH AND PIPE, PIPE FLANGE OR METAL PARTS EMBEDDED IN CONCRETE, A MINIMUM OF 2 INCHES CLEARANCE SHALL BE PROVIDED AT ALL TIMES.

UNLESS OTHERWISE SHOWN ON THE DRAWINGS CONCRETE COVER FOR REINFORCING BARS SHALL BE AS FOLLOWS:

FOR CONCRETE PLACED AGAINST EARTH	3"
FOR SURFACES IN CONTACT WITH WATER OR WEATHER AND FORMED SURFACES IN CONTACT WITH EARTH	2"
FOR CONCRETE NOT EXPOSED TO WEATHER, OR IN CONTACT WITH WATER OR EARTH	1 1/2 "

UNLESS OTHERWISE NOTED, WALLS AND SLABS SHOWN WITH A SINGLE LAYER OF REINFORCEMENT SHALL HAVE THAT REINFORCEMENT CENTERED

SLABS WITH SLOPING SURFACES SHALL HAVE THE INDICATED SLAB THICKNESS MAINTAINED AS THE MINIMUM. SLAB BOTTOMS MAY EITHER SLOPE WITH THE TOP SURFACE OR BE LEVEL. REINFORCING IN SLABS WITH SLOPING SURFACES SHALL BE PLACED AT THE REQUIRED CLEARANCE FROM THE SLAB SURFACES.

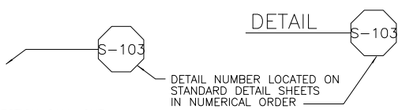
STRUCTURAL STANDARD DETAILS

DETAILS NUMBERED S-XXX ON SHEET GA-1 AND SHEETS GS-1 THRU GS-3 ARE PART OF MONTGOMERY WATSON'S STRUCTURAL STANDARD DETAILS.

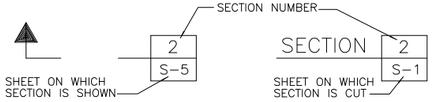
THESE DETAILS ARE TO BE USED WHEN REFERRED TO OR WHEN NO OTHER MORE RESTRICTIVE OR DIFFERENT DETAILS ARE SHOWN ON THE DRAWINGS.

DETAILS NOT PERTAINING TO THE PROJECT ARE MARKED THUS ▨

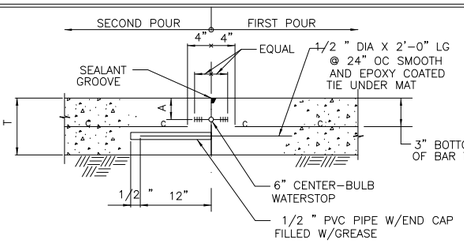
STRUCTURAL STANDARD DETAIL CALL-OUT



SECTION CALL-OUT



DETAIL CALL-OUT



SINGLE MAT REINF – SLEEVE – TYPE JOINT

(TYP CONSTRUCTION JOINT UNLESS OTHERWISE NOTED)

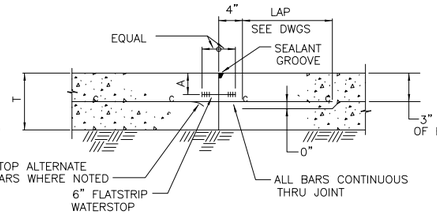
WITH WATERSTOP AND SEALANT GROOVE S-110

NO WATERSTOP OR SEALANT GROOVE S-111

T	A
6"	2"
7"	2 1/2 "
8"	2 1/2 "

NOTES:

1. IN ALL CONSTRUCTION JOINTS WITH WATERSTOPS, APPLY 2 COATS OF BOND BREAKER TO FACE OF JOINT, AVOID COATING WATERSTOP (AND SEALANT GROOVE WHERE USED)



SINGLE MAT REINF – CONTINUOUS THRU JOINT

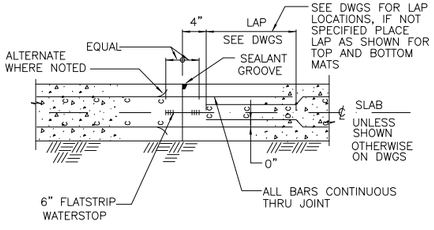
(ONLY WHEN SPECIFIED ON DRAWINGS)

WITH WATERSTOP AND SEALANT GROOVE S-112

NO WATERSTOP OR SEALANT GROOVE S-113

2. WATERSTOPS AND SEALANT GROOVES TO BE PROVIDED IN ALL WATER RETAINING SLABS, SEE DRAWINGS, FOR OTHER LOCATIONS WHERE THEY MAY BE REQUIRED

3. STAGGER SPLICES UNLESS NOTED OTHERWISE



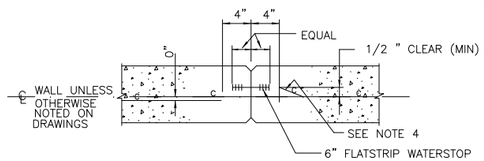
DOUBLE MAT REINF

WITH WATERSTOP AND SEALANT GROOVE S-114

NO WATERSTOP OR SEALANT GROOVE S-115

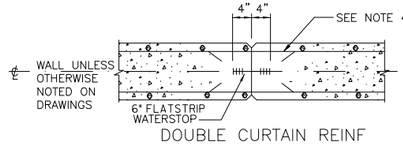
SLAB-ON-GRADE CONSTRUCTION JOINTS

REV 011696



SINGLE CURTAIN REINF

WITH WATERSTOP S-121 NO WATERSTOP S-122



DOUBLE CURTAIN REINF

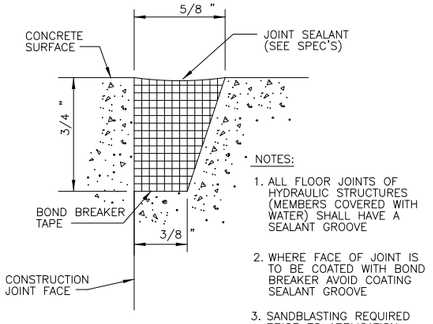
WITH WATERSTOP S-123 NO WATERSTOP S-124

NOTES:

1. IN ALL WALL CONSTRUCTION JOINTS WITH WATERSTOPS APPLY 2 COATS OF BOND BREAKER TO FACE OF JOINT AVOID COATING WATERSTOP
2. WHERE WATERSTOP IS REQUIRED IN SINGLE CURTAIN WALL REINFORCEMENT PLACE WATERSTOP ON WATER SIDE OF WALL
3. UNLESS OTHERWISE NOTED 3/4 " CHAMFERS SHALL BE OMITTED IN SURFACES TO RECEIVE ARCHITECTURAL TREATMENT
4. UNLESS SPECIFICALLY NOTED OTHERWISE #5 AND LARGER BARS SHALL BE CONTINUOUS THRU JOINT. #4 & SMALLER SHALL STOP ALTERNATE AT JOINT
5. STAGGER SPLICES UNLESS NOTED OTHERWISE

VERTICAL WALL CONSTRUCTION JOINT DETAILS

REV 010196

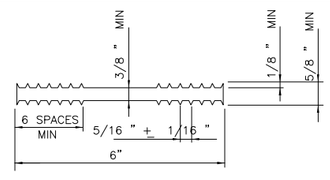


NOTES:

1. ALL FLOOR JOINTS OF HYDRAULIC STRUCTURES (MEMBERS COVERED WITH WATER) SHALL HAVE A SEALANT GROOVE
2. WHERE FACE OF JOINT IS TO BE COATED WITH BOND BREAKER AVOID COATING SEALANT GROOVE
3. SANDBLASTING REQUIRED PRIOR TO APPLICATION OF PRIMER
4. USE BONDBREAKER TAPE ONLY ON SLIP DOWEL JOINTS

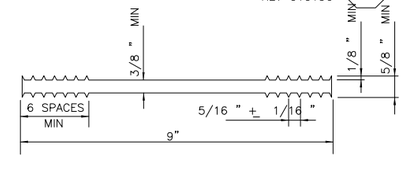
SEALANT GROOVE S-131

REV 010196



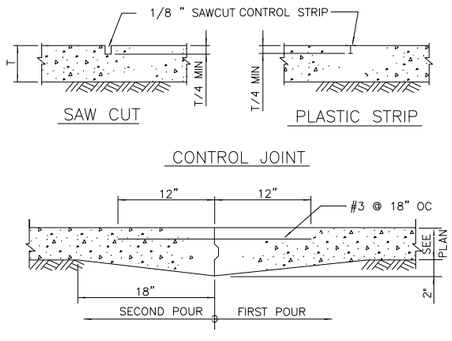
6" FLATSTRIP WATERSTOP S-105

REV 010196



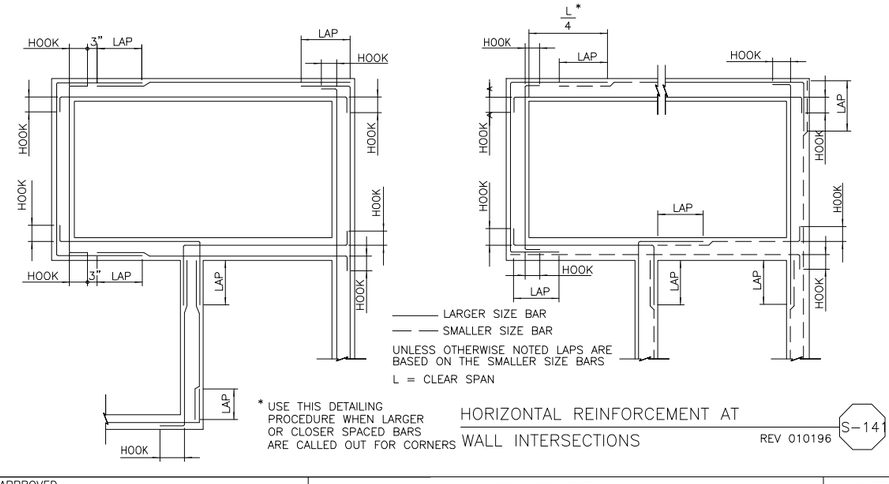
9" FLATSTRIP WATERSTOP S-106

REV 010196



SLAB ON GRADE JOINT DETAILS S-136

REV 010196



* USE THIS DETAILING PROCEDURE WHEN LARGER OR CLOSER SPACED BARS ARE CALLED OUT FOR CORNERS

HORIZONTAL REINFORCEMENT AT WALL INTERSECTIONS S-141

REV 010196

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED MW STD
DRAWN J. TEHANEY
CHECKED C. LINDOW

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
GENERAL NOTES AND STANDARD STRUCTURAL DETAILS – I

SHEET GS-1 OF 40 SHEETS

Plot Date/Time: $$$$$date$$$$ $$time$$

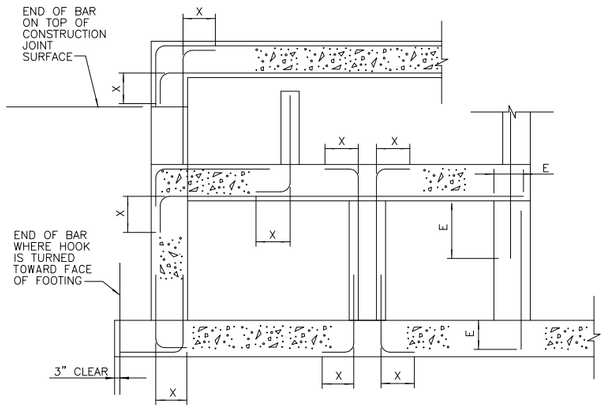
LENGTH (INCHES)						
REBAR SIZE	FOR 1" TO < 2" CONCRETE COVER		FOR 2" TO < 3" CONCRETE COVER		FOR 3" AND LARGER CONCRETE COVER	
	REBAR SPACING (CENTER TO CENTER)		REBAR SPACING (CENTER TO CENTER)		REBAR SPACING (CENTER TO CENTER)	
	< 8"	≥ 8"	< 8"	≥ 8"	< 8"	≥ 8"
LAP						
#8	62"	62"	37"	37"	37"	37"
#9	99"	79"	69"	55"	49"	42"
#10	125"	100"	88"	70"	63"	50"
#11	154"	123"	108"	86"	77"	62"
EMBEDMENT E						
#8	48"	48"	29"	29"	29"	29"
#9	77"	61"	54"	43"	38"	33"
#10	97"	77"	68"	54"	49"	39"
#11	119"	95"	84"	67"	60"	48"

NOTES:

1. USE LAP LENGTHS AS DETERMINED FROM THESE TABLES UNLESS SHOWN OTHERWISE
2. THE TABLES SHOWN ARE FOR f'C=4000 PSI AND fy=60,000 PS1
3. MULTIPLY THE LAP & E SHOWN IN THESE TABLES BY 1.3 FOR WALL HORIZONTAL REBARS AND SLAB BARS WITH 12" OR MORE FRESH CONCRETE UNDERNEATH
4. WHEN BARS OF DIFFERENT SIZE ARE LAP SPLICED, LAP LENGTH SHALL BE THE LARGER OF:
   EMBEDMENT LENGTH OF LARGER BAR
   LAP LENGTH OF SMALLER BAR
5. UNLESS NOTED OTHERWISE USE REBAR COUPLERS FOR SPLICES OF #11 AND LARGER BARS
6. ALL DOWEL BARS SHALL EXTEND AN EMBEDMENT LENGTH E INTO ANOTHER MEMBER OR ACROSS A CONSTRUCTION JOINT UNLESS SHOWN TO SPLICE WITH OTHER BARS OR TO EXTEND TO THE FAR FACE OF THE MEMBER AND END WITH A STANDARD HOOK

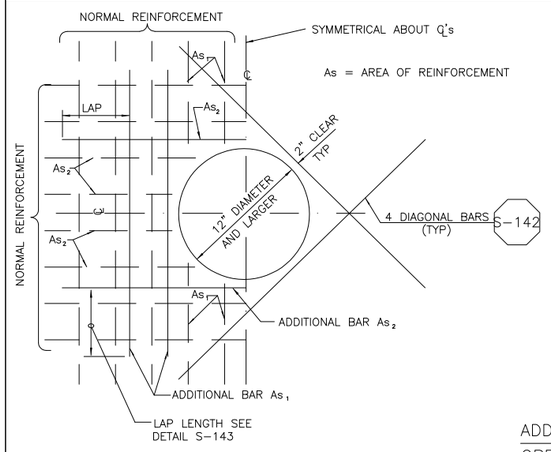
STANDARD 90° BAR HOOKS, EMBEDMENT LENGTHS AND LAP LENGTHS — REV 010196 — S-143

UNLESS OTHERWISE NOTED ON DRAWINGS



SECTION

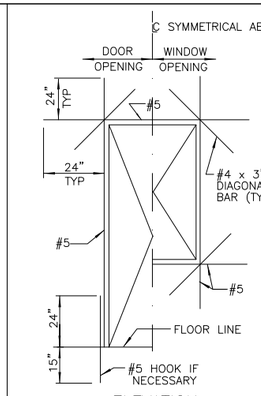
LENGTH (INCHES)			
BAR SIZE	HOOK X	LAP	EMBEDMENT E
#3	6"	18"	12"
#4	8"	18"	14"
#5	10"	23"	18"
#6	12"	28"	22"
#7	14"	33"	25"
#8	16"	SEE TABLE BELOW	SEE TABLE BELOW
#9	19"		
#10	22"		
#11	24"		



NOTES:

1. CUT NORMAL REINFORCEMENT AT OPENINGS:
   As1 AND As2 = 1/2 AREA OF CUT BARS TO BE ADDED ON EACH SIDE OF OPENING
2. ADDITIONAL BARS As1 AND As2 TO BE PLACED:
   A) AT CENTERLINE OF WALLS OR SLABS WHERE ONE LAYER OF REINFORCEMENT IS PROVIDED
   B) AT EACH FACE OF WALLS OR SLABS WHERE TWO LAYERS OF REINFORCEMENT ARE PROVIDED
3. INCREASE SIZE OF ADDITIONAL BARS AS NEEDED TO FIT WITHIN A DISTANCE OF 2 X WALL/SLAB THICKNESS FROM OPENING, PROVIDE 2" MIN CLEAR BETWEEN BARS
4. THIS DETAIL TO BE USED ONLY WHEN NO OTHER DETAIL IS INDICATED ON THE DRAWINGS
5. WHERE A SLAB OR INTERSECTING WALL CONNECTS WITHIN ONE WALL THICKNESS OF THE OPENING, ADDITIONAL BARS ON THAT SIDE MAY BE OMITTED

ADDITIONAL REINFORCEMENT AT CIRCULAR OPENINGS (12" DIA OR LARGER) — REV 010196 — S-144

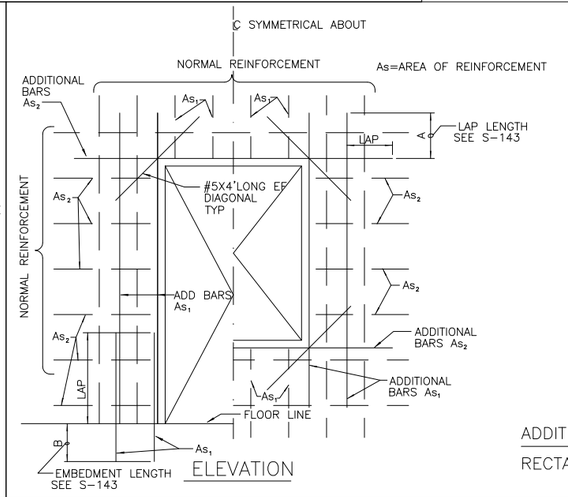


ELEVATION

NOTES:

1. CUT NORMAL REINFORCING AT OPENING
2. FOR WALLS WITH 2 LAYERS OF REINFORCING PROVIDE 1 BAR EACH FACE
3. FOR WALLS WITH 1 LAYER OF REINFORCING PROVIDE 1 BAR ON WALL CENTERLINE
4. BAR LENGTHS FOR GRADE 60
5. THIS DETAIL TO BE USED ONLY ON BUILDING WALLS WHEN NO OTHER DETAIL IS INDICATED ON THE DRAWINGS

TYPICAL REINFORCEMENT AROUND RECTANGULAR WALL OPENING — REV 010196 — S-147

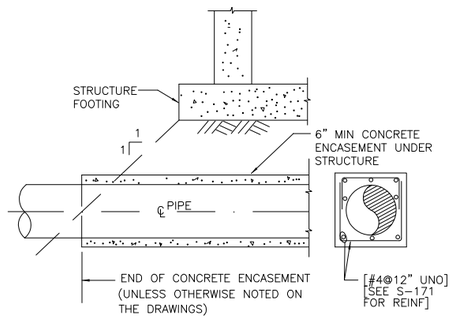


ELEVATION

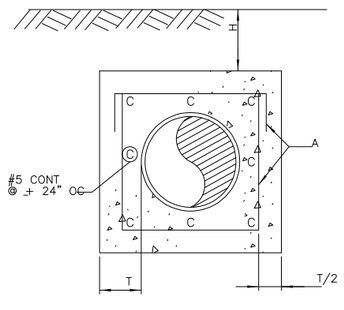
NOTES:

1. CUT NORMAL REINFORCEMENT AT OPENING:
   As1 AND As2 = 1/2 AREA OF CUT BARS TO BE ADDED ON EACH SIDE OF OPENING
2. ADDITIONAL BARS As1 AND As2 TO BE PLACED:
   A) AT CENTERLINE OF WALLS OR SLABS WHERE ONE LAYER OF REINFORCEMENT IS PROVIDED
   B) AT EACH FACE OF WALLS OR SLABS WHERE TWO LAYERS OF REINFORCEMENT ARE PROVIDED
3. INCREASE SIZE OF ADDITIONAL BARS AS NEEDED TO FIT WITHIN A DISTANCE OF 2 X WALL/SLAB THICKNESS FROM OPENING. PROVIDE 2" MIN CLEAR BETWEEN BARS
4. THIS DETAIL TO BE USED ONLY WHEN NO OTHER DETAIL IS INDICATED ON THE DRAWINGS
5. WHERE A SLAB OR INTERSECTING WALL CONNECTS WITHIN ONE WALL THICKNESS OF THE OPENINGS, ADDITIONAL BARS ON THAT SIDE MAY BE OMITTED

ADDITIONAL REINFORCEMENT AROUND RECTANGULAR OPENINGS — REV 010196 — S-148



END OF PIPE ENCASEMENT UNDER STRUCTURES — REV 010196 — S-170

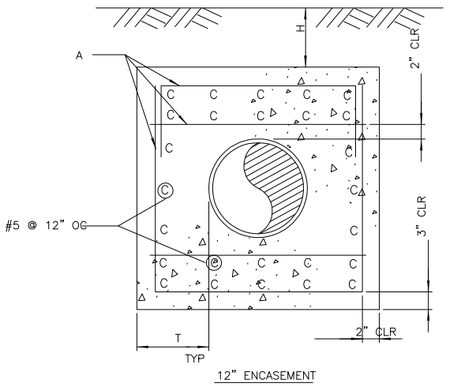


6" OR 8" ENCASEMENT

COVER H	PIPE DIAMETER 8" – 32" A	8" – 32" T	36" A	36" T	42" – 48" A	42" – 48" T	54" – 60" A	54" – 60" T	66"–72" A	66"–72" T
2'	#4@12"	6"	#4@9"	6"	#4@9"	8"	#5@10"	8"	#4@9"	12"
3'			#4@12"		#4@12"		#4@9"		#5@10"	8"
4'									#5@12"	
5'									#5@12"	
6'									#5@12"	
7'									#5@10"	
8'									#5@10"	
9'							#4@9"		#5@10"	
10'							#5@12"		#6@12"	
12'							#5@10"		#6@12"	
14'					#4@12"		#5@10"		#6@10"	8"
16'					#4@9"		#5@10"		#4@9"	12"
18'					#4@9"		#6@12"	8"	#5@12"	12"
20'	#4@12"	6"	#4@12"	6"	#4@9"	8"	#4@9"	12"	#5@12"	12"

NOTES:

1. PIPE ENCASEMENT DESIGNED FOR TRENCH CONDITION
2. WHERE ENCASEMENT PASSES UNDER SPREAD FOOTING OR MAT FOUNDATION, USE H=20' UNO
3. ALL ENCASEMENTS UNDER STRUCTURES SHALL BE SEPARATED FROM THE STRUCTURE FOUNDATIONS BY BACKFILL OR 2 LAYERS OF 40# FELT UNO
4. WHEN ENCASEMENTS TERMINATE @ STRUCTURE, ENCASEMENT REINFORCING SHALL BE DOWELED INTO THE STRUCTURE



12" ENCASEMENT

ENCASEMENT DETAIL TRENCH CONDITION — REV 010196 — S-172

This record drawing has been prepared, in part, on the basis of information compiled and furnished by others. The Engineer is not responsible for any errors or omissions which have been incorporated into this document as a result.

RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

FILE: $$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

JOB No. 1065073.013584

REV	DATE	BY	DESCRIPTION
1	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED MW STD
DRAWN J. TEHANEY
CHECKED C. LINDOW

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

MONTGOMERY WATSON R. C. E. NO. DATE

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
STANDARD STRUCTURAL DETAILS – II

SHEET GS-2 OF 40 SHEETS

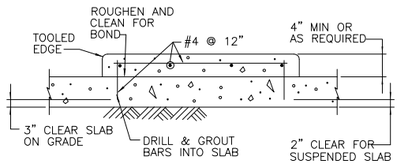
Plot Date/Time: $$$$date$$$$ $$time$$

DIAMETER (inches)	MINIMUM EMBEDMENT	
	TOP OF COLUMNS	OTHER APPLICATIONS
1/4	5	3
3/8	5	3
1/2	6	4
5/8	6	4
3/4	7	5
7/8	8	6
1	9	7
1 1/8	10	8
1 1/4	11	9

NOTES

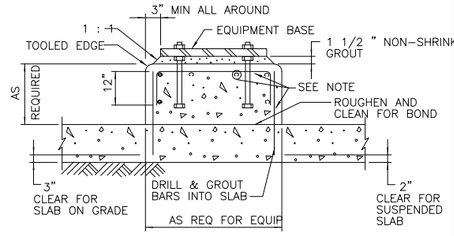
1. USE ONLY HEADED ANCHORS, J-BOLTS ARE NOT ALLOWED
2. THIS DETAIL APPLIES TO BOTH CONCRETE AND MASONRY
3. IN MASONRY PROVIDE A 1" ANNULAR SPACE IN BLOCK SHELL AROUND ANCHOR. GROUT TO SURFACE

TYPICAL ANCHOR BOLT EMBEDMENT — S-175
REV 010196



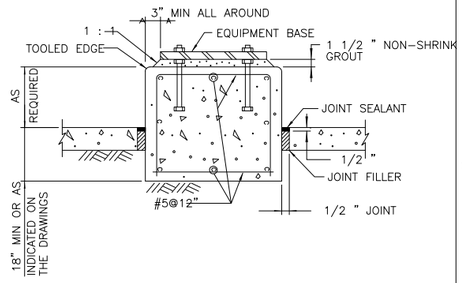
HOUSEKEEPING PAD — S-191
REV 010196

NOTE:
#5@12" OR AS REQUIRED TO DEVELOP ANCHOR BOLTS

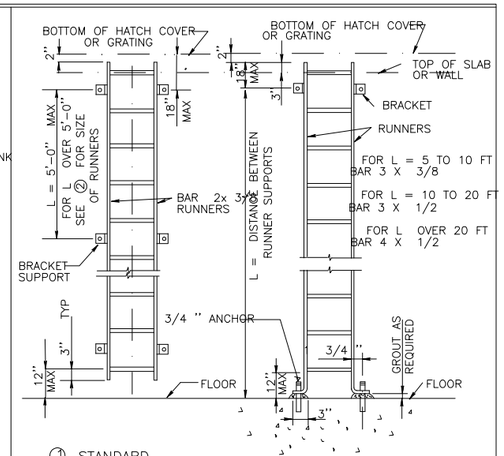


EQUIPMENT BASE — S-192
REV 010196

NOTE:
WHERE NO DIMENSION IS INDICATED ON THE DRAWINGS, BASE DEPTH SHALL BE SET SO THAT THE BASE WEIGHS AT LEAST TWICE THE WEIGHT OF THE EQUIPMENT SUPPORTED

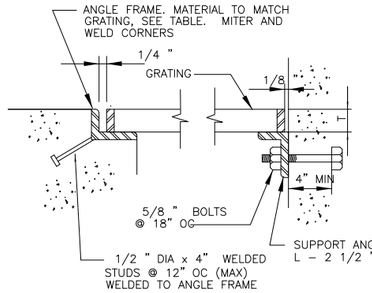


EQUIPMENT BASE ON GRADE WITH SEPARATING JOINT — S-193
REV 010196



① STANDARD LADDER WITH RUNNER SUPPORTS AT 5'-0" OC MAX

② LADDER WITH RUNNER SUPPORTS OVER 5'-0" OC



NOTES:

1. GRATING DEPTH TO BE DETERMINED BY MANUFACTURER AND APPROVED BY ENGINEER (UNO)
2. ALL ENDS AND OPENINGS SHALL BE BANDED
3. ALL GRATING SHALL BE SECURED IN PLACE WITH REMOVABLE FASTENERS, SEE DETAIL S-517
4. WEIGHT OF GRATING SECTION SHALL NOT EXCEED 80 LBS
5. BEARING BARS SHALL BE DEPTH T x 3/16 " @ 1 3/16 " OC CROSS BARS SHALL BE @ 4" OC

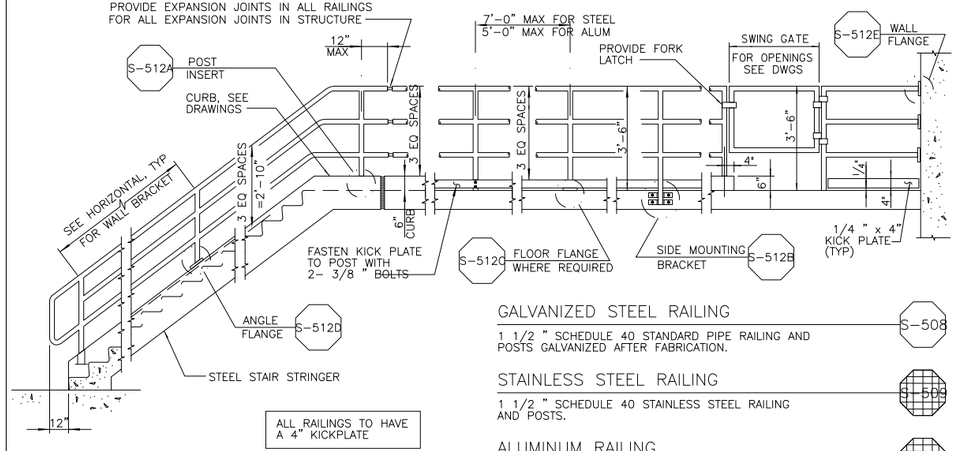
ALUMINUM GRATING — S-501
USE ALUMINUM ANGLE SUPPORTS AND STAINLESS STEEL BOLTS

GRATING FRAME TABLE			
GRATING DEPTH T	FRAME ANGLE	GRATING DEPTH T	FRAME ANGLE
1"	1 3/4 x 1 1/4 x 1/4	2"	*2 1/2 x 2 1/2 x 1/2
1 1/4 "	2 x 1 1/2 x 1/4	2 1/4 "	2 1/2 x 2 1/2 x 1/4
1 1/2 "	3/4 x 1 3/4 x 1/4	2 1/2 "	3 x 2 1/2 x 1/2
1 3/4 "	2 x 2 x 1/4		

* OR USE 2 1/2 x 2 1/2 x 1/4 W/ 1/4 " SHIM PLATE WELDED TO BOTTOM

GALVANIZED STEEL GRATING — S-502
USE STEEL ANGLE SUPPORTS AND BOLTS GALVANIZE AFTER FABRICATION

STAINLESS STEEL GRATING — S-503
REV 011696
USE STAINLESS STEEL ANGLE SUPPORTS AND BOLTS

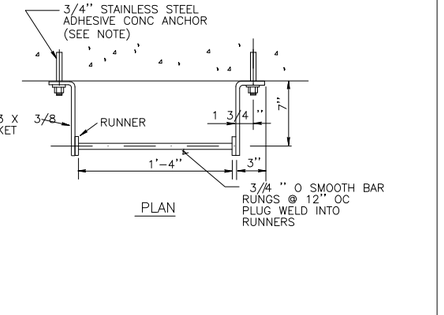


ALL RAILINGS TO HAVE A 4" KICKPLATE

GALVANIZED STEEL RAILING — S-508
1 1/2 " SCHEDULE 40 STANDARD PIPE RAILING AND POSTS GALVANIZED AFTER FABRICATION.

STAINLESS STEEL RAILING — S-509
1 1/2 " SCHEDULE 40 STAINLESS STEEL RAILING AND POSTS.

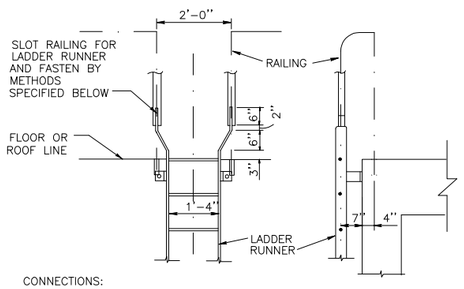
ALUMINUM RAILING — S-510
REV 022696
1 1/2 " SCHEDULE 40 STANDARD PIPE RAILING AND POSTS WITH MECHANICAL JOINTS.



PLAN

GALVANIZED STEEL LADDER — S-504
REV 101094

NOTE:
PROVIDE ANCHOR BOLT INSERTS FOR PRESTRESSED TANK WALL

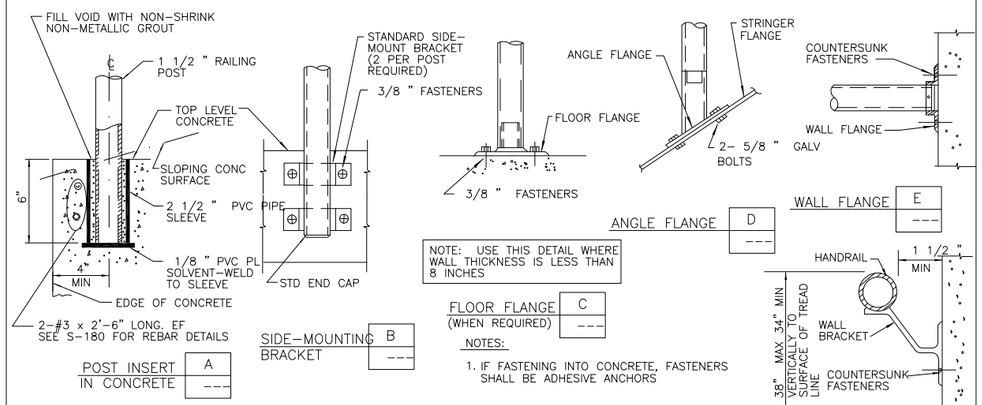


CONNECTIONS:

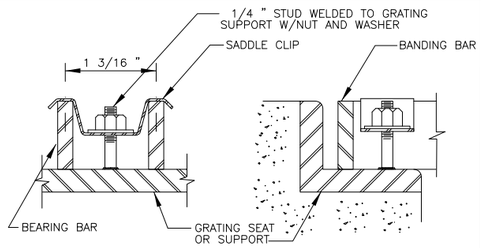
STEEL TO STEEL OR ALUMINUM TO ALUMINUM: WELDED CONNECTION, GRIND SMOOTH.

STEEL TO ALUMINUM: DRILL HOLE THRU LADDER RUNNER AND RAILING FOR 1/2 " PIN. INSERT PIN AND WELD BOTH ENDS AND GRIND SMOOTH. PIN SHALL BE THE SAME MATERIAL AS RAILING.

LADDER TO RAILING CONNECTIONS — S-507
REV 051893



RAILING, GUARDRAIL AND HANDRAIL SUPPORT DETAILS — S-512
REV 010196



NOTES:

1. PROVIDE 4 CLIPS PER GRATING PANEL, APPROX 4" FROM PANEL CORNERS. MAXIMUM CLIP SPACING AT 36" OC
2. STUD, NUT, WASHER AND CLIP TO BE THE SAME MATERIAL AS THE GRATING EXCEPT FOR ALUMINUM USE SS
3. AT FRP GRATING USE 1/4 " FRP ALL TREAD BOLTS AND ADHESIVE ANCHORS AS APPROPRIATE

GRATING ANCHOR DETAIL — S-517
REV 010196

This record drawing has been prepared, in part, on the basis of information compiled and furnished by others. The Engineer is not responsible for any errors or omissions which have been incorporated into this document as a result.

RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

FILE: $$$$directory/filename$$$$

JOB No. 1065073.013584

REV	DATE	BY	DESCRIPTION
1	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED MW STD
DRAWN J. TEHANEY
CHECKED C. LINDOW

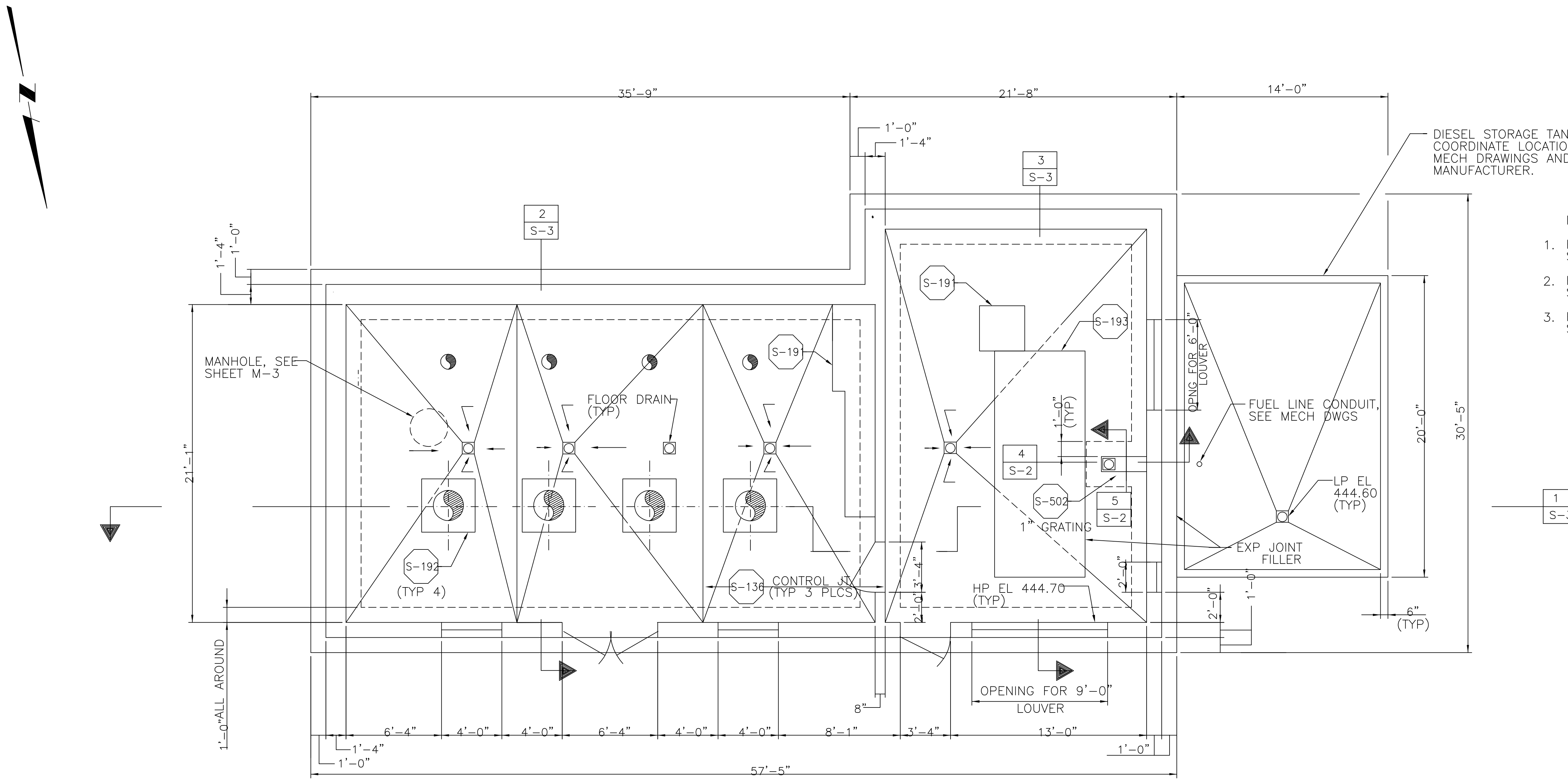
SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
STANDARD STRUCTURAL DETAILS – III

SHEET GS-3 OF 40 SHEETS



FLOOR PLAN

NOTES:

1. FOR DRAIN AND EQUIP PAD LOCATIONS, SEE MECHANICAL DRAWINGS
2. FOR PERIMETER DRAINS, SEE CIVIL DRAWINGS
3. FOR PIPING AND FLOOR PENETRATIONS, SEE MECHANICAL DRAWINGS

This record drawing has been prepared, in part, on the basis of information compiled and furnished by others. The Engineer is not responsible for any errors or omissions which have been incorporated into this document as a result.

RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
RD	4/99	DPR	RECORD DRAWING

SCALE: 1/4 " = 1'-0"

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED J. TEHANEY
DRAWN D. PALMER
CHECKED C. LINDOW

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

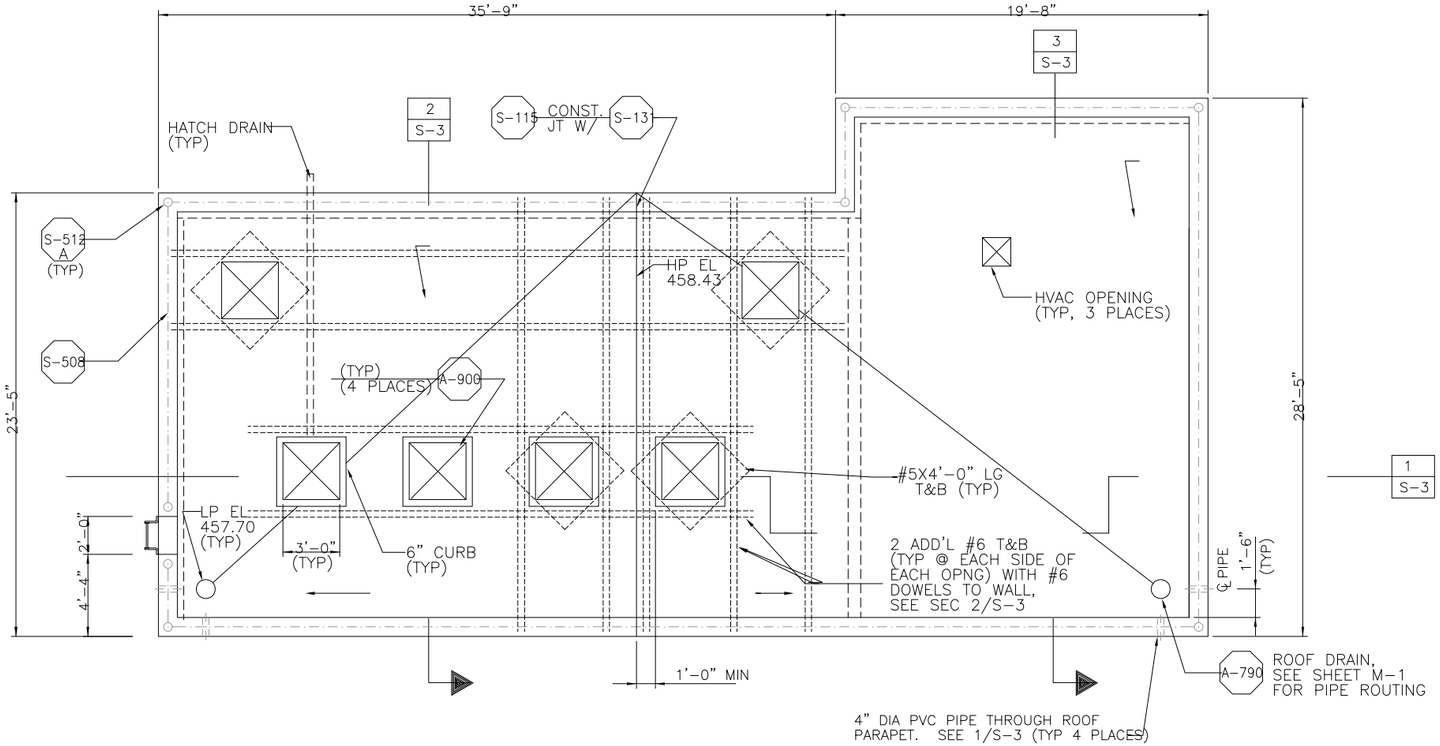
MONTGOMERY WATSON
Portland, Oregon

APPROVED DATE
APPROVED DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PUMP STATION FLOOR PLAN

SHEET S-1 OF 40 SHEETS

Plot Date/Time: $$$$$date$$$$ $$time$$

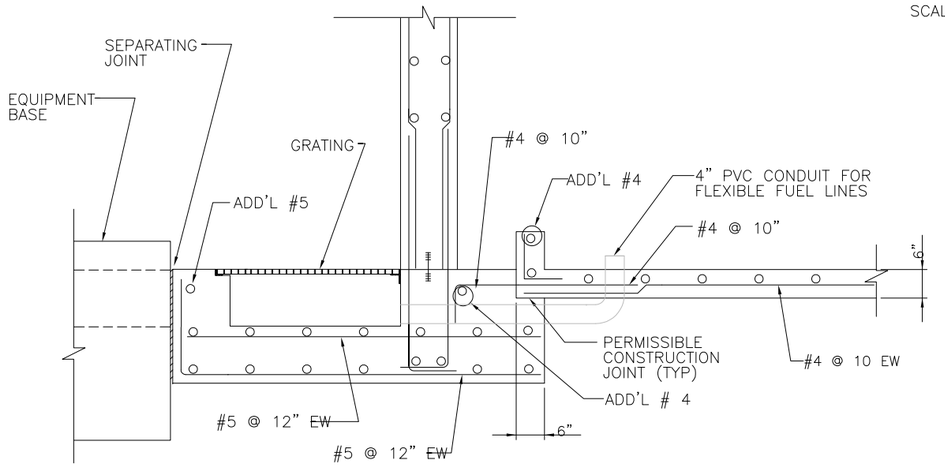


NOTES:

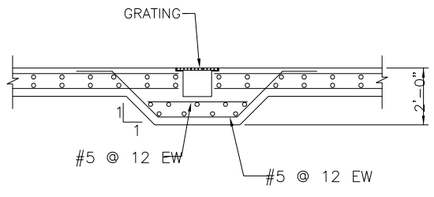
1. FOR LOCATIONS AND DIMENSIONS OF HVAC OPENINGS, SEE HVAC DRAWINGS.
2. CENTER SKYLIGHTS OVER PUMP CANS.

ROOF PLAN

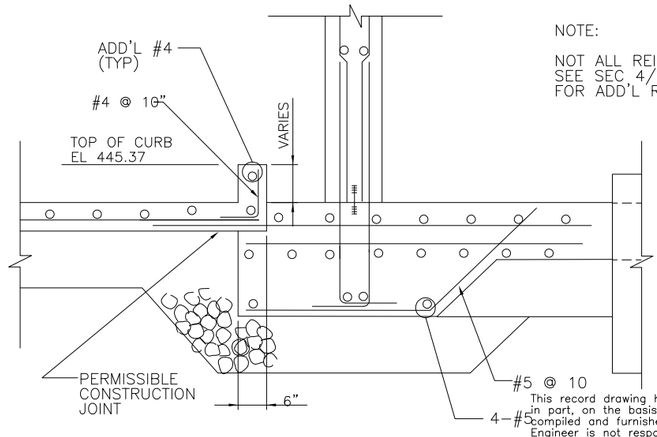
SCALE: 1/4 = 1'-0"



SECTION 4
SCALE: 3/4 " = 1'-0"



SECTION 5
SCALE: 3/8 " = 1'-0"



NOTE:

NOT ALL REINF SHOWN, SEE SEC 4/– AND SHEET S-3 FOR ADD'L REINF INFO

DETAIL A
SCALE: 3/4 = 1'-0"

REV	DATE	BY	DESCRIPTION
RD	4/99	DPR	RECORD DRAWING

SCALE: AS NOTED

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED J. TEHANEY
DRAWN D. PALMER
CHECKED C. LINDOW

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE
APPROVED ____ DATE

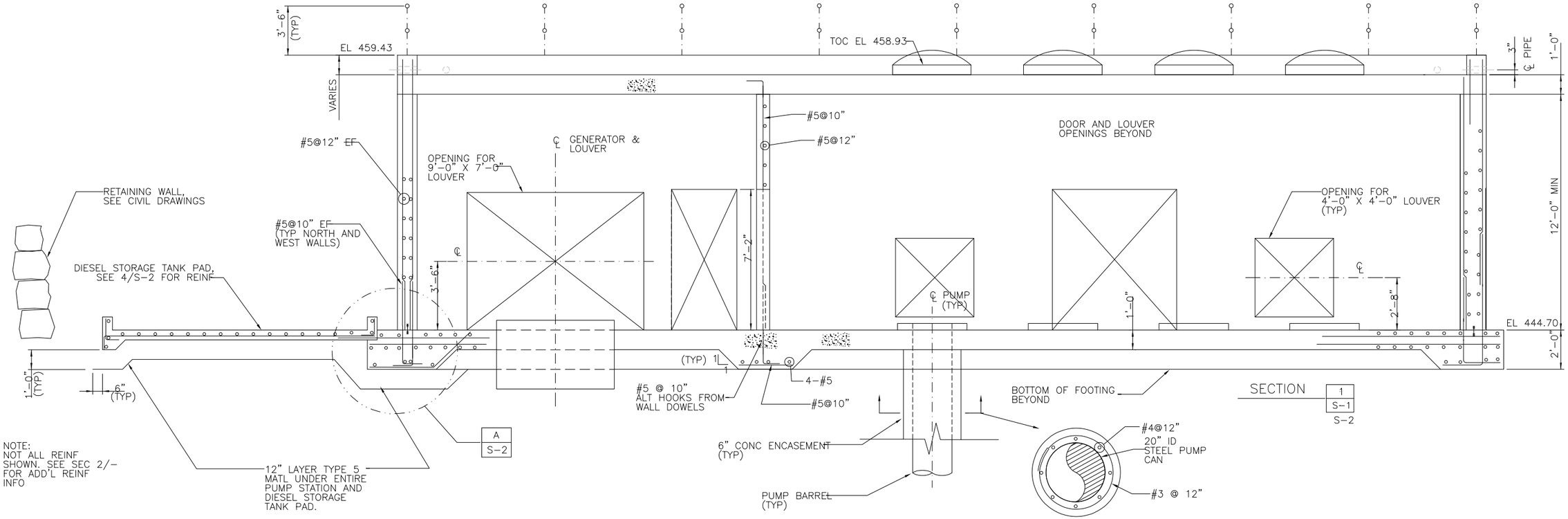
CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PUMP STATION ROOF PLAN

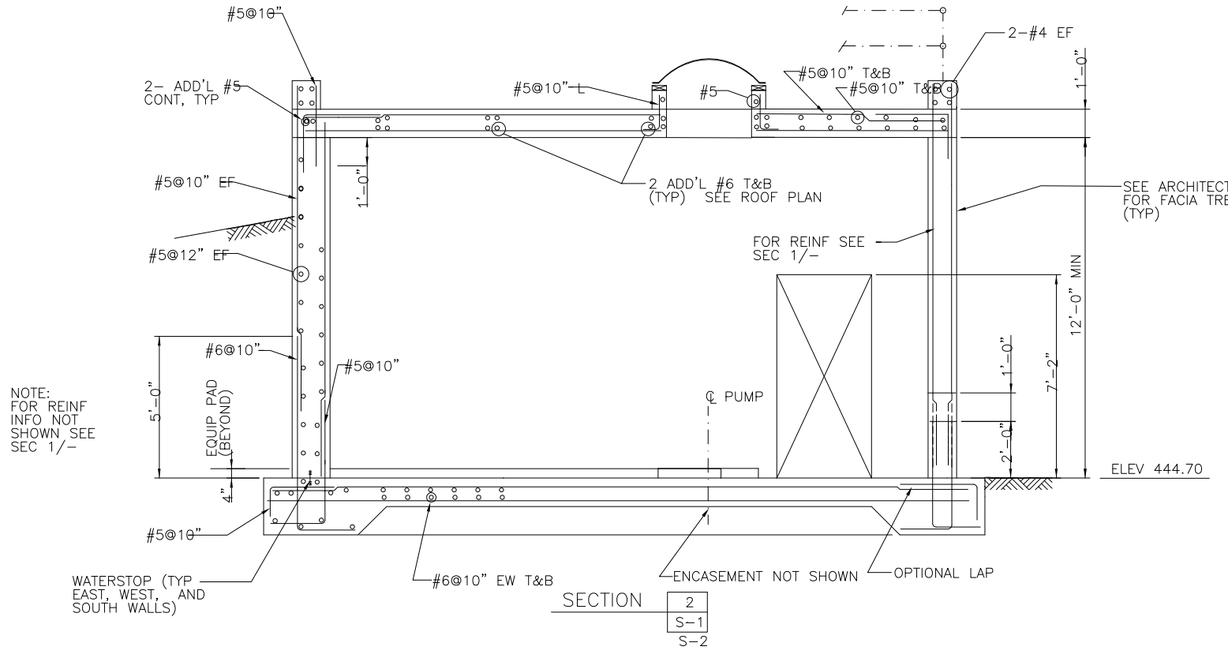
SHEET S-2 OF 40 SHEETS

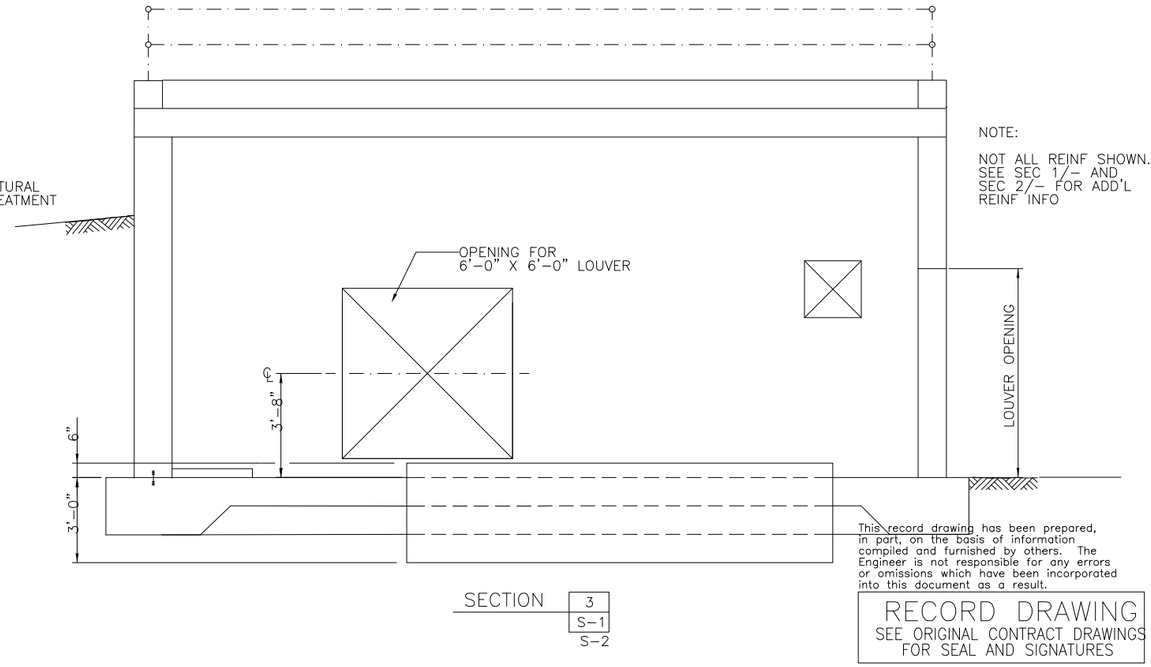
JOB No. 1065073.013584

FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

Plot Date/Time: $$$$date$$$$ $$time$$







RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: 3/8 " = 1'-0"

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED J. TEHANEY
DRAWN J. TEHANEY/D. PALMER
CHECKED C. LINDOW

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE
APPROVED ____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PUMP STATION SECTIONS AND DETAILS

SHEET S-3 OF 40 SHEETS

FILE: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

JOB No. 1065073.013584

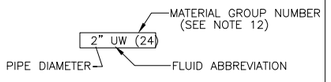
Plot Date/Time: $$$$date$$$$ $$time$$

FILE: $$$$$$$$directory/filename$$$$$$$$

PIPING SCHEDULE

FLUID ABBREVIATION	FUNCTION	PIPING MATERIALS (SEE SCHEDULE BELOW)				FIELD TEST REQUIREMENTS (SEE NOTE 3 AND NOTE 4)		
		EXPOSED PIPING (SEE NOTE 14)		BURIED PIPING (SEE NOTE 13)		MINIMUM TEST PRESSURE PSI	TEST MEDIUM	LEAKAGE ALLOWANCE (SEE NOTE 2)
		2 IN. DIA. AND SMALLER	2-1/2IN. DIA. AND LARGER	2 IN. DIA. AND SMALLER	2-1/2IN. DIA AND LARGER			
C	CULVERT	NA	NA	NA	22	NA	NA	
D	DRAIN	--	--	--	19	NOTE 6	WATER	(C)
FOR	FUEL OIL RETURN	9	--	--	--	75	AIR	(A)
FOS	FUEL OIL SUPPLY	9	--	--	--	75	AIR	(A)
PC	PUMP CAN	--	--	--	36	50	WATER	(A)
RWL	RAIN WATER LEADER	12	12	12	12	NOTE 7	--	--
SD	SERVICE DRAIN	24	--	24	--	25	WATER	(A)
SPD	SUMP PUMP DISCHARGE	2	26	2	26	50	WATER	(A)
SDR	STORM DRAIN	--	--	--	19	NOTE 6	WATER	(B)
UW	UTILITY WATER (NON-POTABLE WATER)	24	11, 24	24	11, 24	75	WATER	(A)
W	WATER	24	11	16	11	200	WATER	(B)

TYPICAL PIPE DESIGNATION:



PIPING MATERIAL SCHEDULE (SEE NOTE 4)

GROUP NO.	PIPE (SEE NOTE 13)	FITTINGS	VALVES, 6 INCHES AND SMALLER (SEE NOTE 1, NOTE 11 AND NOTE 16)
1	STEEL, ASTM A53, SCHEDULE 40, BLACK WELDED.	2-1/2 INCH AND SMALLER, MALLEABLE IRON, ANSI B16.3, THREADED, BANDED, BLACK, 150 PSI OR STEEL, ANSI B16.9, BUTT-WELDED. 3 INCH AND LARGER, CAST IRON, ANSI B16.1, 125 PSI FLANGED OR MECHANICAL COUPLINGS.	BRONZE, THREADED, GATE, CRANE NO. 428 UB OR STOCKHAM B-105. GLOBE, CRANE NO. 14-1/2P OR STOCKHAM B-29, CHECK, CRANE NO.37 OR STOCKHAM B-319. STEEL, LUBRICATED PLUG, ROCKWELL FIG. 142 OR 143 OR POWELL FIG 2200 OR 2201, ECCENTRIC PLUG, DEZURIK SERIES 118 OR KEYSTONE 1512. BALL, JENKINS NO.900T OR JAMESBURY FIG.351
2	STEEL, ASTM A53, SCHEDULE 40 WELDED, GALVANIZED.	2-1/2 INCH AND SMALLER, MALLEABLE IRON, ANSI B16.3, THREADED, BANDED, GALVANIZED 150 PSI. 3 INCH AND LARGER, CAST IRON, ANSI B16.1, 125 PSI FLANGED OR MECHANICAL COUPLINGS.	2-1/2 INCH AND SMALLER, ECCENTRIC PLUG, SYNTHETIC RUBBER FACED, DEZURIK 118S OR HOMESTEAD 1512. BALL, JENKINS NO. 900T OR JAMESBURY FIG. 351 3 INCH AND LARGER, ECCENTRIC PLUG, SYNTHETIC RUBBER FACED, DEZURIK 118F OR KEYSTONE 1522 OR 1532 EWG. GATE, AWWA C500. BUTTERFLY, AWWA, FLANGED.
3	STEEL, ASTM A106 OR A53, SCHEDULE 80, SEAMLESS, BLACK.	FORGED STEEL, ANSI B16.11, SOCKET WELDED OR THREADED, BLACK, 2000 PSI, OR STEEL, ANSI B16.9, BUTT-WELDED, SCHEDULE 80.	CAST IRON, LUBRICATED PLUG, ROCKWELL FIG. 214 OR 305 OR POWELL FIG. 2210 OR 2211.
6	STEEL, ASTM A106, OR A53, SCHEDULE 40, SEAMLESS, BLACK.	STEEL, ANSI B16.9, BUTT-WELDED. CAST IRON, ANSI B16.1, 125 PSI, FLANGED. FORGED STEEL, SOCKET WELDED, ANSI B16.11, 2000 PSI OR STEEL, ANSI B16.5, 150 PSI FLANGED.	CAST IRON, FLANGED, LUBRICATED PLUG ROCKWELL FIG 143 OR POWELL FIG 2201.
9	STEEL, ASTM A53, SCHEDULE 40, BLACK WELDED.	2-1/2" AND SMALLER, MALLEABLE IRON, ANSI B16.3, THREADED BANDED, BLACK, 150 PSI. 3" AND LARGER, STEEL, ANSI B16.9, BUTT-WELDED. THREADED FITTINGS TO BE CONTINUOUS SEAL WELDED.	ECC. PLUG, DEZURIK SERIES 118 OR KEYSTONE 1512, CHECK, CRANE NO. 336E OR WALWORTH NO. 904 OR POWELL FIG 668Y. BALL, JENKINS NO. 900T OR JAMESBURY FIG 351.
11	DUCTILE IRON, ANSI A21.51, (AWWA C150) CL52 BELL AND SPIGOT, MECHANICAL JOINTS, MECHANICAL COUPLINGS, OR FLANGED (TYPICAL SERVICE - WATER LINES)	DUCTILE IRON OR , ANSI A21.10, OR AWWA C110, BELL AND SPIGOT, MECHANICAL COUPLINGS, FLANGED OR MECHANICAL JOINTS, 250 PSI, (PRESSURE RATING)	GATE, AWWA C500, 'O' RING SEALS, MECHANICAL JOINTS ENDS, MUELLER A-2380-20, OR EDDY-IOWA (CLOW) F-5155. BUTTERFLY, AWWA. ECCENTRIC PLUG, DEZURIK SERIES 118 OR KEYSTONE 1512, OR BALL, PRATT OR W-K-M.
12	CAST IRON SOIL, ANSI/ASTM A-74, SERVICE WEIGHT, BELL AND SPIGOT OR HUBLESS. AT THE OPTION OF THE CONTRACTOR, DUCTILE IRON (GROUP NO. 11) MAY BE SUBSTITUTED	CAST IRON SOIL, ANSI/ASTM A-74, SERVICE WEIGHT, BELL AND SPIGOT OR HUBLESS. AT THE OPTION OF THE CONTRACTOR, DUCTILE IRON (GROUP NO. 11) MAY BE SUBSTITUTED.	AS INDICATED ON DRAWINGS.
13	CORROSION RESISTANT (HIGH SILICON CONTENT) CAST IRON, SERVICE WEIGHT, BELL AND SPIGOT OR HUBLESS.	CORROSION RESISTANT (HIGH SILICON CONTENT) CAST IRON, SERVICE WEIGHT, BELL AND SPIGOT OR HUBLESS.	--------
14	STAINLESS STEEL, TYPE 316, ASTM A312, SCHEDULE 40S.	STAINLESS STEEL, TYPE 316 ANSI B16.3, SCREWED, 150 PSI, ANSI B16.9, BUTT-WELDED, SCHEDULE 40S, OR 150 PSI FLANGED.	STAINLESS STEEL, BALL, FLANGED, LADISH NO. 4202, OR JAMESBURY TYPE A/D150F. CHECK, LADISH, NO.5272 OR STOCKHAM FIG. 15 SF 316 OR AS SHOWN ON DRAWINGS.
15	STAINLESS STEEL, TYPE 316, ASTM A312, SCHEDULE 10S.	STAINLESS STEEL, TYPE 316 ANSI B16.9 BUTT-WELDED SCHEDULE 10S OR 150 PSI FLANGED.	STAINLESS STEEL, AS INDICATED ON DRAWINGS.
16	POLYVINYL CHLORIDE, SCHEDULE 80, NORMAL IMPACT. ASTM D1785	POLYVINYL CHLORIDE, SCHEDULE 80, NORMAL IMPACT, SOCKET SOLVENT WELD JOINTS, ASTM D2467.	POLYVINYL CHLORIDE, BALL, DIAPHRAGM, BUTTERFLY, BALL OR LIFT CHECK. CHEMTROL, HILLS-MCCANNA OR GSR-R.G. SLOAN CO.
17	POLYPROPYLENE, ASTM D2146, SCHEDULE 40, WITH HEAT FUSED JOINTS.	POLYPROPYLENE, SCHEDULE 40, DRAINAGE TYPE WITH HEAT FUSED SOCKET JOINTS.	--------
18	FIBERGLASS REINFORCED PLASTIC, ASTM D2996, FILAMENT-WOUND, SOCKET AND SPIGOT ENDS, ADHESIVE BONDED.	FIBERGLASS REINFORCED PLASTIC, FILAMENT-WOUND, SOCKET ENDS, ADHESIVE BONDED, OR FIBERGLASS FLANGED.	PLASTIC LINED, FLANGED. FLANGES TO MATCH 150 PSI ANSI B16.5 DIMENSIONS, OR AS INDICATED ON DRAWINGS.
19	POLYVINYL CHLORIDE GRAVITY SEWER PIPE, ASTM D3034, BELL AND SPIGOT. SEE NOTE 17 FOR PERFORATIONS	POLYVINYL CHLORIDE, ANSI/ASTM C3034, BELL AND/OR SPIGOT.	--------
22	REINFORCED CONCRETE, ASTM C76, CL III TONGUE AND GROOVED JOINTS. (TYPICAL SERVICE-CULVERTS)	--------	--------
24	COPPER, ASTM B88, TYPE K, SOFT TEMPERED WHERE BURIED, HARD TEMPERED WHERE EXPOSED.	WROUGHT COPPER OR CAST BRONZE, ANSI B16.22, SOLDER JOINT, 150 PSI OR COMPRESSION FITTINGS. (FOR OXYGEN PIPING USE SILVER SOLDER, FOR COMPRESSED AIR PIPING USE 95-5 TIN-ANTIMONY SOLDER).	BRONZE, SOLDER JOINT, GLOBE, CRANE NO. 1310 OR STOCKHAM B-14. CHECK, CRANE NO. 1342 OR 36, OR STOCKHAM B-309 OR B-345. GATE, CRANE NO. 1320 OR 426, OR STOCKHAM B-104 OR B-105.
36	STEEL PIPE - MORTAR LINED AND COATED (BURIED), MORTAR LINED AND PAINTED (EXPOSED), AWWA C200 & C205, JOINTS WELDED	STEEL PIPE - COATING SAME AS PIPE, AWWA C200 & C205	AS INDICATED ON DRAWINGS

NOTES

NOTE 1
PROPRIETARY NAMES HAVE BEEN QUOTED FOR IDENTIFICATION PURPOSES ONLY. SUBSTITUTIONS WILL BE PERMITTED SUBJECT TO PROVISIONS OF THE SPECIFICATIONS.

NOTE 2
LEAKAGE ALLOWANCE IS AS FOLLOWS:
(A) PIPES SO DESIGNATED SHALL SHOW ZERO LEAKAGE.
(B) PIPES SO DESIGNATED SHALL SHOW ZERO LEAKAGE FOR UNBURIED PIPE AND NOT MORE THAN 0.02 GALLON PER HOUR PER INCH DIAMETER PER 100 FEET OF BURIED PIPE.
(C) PIPES SO DESIGNATED SHALL NOT SHOW A LEAKAGE OF MORE THAN 0.15 GALLON PER HOUR PER INCH OF DIAMETER PER 100 FEET OF PIPE.
(D) PIPES SO DESIGNATED SHALL NOT SHOW A LOSS OF PRESSURE OF MORE THAN 5 PERCENT.

NOTE 3
FOR FIELD TEST PROCEDURES AND ADDITIONAL TEST REQUIREMENTS, SEE PIPING SECTION OF SPECIFICATIONS.

NOTE 4
ANY DEVIATION FROM THE PIPING MATERIALS OR FIELD TEST REQUIREMENTS SHOWN WILL BE NOTED IN THE SPECIFICATIONS OR ON THE DRAWINGS. THE VALVE TYPE SHOWN SHALL TAKE PRECEDENCE OVER THIS TABLE.

NOTE 5
PIPING GROUP NUMBER SHOWN THUS SHALL BE INSULATED, SEE PIPING SECTION OF SPECIFICATIONS FOR INSULATING MATERIALS.

NOTE 6
STATIC WATER TEST WITH SURFACE 5 FEET ABOVE HIGH POINT OF PIPE.

NOTE 7
INSPECTION AND TESTING SHALL BE IN ACCORDANCE WITH APPLICABLE PLUMBING CODE.

NOTE 8
NO APPARENT LEAKS UNDER NORMAL OPERATING CONDITIONS.

NOTE 9
INSPECTION AND TESTING SHALL BE IN ACCORDANCE WITH APPLICABLE NATIONAL FIRE PROTECTION ASSOCIATION STANDARDS.

NOTE 10
PIPING MATERIALS SHALL BE IN ACCORDANCE WITH NATIONAL FIRE PROTECTION ASSOCIATION STANDARDS.

NOTE 11
FOR VALVES 8 INCHES AND LARGER SEE VALVE SCHEDULE. FOR SPECIAL VALVES SEE SPECIFICATIONS.

NOTE 12
CHANGE IN PIPING MATERIAL GROUP NUMBER IS INDICATED THUS: ——◆

NOTE 13
FOR PIPE LINING AND COATING, SEE SPECIFICATIONS.

NOTE 14
EXPOSED PIPING SHALL BE PAINTED IN ACCORDANCE WITH SPECIFICATIONS. COLORS TO BE SELECTED BY ENGINEER.

NOTE 15
PIPING MATERIAL SHALL BE NON-ABRASIVE FLEXIBLE RUBBER HOSE AND QUICK CONNECTION COUPLINGS WITH GROUP NO.1 AT EQUIPMENT.

NOTE 16
VALVES 2- 1/2 INCH AND SMALLER MAY HAVE SCREWED ENDS VALVES 3 INCH AND LARGER SHALL HAVE FLANGED ENDS, UNLESS OTHERWISE SHOWN OR SPECIFIED.

NOTE 17
FOR PERFORATED PVC PIPE PROVIDE 1/2" DRILLED HOLES, CENTERED 60 DEGREES BELOW THE SPRING LINE ON BOTH SIDES OF PIPE SPACED AT 12" ON CENTER.

EQUIPMENT SCHEDULES

PUMP SCHEDULE

EQUIPMENT NO.	SERVICE	TYPE	CAPACITY	HP	COMMENTS
P-1	WATER	VERTICAL TURBINE	1500 GPM	200	1760 RPM
P-2	WATER	VERTICAL TURBINE	1500 GPM	200	1760 RPM
P-3	WATER	VERTICAL TURBINE	1500 GPM	200	(FUTURE)
P-4	WATER	VERTICAL TURBINE	1500 GPM	200	(FUTURE)
P-5	DRAINAGE SUMP	SUBMERSIBLE SUMP	30 GPM	1/4	FLOW METER VAULT
P-6	DRAINAGE SUMP	SUBMERSIBLE SUMP	30 GPM	1/4	SURGE VALVE VAULT

VALVE SCHEDULE

EQUIPMENT NO.	SERVICE	TYPE	SIZE (IN.)	CLASS	OPERATOR	COMMENTS
V-1	PUMP ISOLATION	BUTTERFLY	8	175	HANDWHEEL	---
V-2	PUMP ISOLATION	BUTTERFLY	8	175	HANDWHEEL	---
V-3	PUMP DISCHARGE	PUMP CONTROL	8	150	PUMP CONTROL	ANGLE STYLE
V-4	PUMP DISCHARGE	PUMP CONTROL	8	150	PUMP CONTROL	ANGLE STYLE
V-5	PUMP DISCHARGE	SILENT CHECK	8	250	SPRING ASSISTED	GLOBE STYLE
V-6	PUMP DISCHARGE	SILENT CHECK	8	250	SPRING ASSISTED	GLOBE STYLE
V-7	ISOLATION	BUTTERFLY	8	250	HANDWHEEL	---
V-8	VACUUM RELIEF	SILENT CHECK	8	250	SPRING ASSISTED	GLOBE STYLE
V-9	ISOLATION	BUTTERFLY	8	250	HANDWHEEL	---
V-10	ISOLATION	BUTTERFLY	8	250	HANDWHEEL	---
V-11	ISOLATION	BUTTERFLY	8	250	HANDWHEEL	---
V-12	DISCHARGE PIPE	BUTTERFLY	16	250	2" NUT W/EXT. STEM	NORMALLY OPEN
V-13	--	--	--	--	--	NOT USED
V-14	DISCHARGE PIPE	BUTTERFLY	16	250	2" NUT W/EXT. STEM	NORMALLY OPEN
V-15	--	--	--	--	--	NOT USED
V-16	--	--	--	--	--	NOT USED
V-17	SUCTION	BUTTERFLY	24	250	2" NUT W/EXT. STEM	NORMALLY OPEN (SEE C-215)
V-18	SUCTION INTERCONNECT	BUTTERFLY	18	250	2" NUT W/EXT. STEM	NORMALLY CLOSED (SEE C-215)
V-19	EXISTING SUCTION	BUTTERFLY	18	250	2" NUT W/EXT. STEM	--- (SEE C-215)
V-20	ISOLATION	BUTTERFLY	14	250	2" NUT W/EXT. STEM	NORMALLY OPEN (SEE C-215)
V-21	ISOLATION	BUTTERFLY	6	250	2" NUT W/EXT. STEM	NORMALLY OPEN (SEE C-215)

NOTE: SEE OFFSITE PIPING PLAN FOR 6" VALVES

FAN SCHEDULE

EQUIPMENT NO.	SERVICE	TYPE	CFM	POWER	COMMENTS
EF-1	AIR EXHAUST	CABINET FAN	4750 CFM, 1/2 " SP	480/60/3/ 1 1/2 " HP	PUMP ROOM EXHAUST/PACE,SCF,150,F
EF-2	AIR EXHAUST	CABINET FAN	4750 CFM, 1/2 " SP	480/60/3/ 1 1/2 " HP	PUMP ROOM EXHAUST/PACE,SCF,150,F
EF-3	AIR EXHAUST	CABINET FAN	1120 CFM, 1/2 " SP	480/60/3/ 1 1/2 " HP	GENERATOR ROOM EXHAUST/PACE,SCF,85,F

LOUVER SCHEDULE

EQUIPMENT NO.	SERVICE	SIZE (WxH)	POWER	COMMENTS
L-1	AIR INTAKE	48"x48"	120/60/1	PUMP ROOM VENTILATION-MOTOR OPERATED DAMPER
L-2	AIR INTAKE	48"x48"	120/60/1	PUMP ROOM VENTILATION-MOTOR OPERATED DAMPER
L-3	AIR INTAKE	72"x72"	120/60/1	GENERATOR ROOM AIR INLET-MOTOR OPERATED DAMPER
L-4	AIR EXHAUST	108"x84"	NO MOTOR	GENERATOR ROOM AIR OUTLET-GRAVITY OPERATED DAMPER
L-5	AIR INTAKE	24"x24"	120/60/1	GENERATOR ROOM VENTILATION-MOTOR OPERATED DAMPER

UNIT HEATER SCHEDULE

EQUIPMENT NO.	SERVICE	TYPE	CAPACITY	COMMENTS
UH-1	PUMP ROOM HEATER	UNIT HEATER	7 1/2 KW	
UH-2	PUMP ROOM HEATER	UNIT HEATER	7 1/2 KW	
UH-3	GENERATOR ROOM HEATER	UNIT HEATER	10 KW	

MISCELLANEOUS EQUIPMENT SCHEDULE

EQUIPMENT NO.	SERVICE	TYPE	CAPACITY	COMMENTS
ME-1	POWER	STANDBY POWER GENERATOR	600 KW	DIESEL POWERED
FE-300	FLOW MEASURE	FLOW METER	5,000 GPM	MAGNETIC METER
H-1	HATCH	SKYLIGHT	3' X 3'	SINGLE LEAF
H-2	HATCH	SKYLIGHT	3' X 3'	SINGLE LEAF
H-3	HATCH	SKYLIGHT	3' X 3'	SINGLE LEAF
H-4	HATCH	SKYLIGHT	3' X 3'	SINGLE LEAF

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

JOB No. 1065073.012580

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN J.A. RODRIGUEZ, D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER 19427 4/23/98 (R. C. E. NO. DATE)
MONTGOMERY WATSON 10818 4/23/98 (R. C. E. NO. DATE)

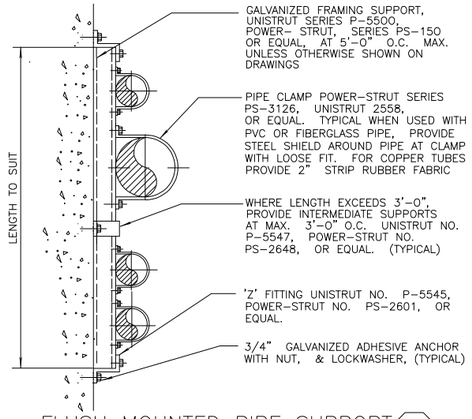
MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

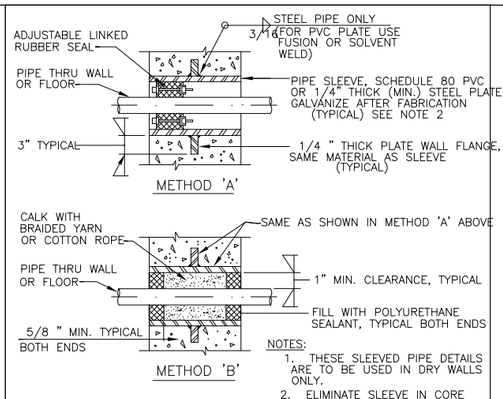
CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PIPING AND EQUIPMENT SCHEDULE

SHEET GM-1 OF 40 SHEETS

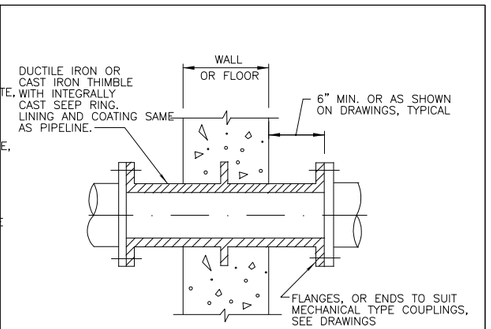
Plot Date/Time: $$$$date$$$$ $$time$$



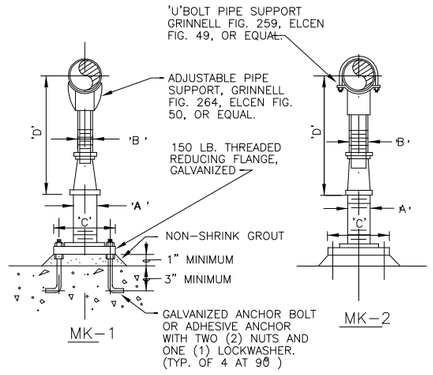
FLUSH MOUNTED PIPE SUPPORT M-102



SLEEVED PIPE OPENING M-111



FLANGED OR GROOVED DUCTILE IRON THIMBLE M-116



ADJUSTABLE PIPE SUPPORT APPROXIMATE DIMENSIONS IN INCHES					
PIPE SIZE	'A'	'B'	'C'	'D' MINIMUM	'D' MAXIMUM
2-1/2	2-1/2	1-1/2	9	8	11-1/2
3	2-1/2	1-1/2	9	8-1/4	11-3/4
3-1/2	2-1/2	1-1/2	9	8-1/2	12
4	3	*2-1/2	9	10-1/4	14
6	3	*2-1/2	9	11-5/8	15-1/4
8	3	*2-1/2	9	13-5/8	16-1/2
10	3	*2-1/2	9	14-5/8	18-1/4
12	3	*2-1/2	9	15-5/8	19-3/4
14	4	3	11	18-7/8	20-3/4
16	4	3	11	19-7/8	22-1/4
18	6	3-1/2	13-1/2	21-1/4	24
20	6	3-1/2	13-1/2	23-1/4	25-1/2
24	6	4	13-1/2	26-1/2	28-1/4
30	6	4	13-1/2	29-5/8	31-1/2
32	6	4	13-1/2	30-5/8	32-3/4
36	6	4	13-1/2	32-5/8	34-3/4

*SEE MFR.

ADJUSTABLE PIPE SUPPORT WITH OR WITHOUT 'U' BOLT M-108

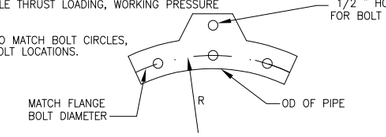
NOTES:

1 DRILL BOLT CIRCLE HOLES TO MATCH FLANGE. DRILL HOLE FOR ALL THREAD TO CLEAR FLEXIBLE COUPLER.

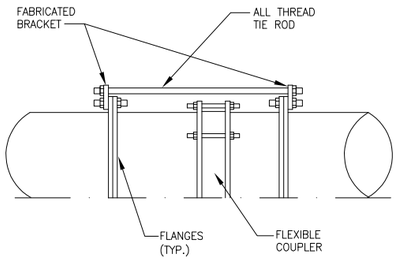
2 TWO ALL THREAD TIE RODS AND FOUR BRACKETS REQUIRED PER JOINT..

3 PROVIDE DESIGN CALCULATIONS FOR BRACKETS AND RODS IN ACCORDANCE WITH AWWA M-11 (BASED ON APPLICABLE THRUST LOADING, WORKING PRESSURE *1.33).

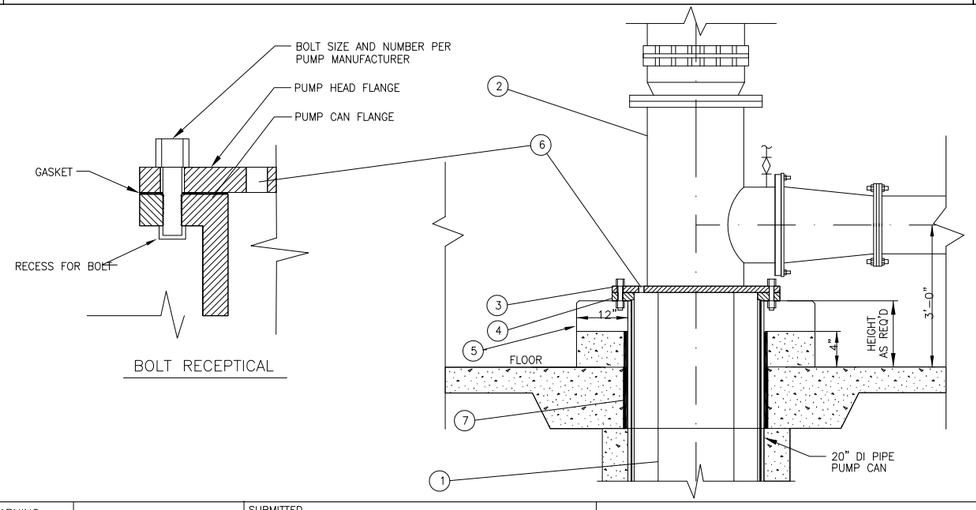
4 RADIUS TO MATCH BOLT CIRCLES, MATCH BOLT LOCATIONS.



FABRICATED BRACKET



HARNESS BRACKET A VAR.



BOLT RECEPTICAL

REFERENCE NOTES:

1. PUMP COLUMN.
2. PUMP HEAD.
3. FLANGE PLATE FOR PUMP HEAD.
4. FLANGE PLATE FOR PUMP CAN (TUBE), MATCH THE SIZE AND BOLT PATTERN OF THE PUMP HEAD FLANGE PLATE, DRILLED & TAPPED FOR FLANGE BOLTS.
5. CONCRETE SILL/SEAL, PROVIDE 1" CHAMFER AT CORNERS.
6. DRILLED AND TAPPED HOLE FOR AIR RELEASE/VENT PIPE.
7. JOINT FILLER MATERIAL.

PUMP BARREL CONNECTION B VAR.

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

FILE: $$$$$$$$$$directory/filename$$$$$$$$$$

JOB No. 1065073.012580

REV	DATE	BY	DESCRIPTION
A6	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN J.A. RODRIGUEZ D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER 19427 R. C. E. NO. 4/23/98 DATE
MONTGOMERY WATSON 10818 R. C. E. NO. 4/23/98 DATE

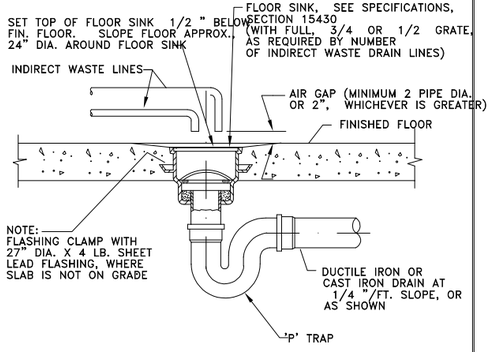
MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE
APPROVED ____ DATE

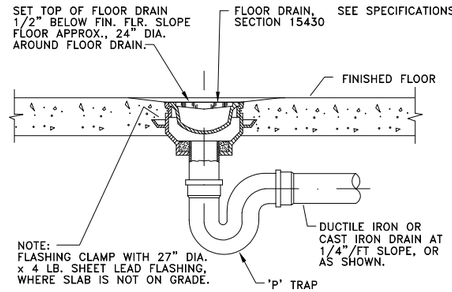
CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
MECHANICAL STANDARD DETAILS - I

SHEET GM-2 OF 40 SHEETS

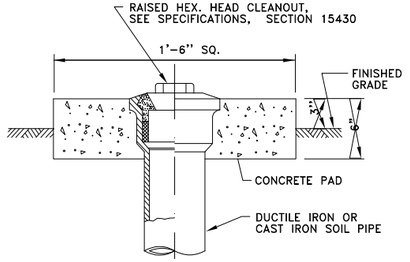
Plot Date/Time: $$$$date$$$$ $$time$$



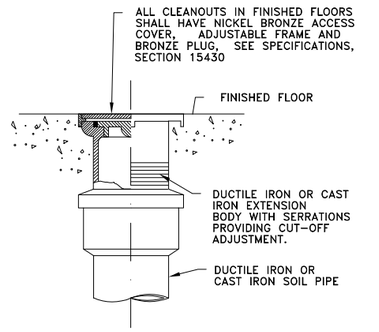
FLOOR SINK — M-301



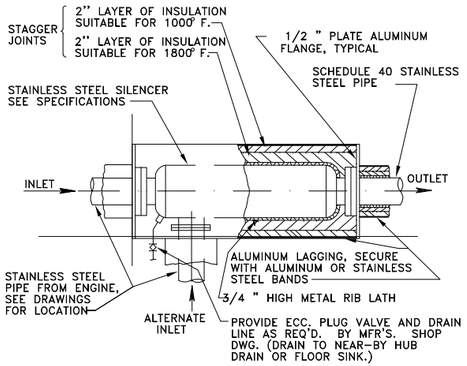
FLOOR DRAIN — M-302



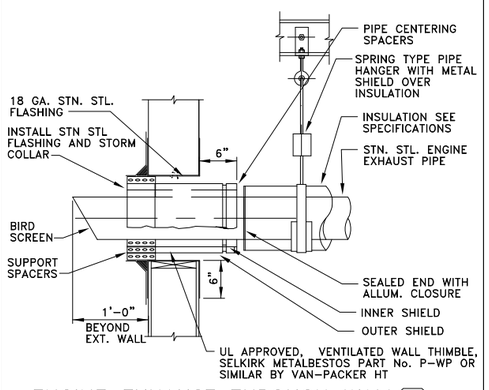
CLEANOUT TO GRADE — M-306



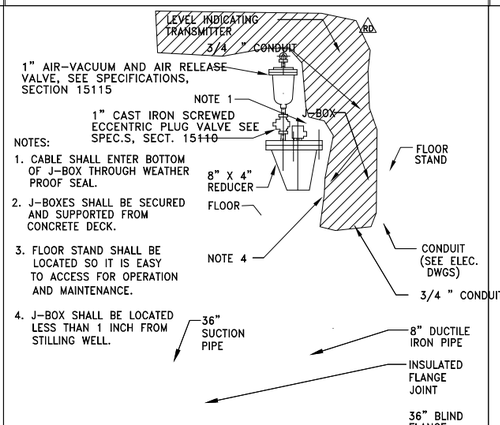
CLEANOUT IN FINISHED FLOOR — M-307



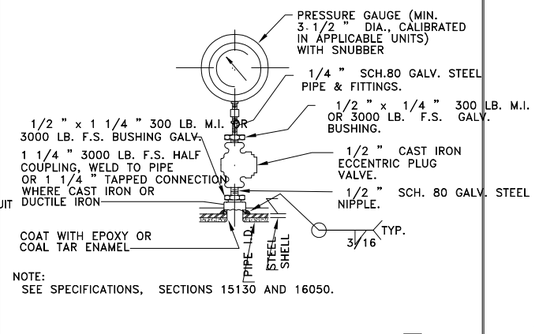
ENGINE SILENCER ASSEMBLY — M-401



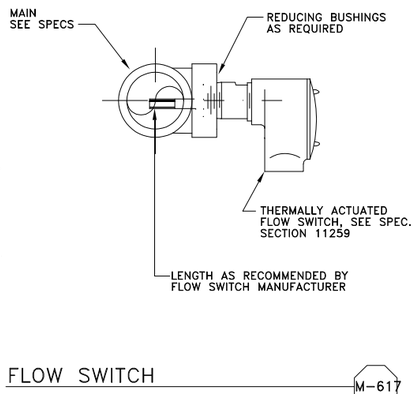
ENGINE EXHAUST THROUGH WALL — M-413



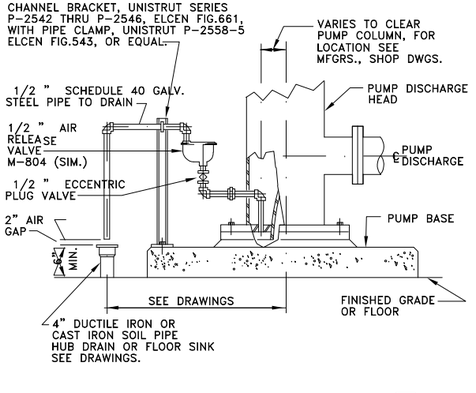
LOW LEVEL CUTOFF — C VAR.



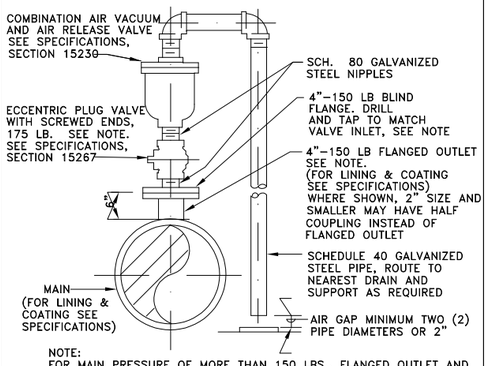
PRESSURE GAUGE — M-610



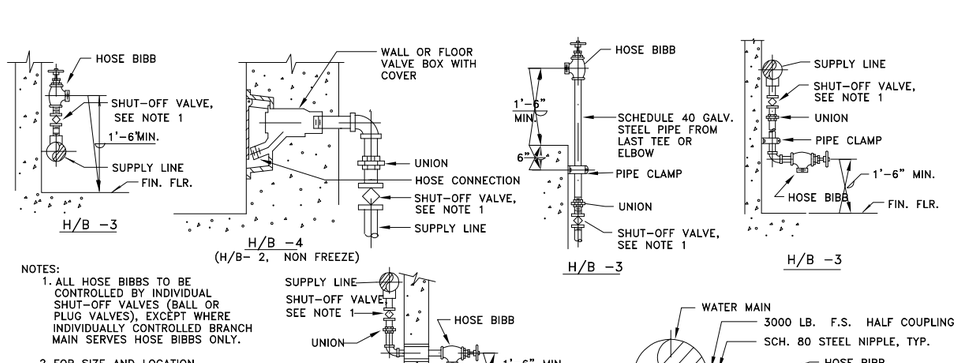
FLOW SWITCH — M-617



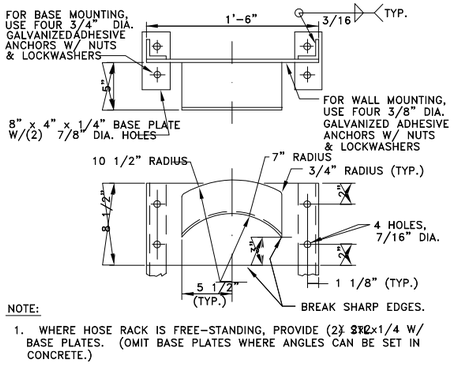
AIR VENT PIPING FOR PRESSURIZED PUMP BARREL — M-801



AIR-VACUUM & AIR-RELEASE VALVE ASSEMBLY 3" AND SMALLER — M-804



HOSE BIBBS — M-904



HOSE RACK — M-905

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

FILE: $$$$$$$$$$directory/filename$$$$$$$$$$

JOB No. 1065073.012580

REV	DATE	BY	DESCRIPTION
RD.	4/99	DPR	RECORD DRAWING

SCALE: NONE

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
J.A. RODRIGUEZ
DRAWN D.P. RAMER
CHECKED B.D. TEEL

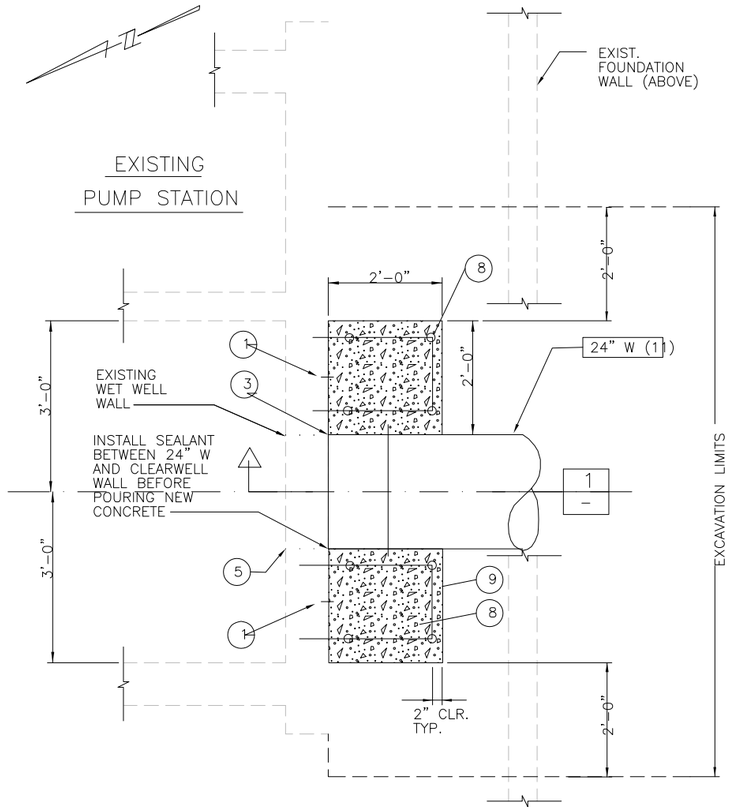
SUBMITTED
PROJECT ENGINEER — 19427 — 4/23/98 (R. C. E. NO. — DATE)
MONTGOMERY WATSON — 10818 — 4/23/98 (R. C. E. NO. — DATE)

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
MECHANICAL STANDARD DETAILS -II

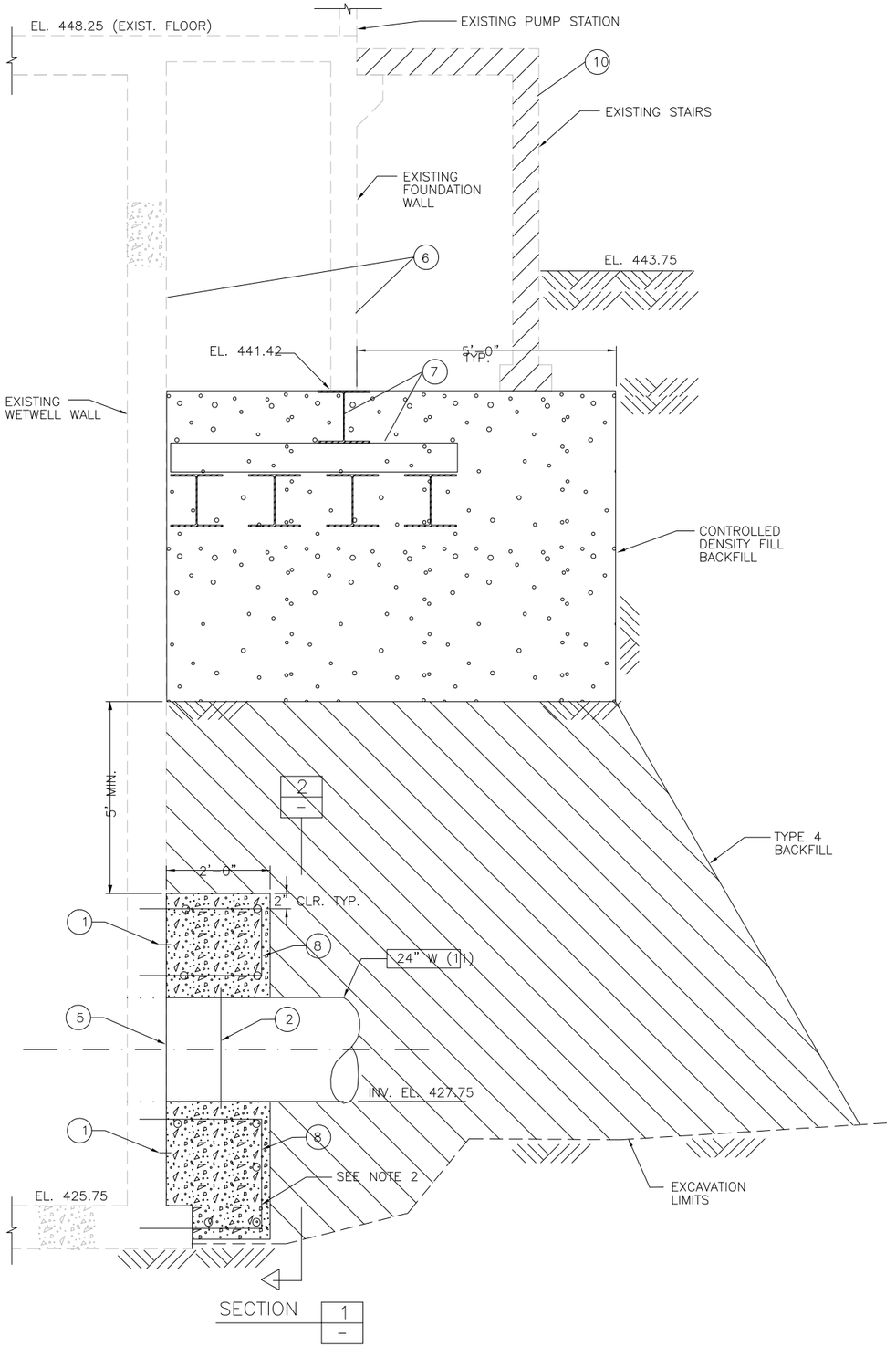
SHEET GM-3 OF 40 SHEETS



PLAN A –

SHEET NOTES:

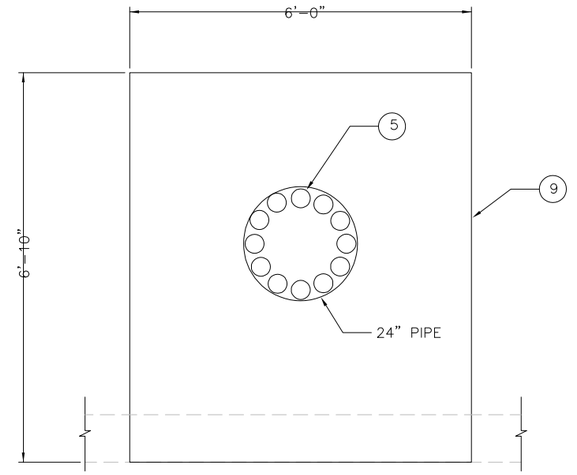
1. VERIFY REINFORCING HOOK DIMENSIONS WITH FIELD CONDITIONS PRIOR TO FABRICATION.
2. WELD REBARS CONTINUOUS ON EACH SIDE 1/4 " FILLET
3. SEE SPECIFICATIONS FOR CONNECTION REQUIREMENTS TO WETWELL.
4. ALL DRILLING AND CUTTING SHALL BE USING ELECTRIC OR PNEUMATIC EQUIPMENT ONLY.
5. ALL DRILLING AND CUTTING RESIDUE SHALL BE REMOVED FROM WET WELL AND THE WET WELL SHALL BE DISINFECTED BEFORE REFILLING.
6. THE SLUICE GATE ENTERING THE CLEARWELL LEAKS, CONTRACTOR SHALL PROVIDE PUMPING AS REQUIRED TO ALLOW CONNECTION TO WET WELL.
7. INSTALL PUMP STATION SUPPORT SYSTEM PRIOR TO EXCAVATION FOR WET WELL CONNECTION. PROTECT EXISTING PUMP STATION FROM DAMAGE. PROVIDE SUBMITTAL STAMPED BY STRUCTURAL ENGINEER, LICENSED IN THE STATE OF OREGON, FOR REVIEW.
8. ASBUILT DRAWINGS FOR THE EXISTING PUMP STATION ARE ON FILE AT THE CITY OF WEST LINN PUBLIC WORKS DEPARTMENT.



SECTION 1 –

REFERENCE NOTES:

1. VOLCLAY SEAL, CONTINUOUS, CUT 1/2 " WIDE BY 1" DEEP GROOVE IN EXISTING CONCRETE TO RETAIN SEAL (TYP)
2. 3/8 " SEED RING WELDED TO THE 24" DI PIPE
3. PRESSURE GROUT FULL CIRCUMERENCE AT 6" CENTER AFTER CONCRETE CURES THEN INSTALL CONTINUOUS SEALANT BEAD (1/2" MIN. DIMENSION)
4. 4" DIAMETER MIN. CORE DRILL THROUGH EXISTING WALL AS SHOWN
5. SAW CUT WALL USING CORE DRILL HOLES, DO NOT OVER CUT
6. PROTECT EXISTING PUMP STATION – STRUCTURE AND WET WELL
7. CONTRACTOR TO SUPPORT EXISTING PUMP STATION AS REQUIRED FOR CONSTRUCTION OF WET WELL CONNECTION PROVIDE DESIGN STAMPED BY PROFESSIONAL STRUCTURAL ENGINEER.
8. #5 @12" CC DRILL AND EPOXY INTO EXISTING WETWELL WALL, 6" MIN. EMBEDMENT.
9. CONCRETE CLOSURE USING 4000 PSI CONCRETE AND GRADE 60 STEEL REINFORCEMENT
10. REMOVE EXISTING STAIRS AND CHLORINE ROOM WALLS AND SLAB. BACKFILL WITH TYPE 4 MATERIAL AND PLACE SHIPS LADDER FOR ACCESS. (SEE GA–1 FOR STD. DETAIL)



SECTION 2 –

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: 3/4" = 1'

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

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DRAWN J.A. RODRIGUEZ, D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER — 19427 — 4/23/98
R. C. E. NO. — DATE

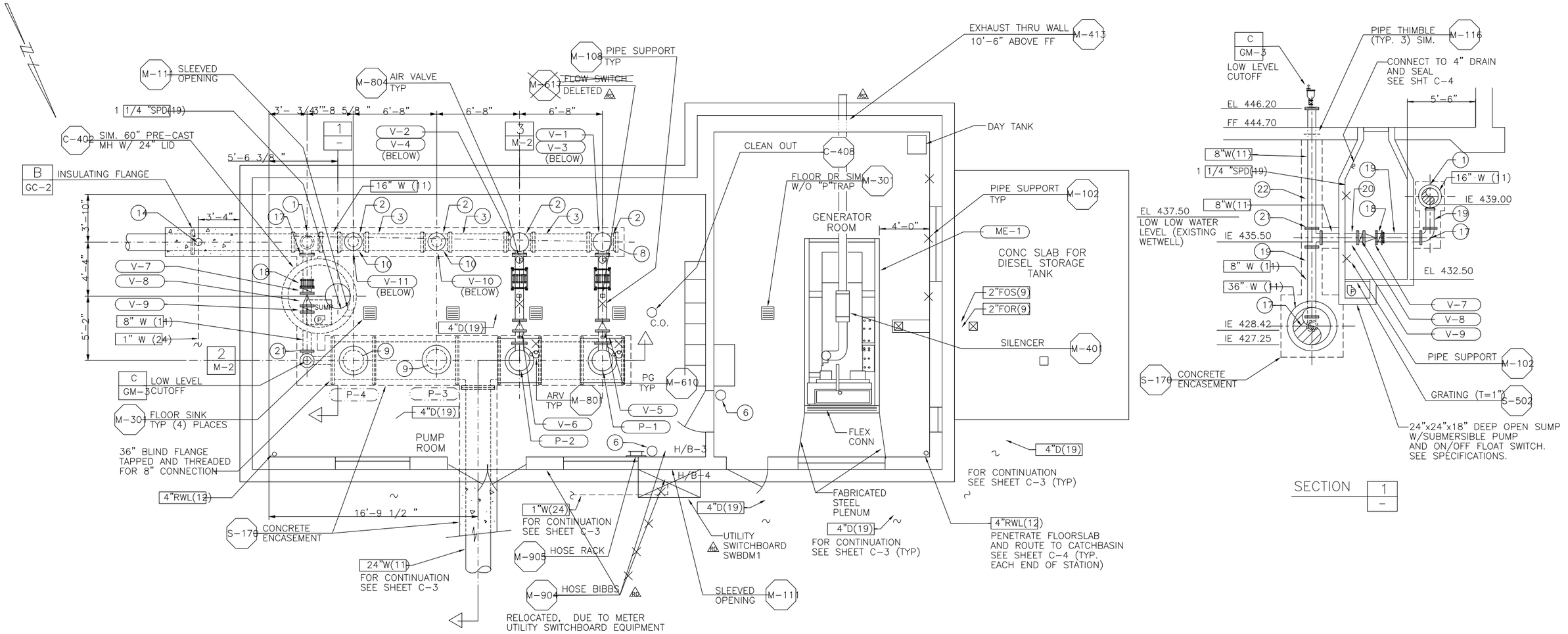
MONTGOMERY WATSON — 10818 — 4/23/98
R. C. E. NO. — DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE _____
APPROVED _____ DATE _____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
WET WELL PENETRATION DETAIL

SHEET GM–4 OF 40 SHEETS



SHEET NOTES:

1. SEE SHEET G-1 FOR GENERAL NOTES.
2. ALL PIPE AND FITTINGS FOR THE 24" SUCTION PIPE, 36" SUCTION PIPE, 16" DISCHARGE PIPE SHOWN ON THIS SHEET ARE DUCTILE IRON CL 53.
3. EXPOSED DUCTILE IRON PIPING – USE FLANGE FITTINGS, CONCRETE ENCASED PIPE – USE PUSH ON JOINTS, EXCEPT WHERE FLANGES ARE SHOWN.
4. SEE 3/M-2 FOR CALLOUTS FOR ELEVATED PUMP SUCTION AND DISCHARGE PIPING.
5. SEE 2/M-2 FOR BURIED SUCTION PIPING CALLOUTS.
6. INSTALL 1" W BURIED AT NOT LESS THAN 36 INCH DEPTH.

REFERENCE NOTES:

1. 16" X 16" X 8" MJ X MJ X MJ TEE
2. 16" X 16" X 8" MJ X MJ X MJ TEE
3. 16" PE X PE SPOOL PIECE (LENGTH AS REQUIRED)
4. 16" X 16" x16" MJ X MJ X MJ TEE
5. NOT USED
6. FIRE EXTINGUISHER, 25 LB. WITH WALL MOUNT BRACKET
7. NOT USED
8. 16" MJ PLUG
9. 20" PUMP CAN PIPE FOR FUTURE PUMP, WITH BLIND FLANGE AND FULL FACE GASKET (SEE 2/M-2)
10. 8" DISCHARGE PIPE FOR FUTURE PUMP, WITH BUTTERFLY VALVE, BLIND FLANGE, AND FULL FACE GASKET
11. NOT USED
12. NOT USED
13. NOT USED
14. 1" CORP STOP TAPPED INTO 16" DI PIPE: W/1" COPPER TUBING TO STATION SERVICE WATER.
15. NOT USED
16. NOT USED
17. 8" FLGD 90° BEND (SEE 2/M-2)
18. 8" FLANGE COUPLING ADAPTER
19. 8" FLGxPE SPOOL PIECE (LENGTH AS REQUIRED)
20. 8" FLGxFLG SPOOL PIECE (LENGTH AS REQUIRED)
21. 8" FLGD TEE
22. 8" FLGxFLG SPOOL PIECE W/ RETAINER RING (LENGTH AS REQUIRED)

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE: 1/4 " = 1'

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN J.A. RODRIGUEZ, D.P. RAMER
CHECKED B.D. TEEL

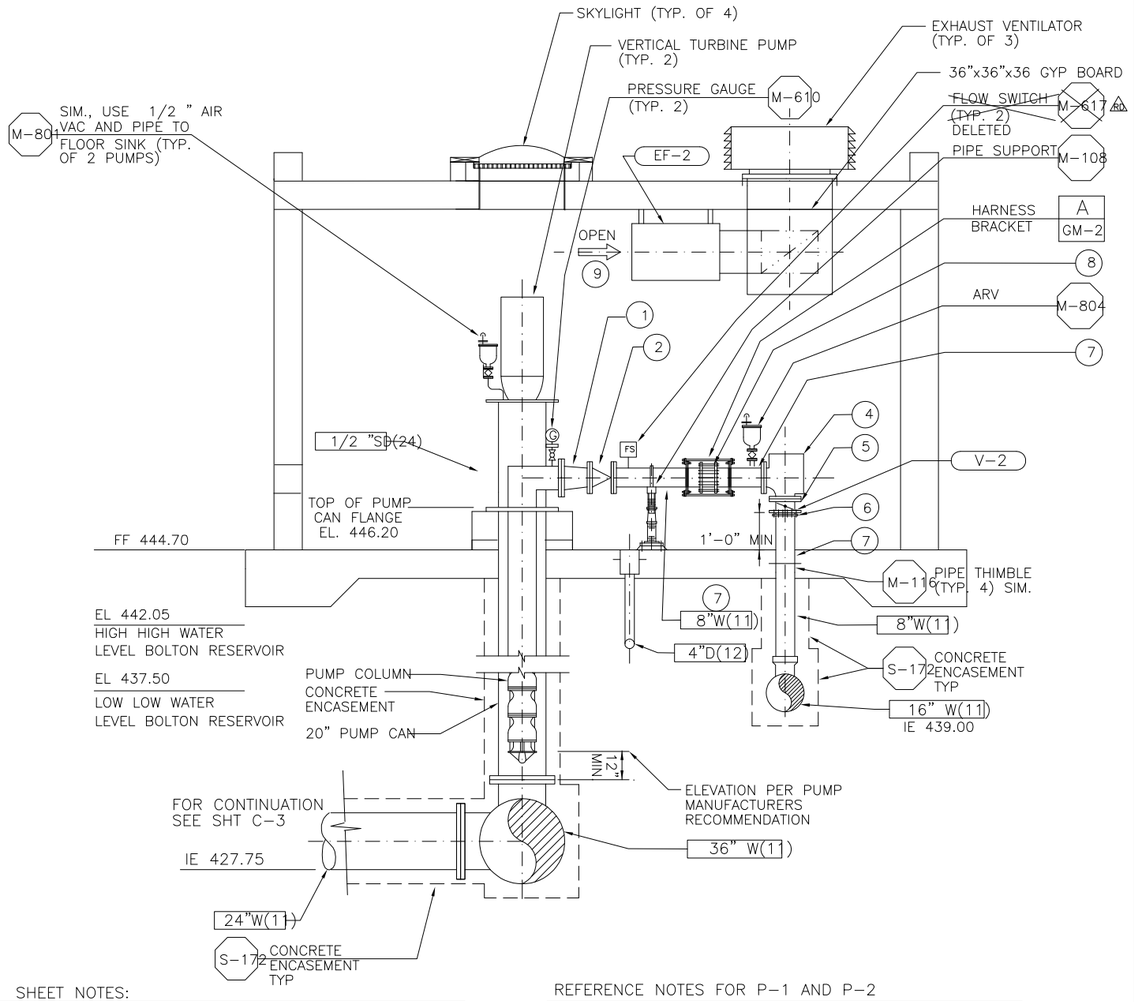
SUBMITTED
PROJECT ENGINEER — R. C. E. NO. 19427 — DATE 4/23/98
MONTGOMERY WATSON — R. C. E. NO. 10818 — DATE 4/23/98

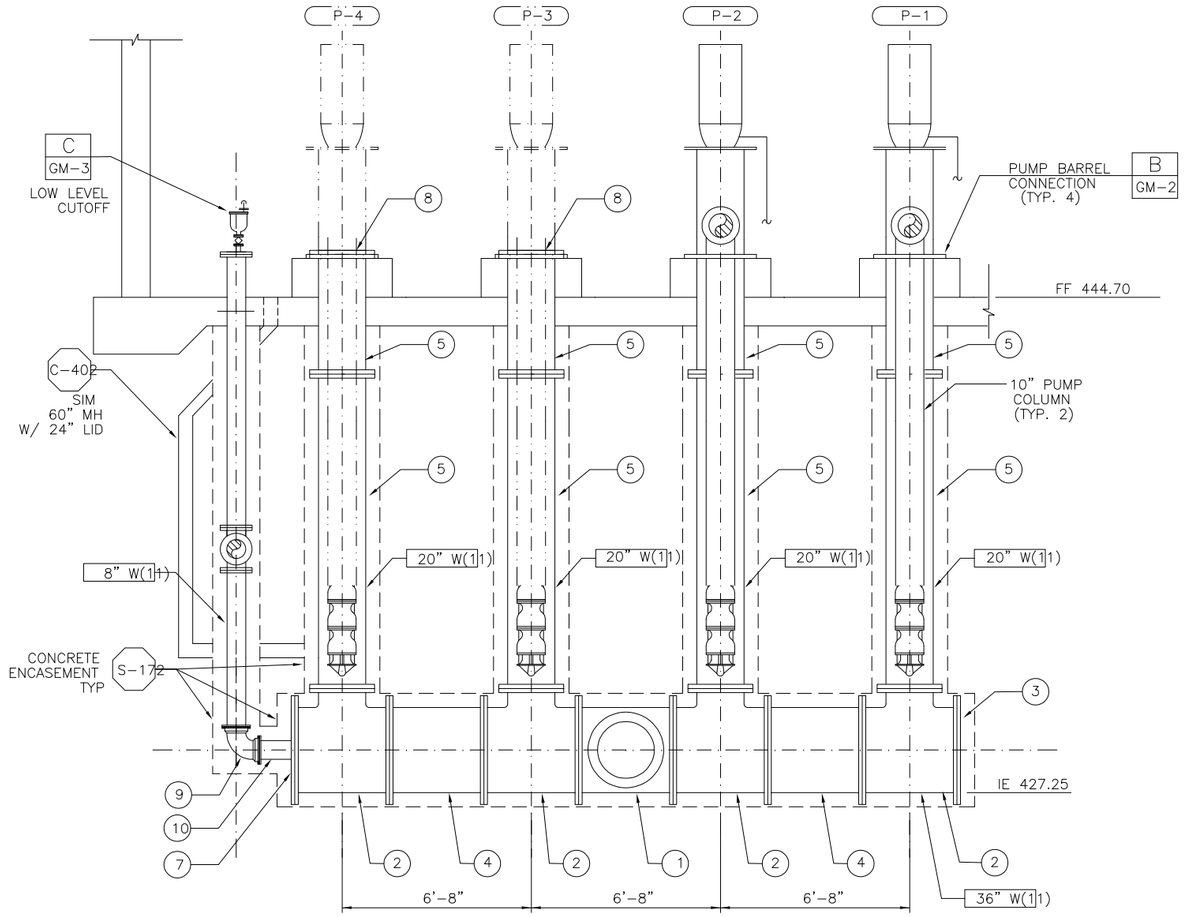
MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE _____
APPROVED _____ DATE _____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PUMP STATION PLAN

SHEET M-1 OF *40 SHEETS





SHEET NOTES:

1. VERIFY PUMP CAN SIZE (20" DI) WITH PUMP SUPPLIER. INCREASE PUMP CAN SIZE IF REQUIRED AND REVISE 36" TEES ON SUCTION PIPING IF REQUIRED.
2. VERIFY PUMP SET HEIGHT WITH PUMP SUPPLIER.
3. ALL DUCTILE IRON PIPE SHOWN IS CL 52.
4. FABRICATED STEEL 20" PUMP CANS AND 36" SUCTION HEADER MAY BE SUBSTITUTED BY THE CONTRACTOR AS DEFINED IN THE SPECIFICATIONS
5. PUMP LOW LEVEL CUTOFF SET AT 435.5' IN PLC PROGRAM. (A6)

REFERENCE NOTES FOR P-1 AND P-2

1. 10" X 8" REDUCER, FL X FL
2. 8" GLOBE CHECK VALVE FLGxFLG V-6
3. 8" FL X PE SPOOL PIECE (LENGTH AS REQUIRED)
4. 8" PUMP CONTROL VALVE (ANGLE STYLE) FLANGED V-4
5. 8" BUTTERFLY VALVE (FLANGED) V-2
6. 8" FLANGED COUPLING ADAPTER
7. 8" FL x PE SPOOL PIECE (LENGTH AS REQUIRED) W/ RETAINER RING
8. 8" SLEEVE COUPLING
9. KEEP EF CLEAR OF VERTICAL SPACE OVER PUMPS

SECTION 3 / M-1

REFERENCE NOTES FOR P-6:

1. 36" X 36" X 24" TEE, FL X FL X FL
2. 36" X 36" X 20" TEE, FL X FL X FL
3. 36" BLIND FLANGE (W/ FULL FACE GASKET GLUED TO FLANGE)
4. 36" SPOOL PIECE, FL X FL (LENGTH AS REQUIRED)
5. 20" SPOOL PIECE FL X FL (LENGTH AS REQUIRED)
6. NOT USED
7. 36" BLIND FLANGE DRILLED AND TAPPED FOR 8" CONNECTION
8. CIRCULAR 1/2 " STEEL PLATE W/ GASKET OVER PUMP CAN, DIAMETER AND BOLT PATTERN TO MATCH PUMP CAN FLANGE
9. 8" 90° BEND MJxMJ
10. 8" DUCTILE IRON SPOOL PIECE PExPE (LENGTH AS REQUIRED) ONE END THREADED TO MATCH BLIND FLANGE

SECTION 2 / M-1

REV	DATE	BY	DESCRIPTION
(A6)	4/99	DPR	RECORD DRAWING

SCALE: 3/8 " = 1'

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN J.A. RODRIGUEZ, D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER 19427 R. C. E. NO. 4/23/98 DATE
MONTGOMERY WATSON 10818 R. C. E. NO. 4/23/98 DATE

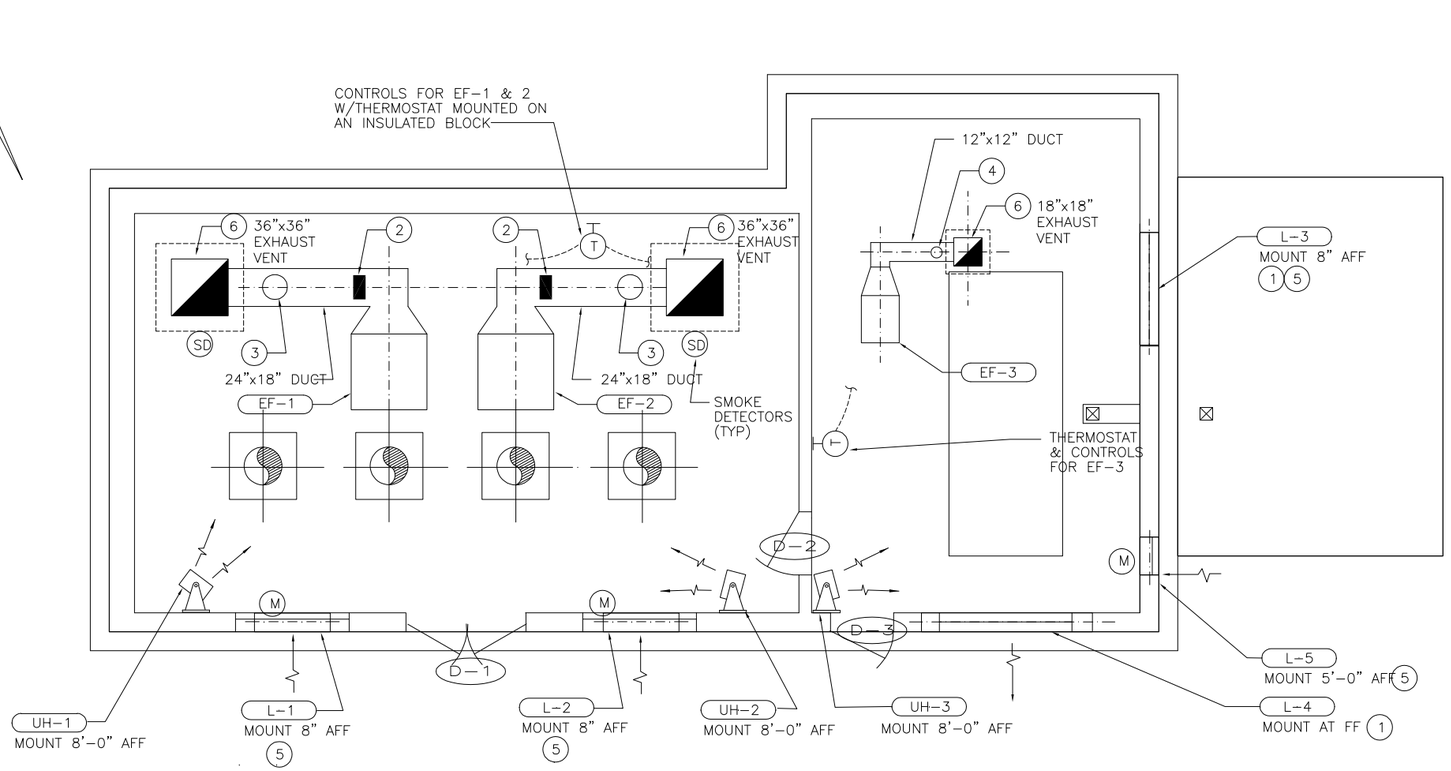
MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE
APPROVED _____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PUMP STATION SECTIONS AND DETAILS

SHEET M-2 OF 40 SHEETS

Plot Date/Time: $$$$date$$$$ $$time$$

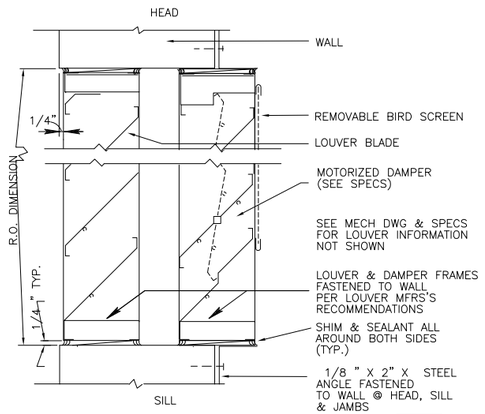


PLAN

SCALE: 1/4 " = 1' - 0"

SHEET NOTES:

1. LOUVER L-3 SHALL BE MOTORIZED AND CONTROLLED TO BE OPEN WHEN THE GENERATOR IS RUNNING AND CLOSED OTHERWISE. L-4 IS A GRAVITY TYPE DAMPER - NOT MOTORIZED
2. GRAVITY BACKDRAFT DAMPERS.
3. SOUND TRAP: IAC, TYPE L, 24"x18"x3 FT.
4. SOUND TRAP: IAC, TYPE L, 12"x12"x3 FT.
5. ACOUSTIC LOUVER, IAC, MODEL R; OR EQUAL.
6. CARNES MODEL 6L OR EQUAL.



LOUVER W/ DAMPER — A

N.T.S. —

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

REV	DATE	BY	DESCRIPTION
6D	4/99	DPR	RECORD DRAWING

SCALE: AS NOTED

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED P.M. VAN DUSER
DRAWN J.A. RODRIGUEZ D.P. RAMER
CHECKED B.D. TEEL

SUBMITTED
PROJECT ENGINEER 19427 4/23/98 (R. C. E. NO. DATE)
MONTGOMERY WATSON 10818 4/23/98 (R. C. E. NO. DATE)

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
HVAC PLAN AND DETAILS

SHEET M-3 OF 40 SHEETS

JOB No. 1065073.012580 FILE: $$$$$$$$$$directory/filename$$$$$$$$$

1/4 " = 1'

PLAN	ONE–LINE DIAGRAM	CONTROL DIAGRAM	DESCRIPTION
M	M	MTR	MOTOR, NUMBER INSIDE CIRCLE INDICATES HORSEPOWER. MOTOR NUMBER SHOWN EXTERNAL
HTR			HEATER, NUMBER INDICATES KW
		ST	PUSHBUTTON, N.O. SHOWN, LETTERS INDICATE: A–AUTO, DN–DOWN, FWD–FORWARD, H–HAND, LOS–LOCK OUT STOP, O–OFF, REV–REVERSE, ST–START, SP–STOP, T–TEST
			SELECTOR SWITCH, "A" POSITION SHOWN. ARROW, WHEN USED, INDICATES SPRING RETURN, X'S AND O'S TO RIGHT OF CONTACTS, WHEN USED, INDICATE CONTACT DEVELOPMENT. SW SHOWN HAS BOTH CONTACTS CLOSED IN "I" POSITION, NEITHER CONTACT CLOSED IN "O" POSITION, AND BOTTOM CONTACT CLOSED IN "A" POSITION. LETTERS INDICATED LEGEND AS ABOVE.
			SPEED SWITCH, N.O. SHOWN. CONTACT CLOSES AT PRESET SPEED.
			FLOAT SWITCH, N.C. SHOWN. CONTACT OPENS ON RISING LEVEL AT PRESET VALUE.
			PRESSURE SWITCH, N.O. SHOWN. CONTACT CLOSES ON RISING PRESSURE AT PRESET VALUE.
			TEMPERATURE SWITCH OR THERMOSTAT N.C. SHOWN. CONTACT OPENS ON RISING TEMPERATURE AT PRESET VALUE
			LIMIT SWITCH, N.O. SHOWN. CONTACT CLOSES WHEN DEFLECTED
			DOOR SWITCH, N.C. SHOWN, CONTACT OPENS WHEN DEFLECTED.
			FLOW SWITCH, N.O. SHOWN. CONTACT CLOSES ON INCREASING FLOW AT PRESET VALUE.
			TORQUE SWITCH, N.C. SHOWN. CONTACT CLOSES ON INCREASING TORQUE AT PRESET VALUE.
			RELAY AND DEVICE CONTACTS LETTERS & NUMBERS DESIGNATE DEVICE
		1 CR	CONTROL DEVICE, LETTER INDICATES: CR–CONTROL RELAY, TR–TIME DELAY RELAY, CC–CLOSING COIL, TM–TIMER, TC–TRIP COIL. NUMBER IDENTIFIES RELAY
		1CR	NORMALLY OPEN WHICH CLOSES ON COIL ENERGIZATION
		1CR	NORMALLY CLOSED WHICH OPENS ON COIL ENERGIZATION
	2	M	M–MAGNETIC MOTOR STARTER, C–GENERAL USE CONTACTOR (NUMBER INDICATED NEMA SIZE)
			F–FORWARD, R–REVERSE
			SV–SOLENOID VALVE
			TIME DELAY CONTACTS LETTERS AND NUMBERS DESIGNATE DEVICE
	NOTC	1TR	NORMALLY OPEN WITH TIME DELAY CLOSING (ON DELAY)
	NCTO	2TR	NORMALLY CLOSED WITH TIME DELAY OPENING (ON DELAY)
	NOTO	3TR	NORMALLY OPEN WITH TIME DELAY OPENING (OFF DELAY)
	NCTC	4TR	NORMALLY CLOSED WITH TIME DELAY CLOSING (OFF DELAY)

PLAN	ONE–LINE DIAGRAM	CONTROL DIAGRAM	DESCRIPTION
			MATING CONTACTS (DRAWOUT EQUIPMENT)
			THERMAL OVERLOAD HEATER
50	50 HP		DISCONNECT SWITCH (NUMBER INDICATES HORSEPOWER OR AMPERE RATING)
	1	1	MANUAL COMBINATION MOTOR STARTER (NUMBER INDICATES NEMA STARTER SIZE)
LV			LOW VOLTAGE (24V DUTY) TOGGLE SWITCH (MONETARY), LOWER CASE LETTER IDENTIFIES SWITCH
			BLOWN FUSE INDICATOR
			AUTOMATIC OR MANUAL TRANSFER SWITCH
	N		BUS CONNECTION (N=NEUTRAL, G=GROUND)
			CARTRIDGE FUSE AND FUSEHOLDER
	200/200		CIRCUIT BREAKER: 200A CURRENT SENSOR OR TRIP SETTING, 3 POLE SHOWN FIRST NUMBER INDICATES FRAME SIZE, SECOND NUMBER IDICATES TRIP SETTING.
		R	INDICTING LIGHT, LETTER INDICATES: R–RED, G–GREEN, A–AMBER, W–WHITE, B–BLUE
T			TRANSFORMER
600/5			CURRENT TRANSFORMER (NUMBERS INDICATE TRANSFORMER RATIO)
7200–120V			POTENTIAL TRANSFORMER (NUMBERS INDICATE TRANSFORMER RATIO)
		12Vdc	BATTERY, NUMBER INDICATES POTENTIAL
			RECTIFIER OR DIODE
			TERMINAL
			GROUND CONNECTION
			CONDUCTORS NOT CONNECTED
			CONDUCTORS CONNECTED
			MECHANICAL CONNECTION, INTERLOCKS
			EQUIPMENT ENCLOSURE/ BOUNDARY
	RES	RES	RESISTOR
			POTENTIOMETER
			EQUIPMENT OR INSTRUMENT CONNECTION
KWH	V	V	METER OR SWITCH, LETTER INDICATES: DEM–DEMAND METER, F–FREQUENCY METER, A–AMMETER, H–HOURMETER, PF–POWER FACTOR, T–TACHOMETER, V–VOLTMETER, VR–VARMETER, W–WATTMETER, KWH–WATTHOUR METER, VS–VOLTMETER SWITCH AS–AMMETER SWITCH (CIRCLE USED WITH METERS, SQUARE USED WITH SWITCHES)
			COMMERCIAL TELEPHONE
			GENERATOR RECEPTACLE
			POWER FACTOR CORRECTION CAPACITOR
	IC BP SSS BP		SOFT STARTER

PLAN	DESCRIPTION
	GROUND ROD AND WELL
	ARROW WITH ANY FIXTURE DENOTES ORIENTATION OF REFLECTOR OR DIRECTION OF MOUNTING
	LIGHTING FIXTURE, PENDANT MOUNT
8'6 A	LIGHTING FIXTURE IDENTIFIER, DESIGNATION INSIDE ON DRAWINGS 8'6 MOUNTING HEIGHT TO BOTTOM OF FIXTURE, SURFACE MOUNTED IF NO HEIGHT SHOWN HEXAGON INDICATES FIXTURE TYPE. SEE SCHEDULE
	LIGHTING FIXTURE, POLE MOUNT
PC	PHOTOELECTRIC CONTROL UNIT. WALL MOUNTED
a	LIGHTING FIXTURE, FLUORESCENT, LOWER CASE LETTER REFERS TO SWITCHED CIRCUIT
	LIGHTING FIXTURE, WALL MOUNT
	DUPLEX RECEPTACLE, GROUNDING TYPE. SEE PANELBOARD SCHEDULE
TC	TELEPHONE CABINET
	CIRCUIT BREAKER PANELBOARD
	EXPOSED CONDUIT
	CONCEALED CONDUIT, FLOOR OR WALL
	CONCEALED CONDUIT, CEILING
	DUCT BANK CONCRETE ENCASED
	DUCT BANK, CONCRETE ENCASED, STEEL REINFORCED
	CONDUIT BENT UP OR TOWARD
	CONDUIT BENT DOWN OR AWAY
PBD–1	HOME RUN, 4 CONDUCTORS, #12 AWG. MIN. PANEL PBD1 3 PHASE CONDUCTORS AND NEUTRAL. SEE PANELBOARD SCHEDULE FOR CIRCUIT ASSIGNMENT
G	GROUND WIRE WITH CADWELD CONNECTION PIGTAILED 18" ABOVE FINISHED FLOOR
G	GROUND WIRE WITH CADWELD CONNECTION
MH–1	MH–MANHOLE, HH–HANDHOLE, OR PB–PULL BOX (NUMBER IDENTIFIES MANHOLE, HANDHOLE, OR PULL BOX)
J	JUNCTION BOX
T	THERMOSTAT (T–STAT)
TB	TERMINAL BOX, SIZE AS REQUIRED.
	FLEXIBLE METALLIC CONDUIT

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

ABBREVIATION	WORD
AFF	ABOVE FINISHED FLOOR
A, AMP	AMPERE
AL	ALUMINUM
AUTO	AUTOMATIC
AIL	AMBER INDICATING LIGHT
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
BLDG	BUILDING
BP	BY–PASS CONTACTOR
CB	CIRCUIT BREAKER
CDR	CONDUCTOR
COMPT	COMPARTMENT
C	CONDUIT
CONTD	CONTINUED
CNTL	CONTROL
CU	COPPER
CKT	CIRCUIT
DB	DUCT BANK
DET	DETAIL
DIAG	DIAGRAM
DISC	DISCONNECT
EL, ELEV	ELEVATION
EQUIP	EQUIPMENT
EMER	EMERGENCY
ETM	ELAPSED TIME METER
FDR	FEEDER
FV	FRONT VIEW
GFI	GROUND FAULT INTERRUPTION
GFP	GROUND FAULT PROTECTION
GIL	GREEN INDICATING LIGHT
GND	GROUND
GRS	GALVANIZED RIGID STEEL
HH	HAND HOLE
HOA	HAND–OFF–AUTO
HZ	HERTZ (CYCLES PER SECOND)
HTR	HEATER
INTLK	INTERLOCK
INST	INSTANTANEOUS
I/O	INPUT/OUTPUT
IC	ISOLATION CONTACTOR
J	JUNCTION BOX
KV	KILOVOLTS
KVA	KILOVOLT AMPERES (APPARENT POWER)
KVAR	KILOVARS (REACTIVE POWER)
KW	KILOWATTS (REAL POWER)
LSH	LEVEL SWITCH HIGH
LT	LEVEL TRANSMITTER
LTG	LIGHTING
LV	LOW VOLTAGE
MAN	MANUAL
MCC	MOTOR CONTROL CENTER
MCM	THOUSAND CIRCULAR MILLS
MTR,M	MOTOR
mA	MILLIAMPERES
mV	MILLIVOLTS
NA	NON–AUTO
N.O.	NORMALLY OPEN
N.C.	NORMALLY CLOSED
NF	NON–FUSED
NO.	NUMBER
NP	NAMEPLATE
NTS	NOT TO SCALE
OL	OVERLOAD
PH. ø	PHASE
PC	PHOTOELECTRIC CONTROL UNIT
PNL	PANEL
PR	SHIELDED PAIR
PVC	POLYVINYL CHLORIDE
REF	REFERENCE
RS	GALVANIZED RIGID STEEL CONDUIT
RECP	RECEPTACLE
RIL	RED INDICATING LIGHT
RTD	RESISTANCE TEMPERATURE DETECTOR
S, SEC	SECOND
S.S.	STAINLESS STEEL
SEL	SELECTOR
SPEC	SPECIFICATION
SW	SWITCH
SWGR	SWITCH GEAR
STA	STATION
SSS	SOFT STARTER
TB	TERMINAL BOX, TERMINAL BLOCK
TOA	TEST–OFF–AUTO
TSP	TWISTED SHIELDED PAIR
TST	TWISTED SHIELDED TRIAD
TYP	TYPICAL
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLTS
Vac or VAC	VOLTS ALTERNATING CURRENT
Vdc or VDC	VOLTS DIRECT CURRENT
W	WIRE
WIL	WHITE INDICATING LIGHT
W/	WITH
W/O	WITHOUT
WP	WEATHER PROOF (NEMA 4)
XFMR	TRANSFORMER
XLP	CROSS LINKED POLYETHYLENE
XP	EXPLOSION PROOF

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P.O. BOX 12884 - Mill Creek, WA. 98082-0884
(206) 338-2416 Fax: (206) 338-0827 ecseng@interserv.com

REV	DATE	BY	DESCRIPTION
1	4/99	DPR	RECORD DRAWING

SCALE:

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED DMB/LD
DRAWN MAR
CHECKED DMB

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
RECOMMENDED
MONTGOMERY WATSON R. C. E. NO. DATE

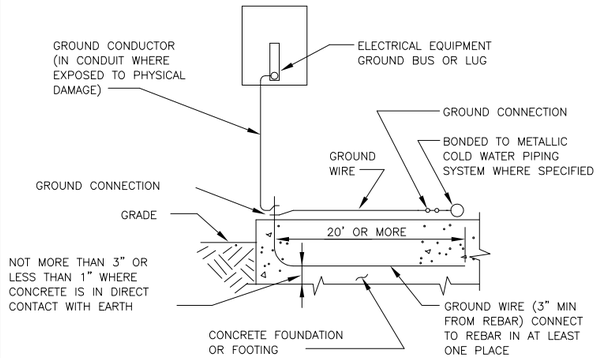
MONTGOMERY WATSON
Portland, Oregon

APPROVED DATE
APPROVED DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
ELECTRICAL
SYMBOLS & ABBREVIATIONS

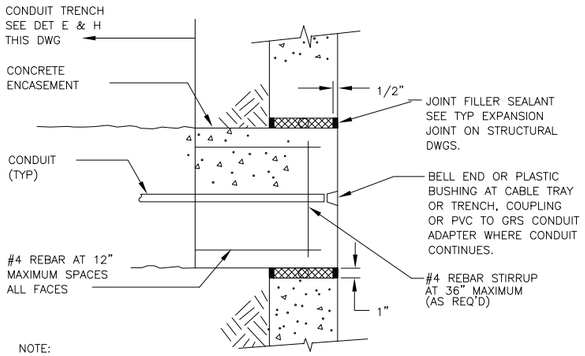
SHEET E–1
OF 40 SHEETS

PLOT TIME: $$$$time$$$$
PLOT DATE: $$$$date$$$$



CONCRETE ENCASED GROUND

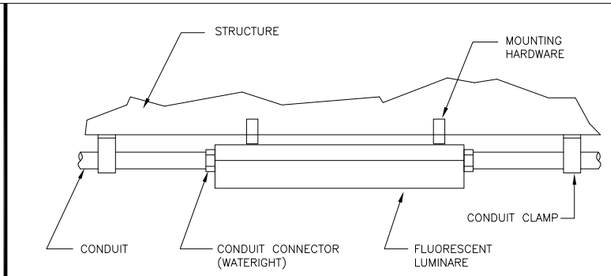
N.T.S. | A | E-6



NOTE:
PROVIDE CONDUIT IDENTIFICATION FOR ALL CONDUITS AT HANDHOLES AND MANHOLES.

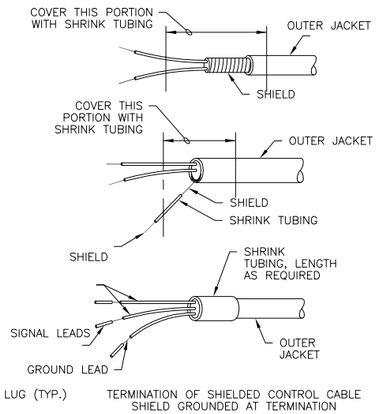
CONDUIT ENTRY AT HANDHOLES OR MANHOLES

N.T.S. | B | E-3



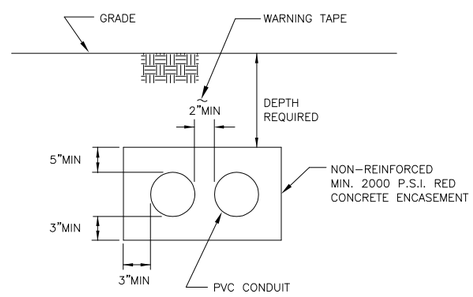
FLUORESCENT LUMINARE SURFACE MOUNTED WITH EXPOSED CONDUIT

C | E-6



SHIELDED CABLE TERMINATION

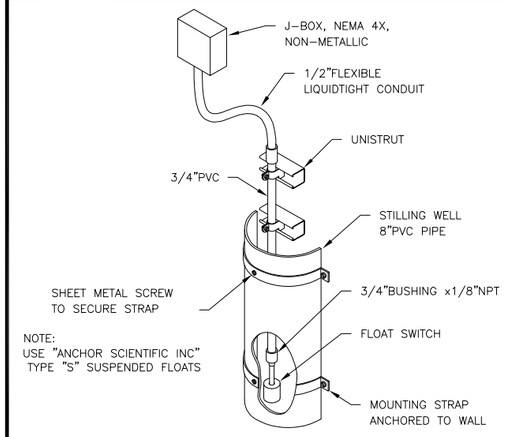
N.T.S. | D | –



CONCRETE ENCASE DUCT BANK

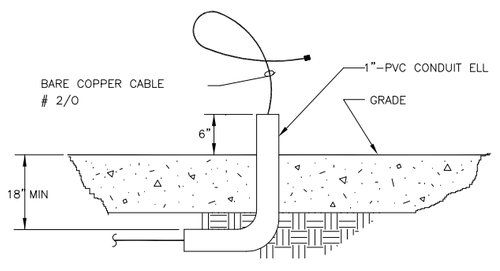
N.T.S. | E | E-3

NOTE: SPACING IS TYPICAL. NUMBER AND SIZE OF CONDUIT AS REQUIRED.



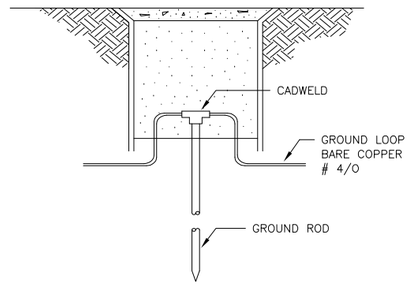
FLOOD SWITCH INSTALLATION DETAIL

N.T.S. | I | E-5



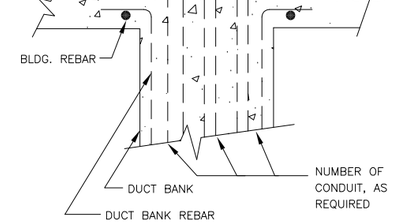
GROUNDING PIGTAIL THRU CONCRETE

N.T.S. | G-1 | E-6



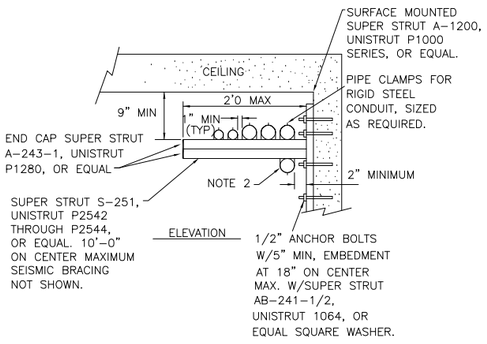
GROUND WELL

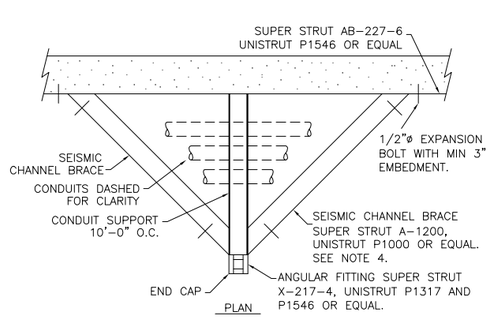
N.T.S. | G-2 | E-6



TYPICAL CONDUIT PENETRATION AT BUILDING

N.T.S. | J | E-5





NOTES:

1. HARDWARE SHALL BE HOT DIP OR MECHANICALLY GALVANIZED AFTER FABRICATION, EXCEPT FASTENERS MAY BE ZINC PLATED.
2. MAX. UNIFORMLY DISTRIBUTED LOAD (CONDUIT AND FILL) PER UNIT TO BE 1000 LBS. CONTRACTOR TO PROVIDE CALCULATIONS WHEN ANY CONDUIT IS OVER 2" IN SIZE OR IF CONDUIT IS INSTALLED ON TOP AND BOTTOM OR RACK.
3. HOLE SIZES ON FITTINGS SHALL BE 9/16"DIA WITH 1/2" HEX HEAD CAP SCREW 15/16" LONG AND 1/2" CLAMP NUT WITH SPRING.
4. SEISMIC CHANNEL BRACING REQUIRED AT INTERVALS OF 60' MAX FOR ZONE 3 AND 40' MAX FOR ZONE 4.

CONDUIT RACK FOR SEISMIC ZONES 3 & 4

N.T.S. | H | –

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RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

ENGINEERING, INC.
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P.O. BOX 12884 - Mill Creek, WA. 98082-0884
(206) 338-2416 Fax: (206) 338-0827 ecseng@interserv.com

PLOT TIME: $$$$time$$$$
PLOT DATE: $$$$date$$$$

REV	DATE	BY	DESCRIPTION
1	4/99	DPR	RECORD DRAWING

SCALE:

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED DMB/LD
DRAWN MAR/HJ
CHECKED DMB

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
RECOMMENDED
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE
APPROVED _____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
ELECTRICAL DETAILS

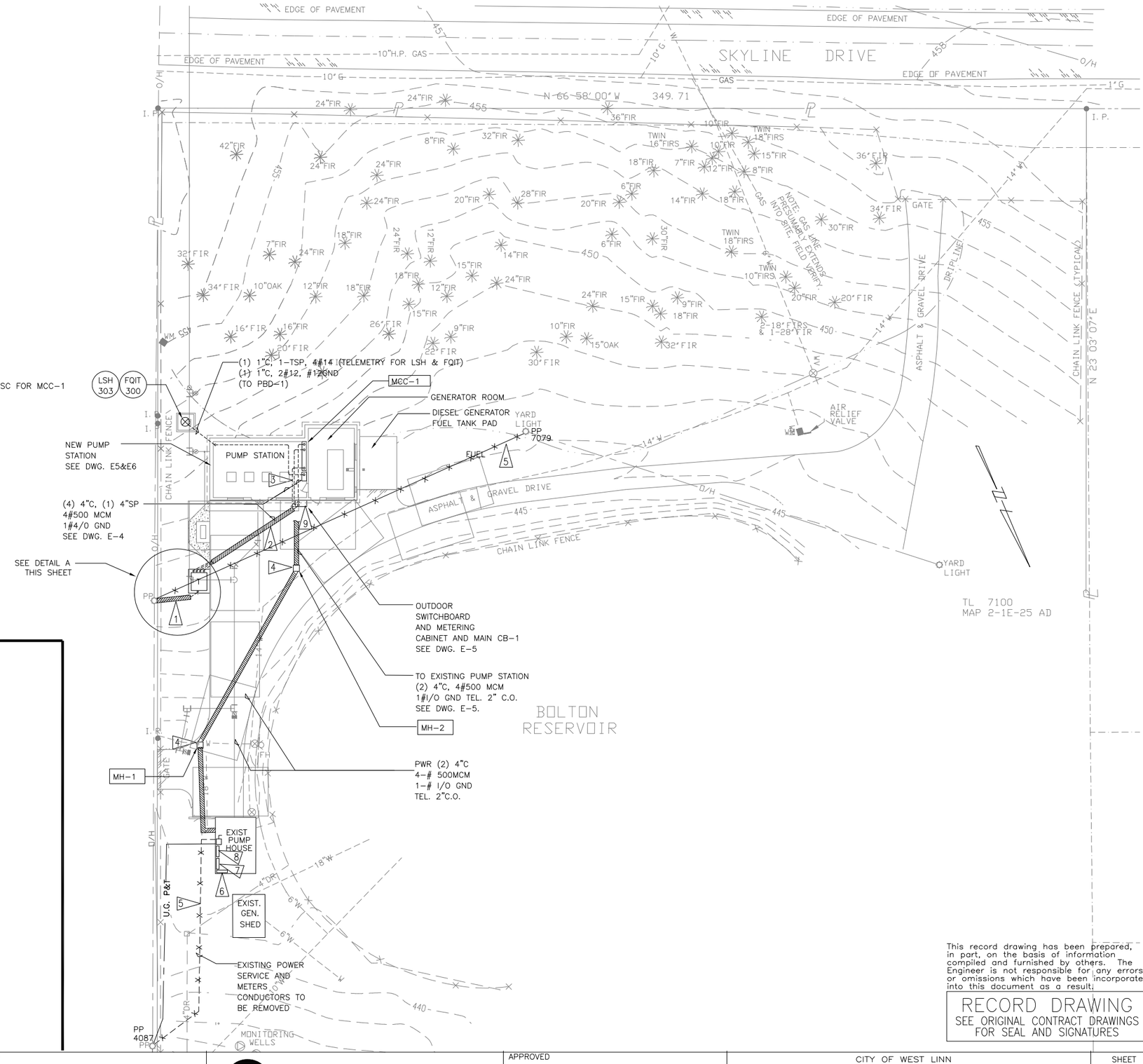
SHEET E-2 OF 40 SHEETS

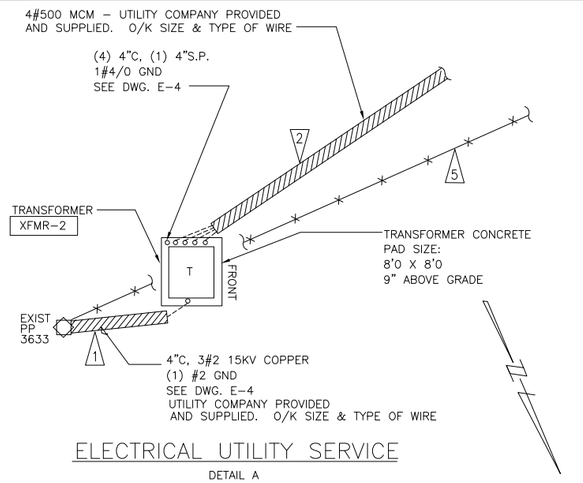
NOTES:

1. UTILITY POWER COMPANY SHALL PROVIDE AND INSTALL TRANSFORMER AND CONDUCTOR FOR NEW SERVICE FROM EXISTING POWER POLE TO PAD MOUNTED TRANSFORMER. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL CONDUIT AS REQUIRED.
2. PROVIDE AND INSTALL UNDERGROUND CONDUIT AND WIRE FOR NEW SERVICE FROM PAD MOUNTED TRANSFORMER TO SWTCHBOARD METERING CABINET. CONTRACTOR SHALL MAKE ALL ARRANGEMENTS, AND PAY ALL FEES FOR OBTAINING NEW SERVICE FOR PUMP STATION. STATION DETAIL E, DWG E2.
3. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL CONDUIT AND WIRE, FOR POWER FROM NEW PUMP STATION MCC TO EXISTING PUMP STATION BREAKER SWITCH. PROVIDE AND INSTALL TELEPHONE CONDUIT ONLY FROM NEW PUMP STATION TELEMETRY INTERFACE JUNCTION BOX TO EXISTING TELEMETRY INTERFACE JUNCTION BOX. SEE DETAIL E, DWG E2.
4. PROVIDE AND INSTALL MINIMUM 2' x 2' x 3' CONCRETE HANDHOLES WITH CONCRETE COVER W/ H20 LOADING LID, AS REQUIRED.
5. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH POWER COMPANY TO DETERMINED THE REMOVAL OF THE EXISTING SERVICE AND THE OVERHEAD POWER LINES TO THE YARD LIGHTING.
6. EXISTING MCC TO REMAIN "SQUARE D".
7. EXISTING MCC SHALL BE REPLACED (ALLIS-CHALMERS) WITH NEW MCC-1A.
8. EXISTING MANUAL TRANSFER SWITCH AND WIRE GUTTER TO BE REMOVED.
9. PROVIDE AND INSTALL OUTDOOR SWITCHBOARD METERING AND CT. CABINET W/1000A MAIN CB DISC FOR MCC-1

REFERENCE DRAWINGS:

1. E-4 SINGLE LINE DIAGRAM
2. E-5 POWER AND SIGNAL PLAN





ELECTRICAL UTILITY SERVICE

DETAIL A
SCALE: 1"=10'0

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A	4/99	DPR	RECORD DRAWING

SCALE: 1" = 20'

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PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

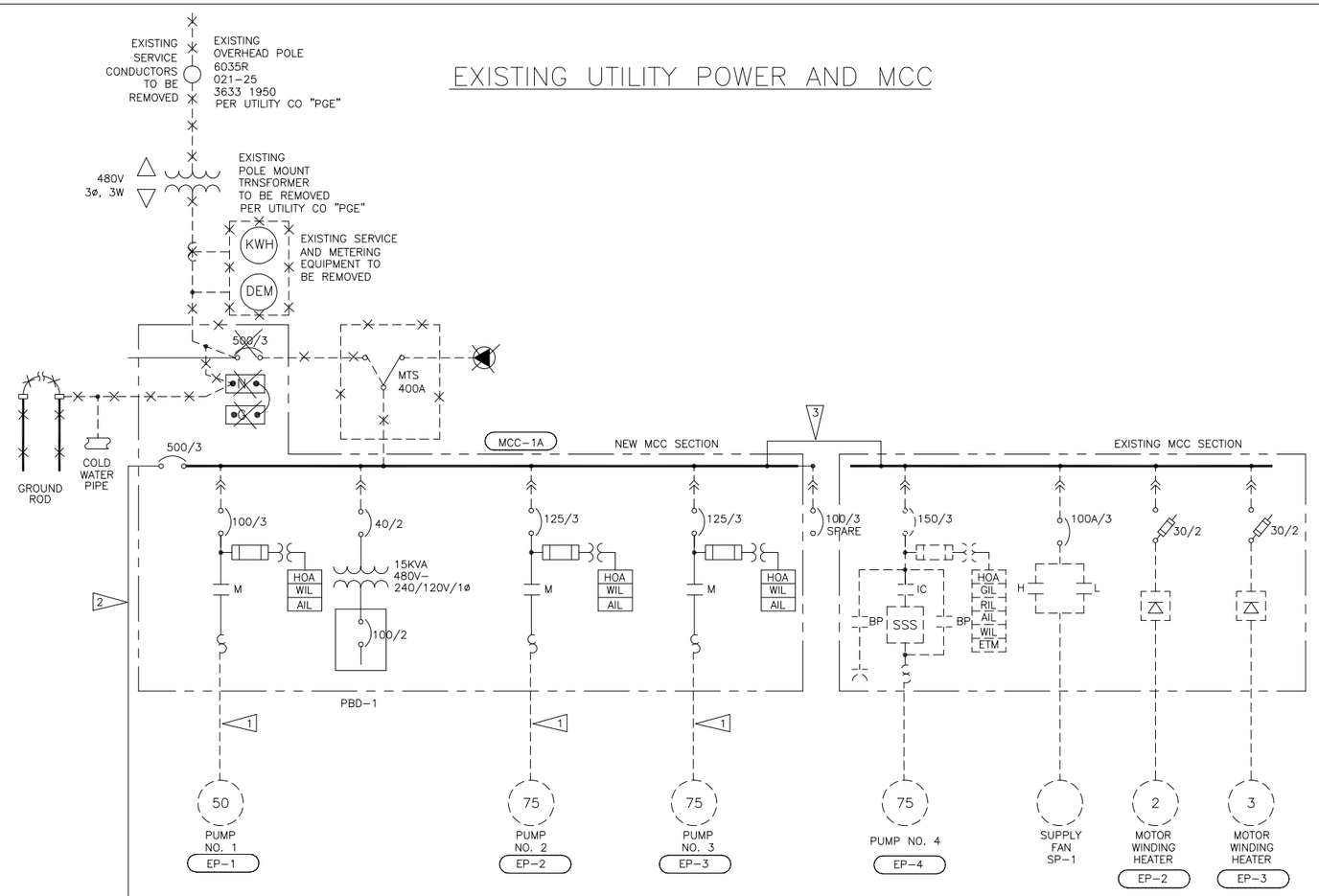
APPROVED ____ DATE
APPROVED ____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
ELECTRICAL SITE PLAN

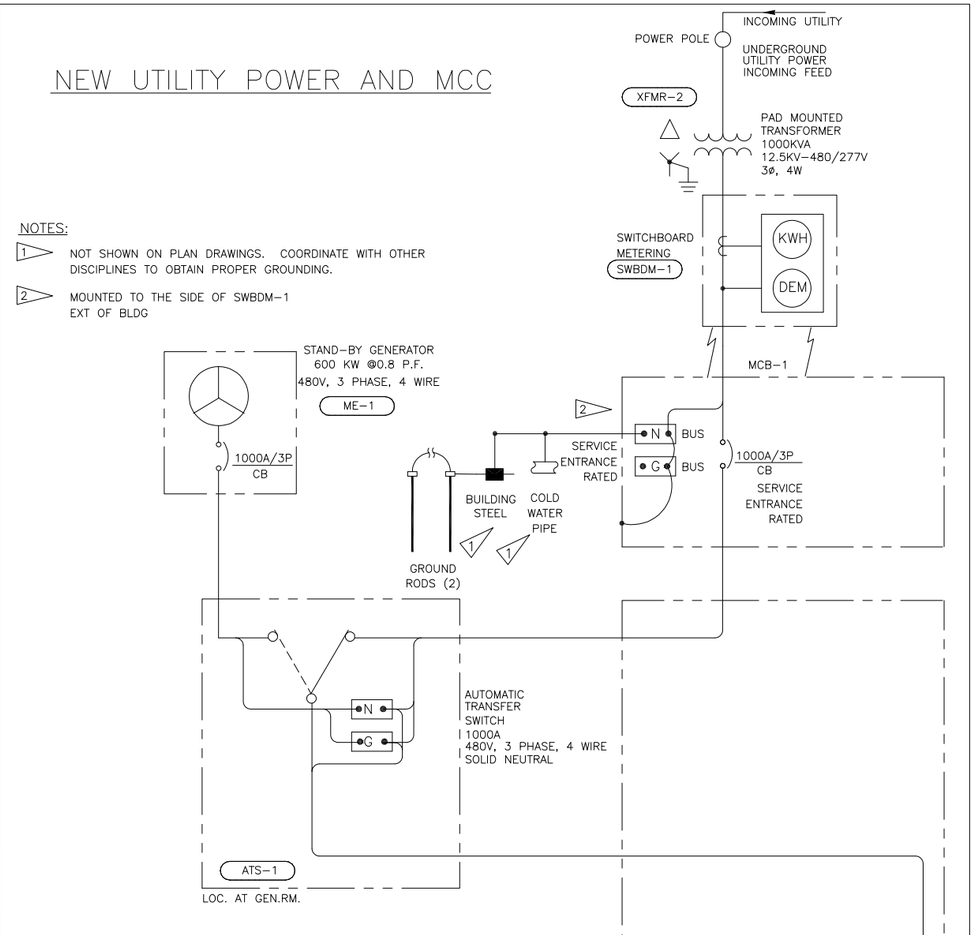
SHEET E-3 OF 40 SHEETS

JOB No. 1065073.012580
FILE K:\WEST LINN, CITY OF\BOLTON PUMP STATION\MEC\BPSM0*.DGN

EXISTING UTILITY POWER AND MCC



NEW UTILITY POWER AND MCC

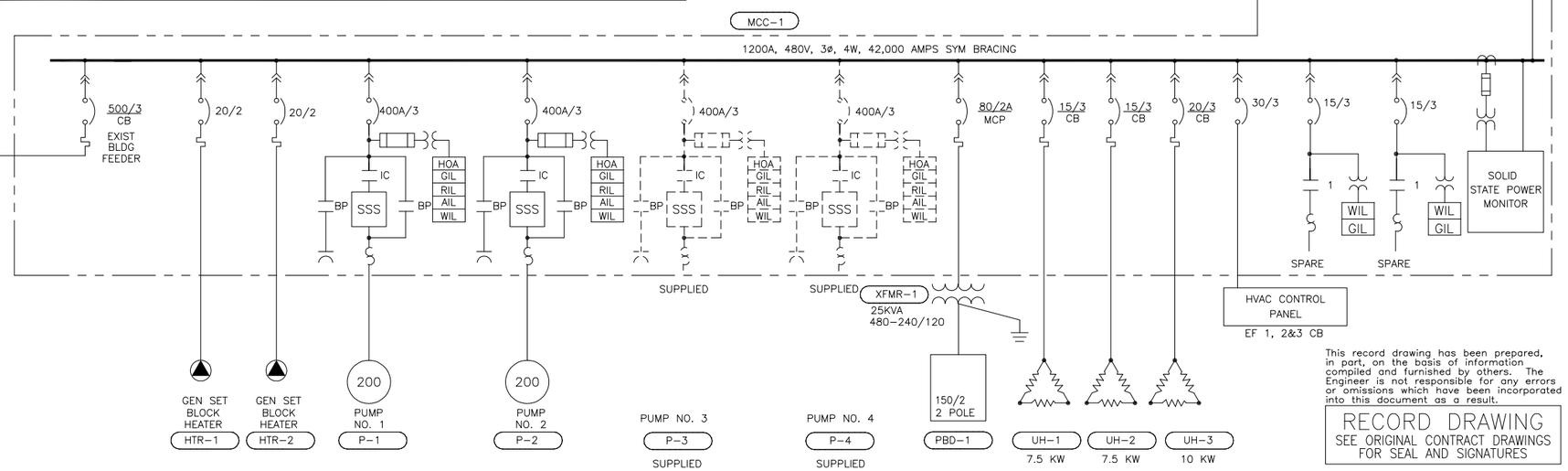


NOTES:

1. NOT SHOWN ON PLAN DRAWINGS. COORDINATE WITH OTHER DISCIPLINES TO OBTAIN PROPER GROUNDING.
2. MOUNTED TO THE SIDE OF SWBDM-1 EXT OF BLDG

NOTES:

1. ELECTRICAL CONTRACTOR SHALL RE-USE EXISTING RACEWAY, REPLACE EXISTING WIRING AS REQUIRED.
2. PROVIDE AND INSTALL CONDUIT AND WIRE FROM NEW PUMP STATION MCC-1 TO NEW MCC-1A IN PUMP STATION.
3. ELECTRICAL CONTRACTOR SHALL DISCONNECT BUS TIE CONNECTION BETWEEN TWO EXISTING MCC'S, REMOVED EXISTING ALLIS CHALMERS MCC AND RECONNECT TO NEW MCC BUS.



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SCALE:

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PROJECT ENGINEER R. C. E. NO. DATE
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MONTGOMERY WATSON R. C. E. NO. DATE

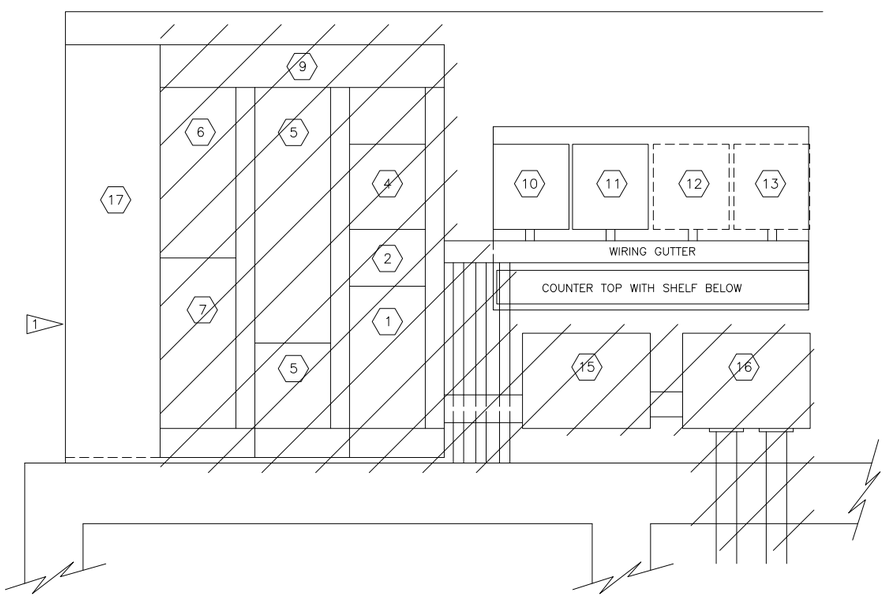
MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
ELECTRICAL
SINGLE LINE

SHEET E-4 OF 40 SHEETS

PLOT DATE: $$$$date$$$$ PLOT TIME: $$$$time$$$$



EXISTING MCC, TERMINAL AND C.T. ENCLOSURE

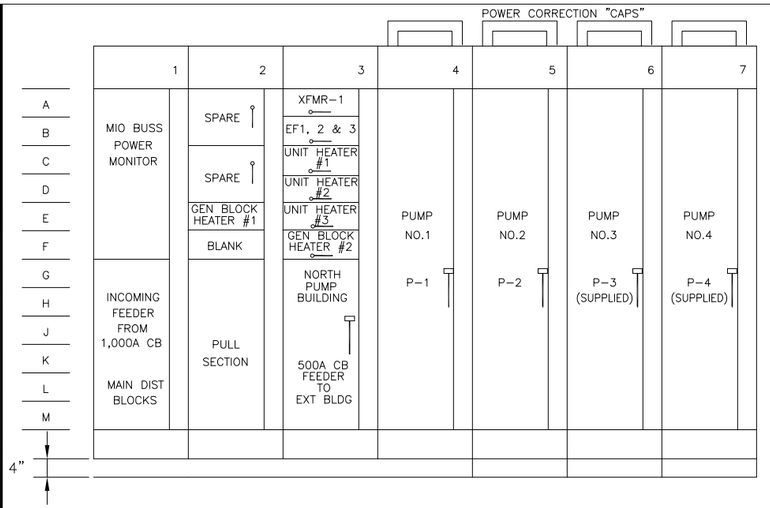
1. MAIN ENTRANCE BREAKER, 3 POLE, 500A., 480V, 3ø, 60Hz
2. BRANCH BREAKER FOR TRANSFORMER, 2 POLE, 20A., 480V, 1ø
3. DRY TRANSFORMER 15KVA 480/240/120V, 1ø
4. LIGHTING PANEL – SPACE FOR 12 SINGLE POLE BREAKERS
5. SPACE FOR COMPONENTS OF 50 HP EXISTING PUMP STARTER. PROVIDE SELECTOR SW., RUBY IND. LAMP & RE-SET IN DOOR.
6. PART WINDING 2-POINT STARTERS WITH BREAKERS FOR 75 HP PUMPS, 480V, 3ø, 60Hz. WITH "ON-OFF-AUTOMATIC"
7. SELECTOR SWITCH, RUBY INDICATOR LAMP & RESET BUTTON IN EACH CABINET DOOR.
8. BOTTOM WIRING GUTTER
9. TOP WIRING GUTTER
10. FOXBORO METER & PUMP SELECTOR. PANEL CUT-OUT REQD. IS 15 11/16" x 13 3/8".
11. RECORDER FOR FLOWMETER
12. SPACE FOR HORTON ROAD RESERVOIR LEVEL CONTROLLER & RECORDER
13. SPACE FOR HIGH LEVEL PRESSURE RECORDER
15. TERMINAL AND C.T. ENCLOSURES AS REQUIRED BY P.G.E. Co.
16. (APPROXIMATELY 24" x 32" x 9" EACH)
17. SPACE FOR FUTURE PUMP STARTER AND CIRCUIT BREAKER

NOTES:

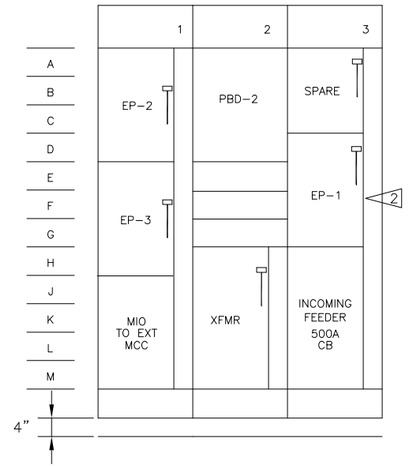
1. EXISTING MCC AND EQUIPMENT TO BE REMOVED AND REPLACED WITH NEW MCC.
2. FIELD VERIFY EXISTING PANELBOARD CIRCUITS PRIOR TO BID. MCC-1A PANEL CIRCUITS SHALL MATCH EXISTING.

EXISTING LOAD CALCULATION

EQUIP. NO.	HP/KVA	CONNECTED LOAD AMPS	DEMAND FACTOR	DEMAND LOAD AMPS	COMMENT
XFMR-1	15KVA	16	0.8	13	
P-1	50HP	65	1.0	15	
P-2	75HP	96	1.25	120	
P-3	75HP	96	1.0	96	
P-4	75HP	96	1.0	96	
FAN	–	10.0	1.0	10	
UH-1	3.00	12.5	1.0	12.5	
TOTALS		385.5		409.5	



NEW PUMP STATION MCC-1 ELEVATION



EXISTING PUMP STATION NEW MCC-1A ELEVATION

LOAD CALCULATION

EQUIP. NO.	HP/KVA	CONNECTED LOAD AMPS	DEMAND FACTOR	DEMAND LOAD AMPS	COMMENT
XFMR-1	25 KVA	52	0.8	42	
P-1	200 HP	240	1.25	300	
P-2	200 HP	240	1	240	
P-3	200 HP FUTURE	–	–	–	FUTURE
P-4	200 HP FUTURE	–	–	–	FUTURE
EF-1	1-1/2	3.0	1.0	3	
EF-2	1-1/2	3.0	1.0	3	
EF-3	1/2	"LISTED IN PBD-1 CKT 12"		480V	GEN RM
UH-1	7.5 KW	9.0	1.0	9	
UH-2	7.5 KW	9.0	1.0	9	
UH-3	10 KW	12.0	1.0	12	
BLK HTR-1	4 KW	9.0	1.0	9.0	
BLK HTR-2	4 KW	9.0	1.0	9.0	
TOTALS		586		636	

PANELBOARD SCHEDULE

PANELBOARD: PBD-1
VOLT:240/120V PHASE:1 WIRE: 3
BUS RATING: 225A
NEMA ENCLOSURE TYPE: 12

MAIN CIRCUIT BREAKER RATING: 100A
RMS SYMMETRICAL BUS BRACING:25KA
CIRCUIT BREAKER AIC RAITING: 35,000

CIRCUIT DESCRIPTION	P	A			A	P	CIRCUIT DESCRIPTION
INTERIOR LIGHTING PUMP RM		20/1	1	2	20/1		INTERIOR LIGHTING GEN RM
INTERIOR LIGHTING PUMP RM		20/1	3	4	20/1		INTERIOR LIGHTING GEN RM
RECEPTACLE PUMP RM		20/1	5	6	20/1		RECEPTACLES GEN RM
OUTDOOR LIGHTING		20/1	7	8	20/1		DAY TANK & REMOTE PUMPS
L-3, L-5 GEN RM		20/1	9	10	30/1		DAY TANK CHARGER IS 480V
L-1, L-2 PUMP RM		20/1	11	12	20/1		SPARE S/B 480V FAN
SPARE		20/1	13	14	20/1		DIESEL SUPPLY TANK
SUMP PUMP P-5		20/1	15	16	20/1		SPARE
SUMP PUMP P-6		20/1	17	18	20/1		SURGE SUPRESSOR
TELEM CABINET RECPT		20/1	19	20	20/1		SURGE SUPRESSOR
SPARE		20/1	21	22	20/1		SPARE
SPARE		20/1	23	24	20/1		SPARE
SPARE		20/1	25	26	20/1		SPARE
SPACE			27	28			SPACE
SPACE			29	30			SPACE
SPACE			31	32			SPACE
SPACE			33	34			SPACE
SPACE			35	36			SPACE
SPACE			37	38			SPACE
SPACE			39	40			SPACE
SPACE			41	42			SPACE

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DESIGNED DMB/LD
DRAWN MAR/HJ
CHECKED DMB

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
RECOMMENDED
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED _____ DATE _____
APPROVED _____ DATE _____

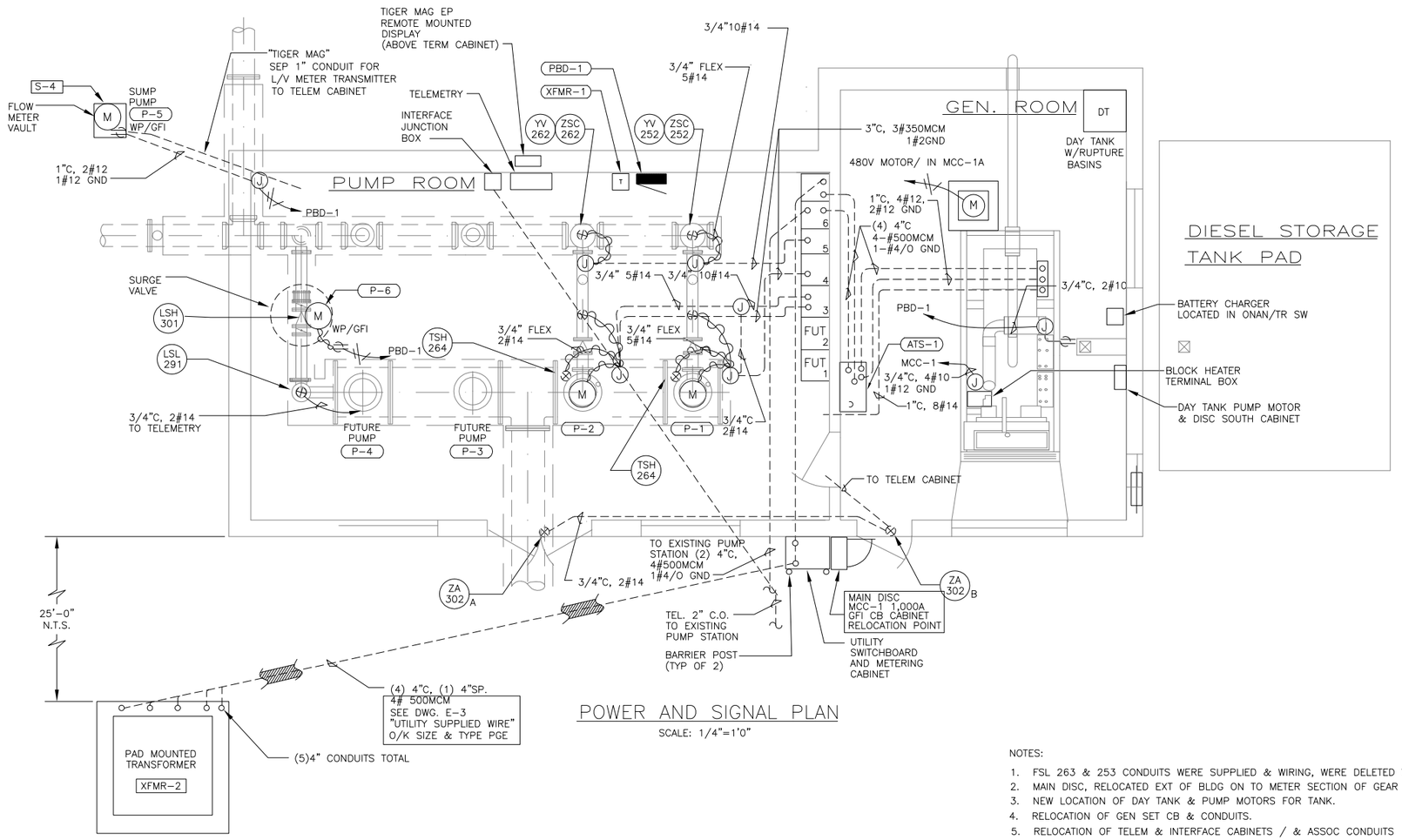
CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
ELECTRICAL
MCC ELEVATION & PANELBOARD SCHEDULE

SHEET
E-4A
OF 40 SHEETS

PLOT DATE: $$$$date$$$$ PLOT TIME: $$$$time$$$$

GENERAL NOTES:

1. ALL WIRES TO BE #12 THHN OR THWN UNLESS OTHERWISE NOTED.



POWER AND SIGNAL PLAN

SCALE: 1/4"=1'0"

NOTES:

1. FSL 263 & 253 CONDUITS WERE SUPPLIED & WIRING, WERE DELETED WHEN SW WOULD NOT WORK.
2. MAIN DISC, RELOCATED EXT OF BLDG ON TO METER SECTION OF GEAR PER M. WATSON & ECS.
3. NEW LOCATION OF DAY TANK & PUMP MOTORS FOR TANK.
4. RELOCATION OF GEN SET CB & CONDUITS.
5. RELOCATION OF TELEM & INTERFACE CABINETS / & ASSOC CONDUITS
6. RELOCATION OF PBD-1 & XFMR.
7. RELOCATION OF LSH301 (FLOAT SW FOR FLOOD ALARM)

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SCALE: 1/4 " = 1'

WARNING
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PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
ELECTRICAL
POWER AND SIGNAL PLAN

SHEET
E-5
OF 40 SHEETS

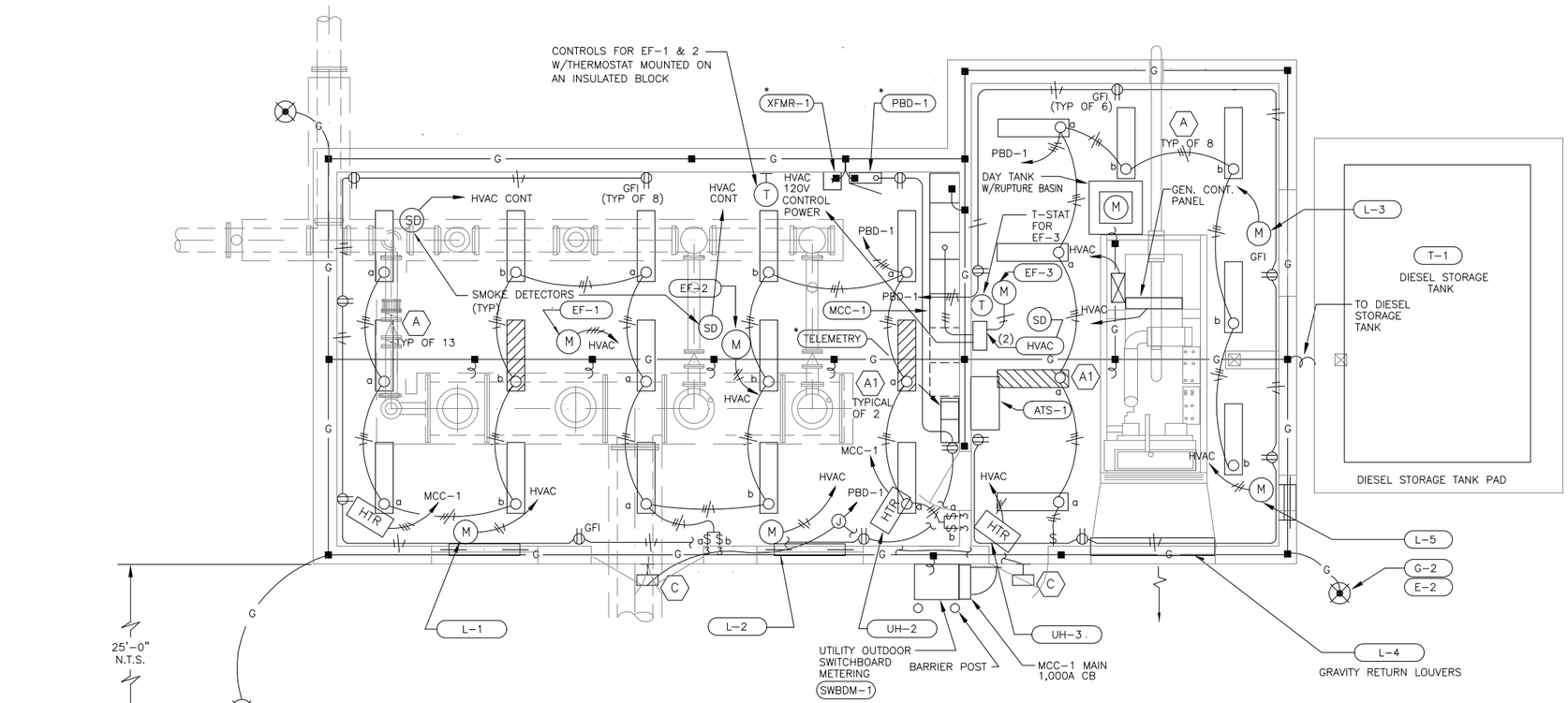
JOB No. 1065073.012580

FILE K:\WEST LINN, CITY OF\BOLTON PUMP STATION\MEC\BPSM0* DGN

Plot Date/Time: $$$$date$$$$$$time$$

LIGHTING FIXTURE SCHEDULE			
	DESCRIPTION	MFG.	CAT. NO.
A	4' FLUORESCENT, 2 LAMP, HIGH IMPACT DIFFUSER ENERGY SAVING BALLAST, UL LISTED WET LOCATION	LITHONIA	DMW-232-AR 120-ES-GLR
A1	HATCHED FIXTURES DENOTE BATTERY PACK FOR EMERGENCY LIGHTING.	LITHONIA	DMW-232-AR 120-ES-EL-GLR
C	70W HIGH PRESSURE SODIUM WALLPACK WITH INTEGRAL PHOTOCELL	GUTH	SND 12-70HP-2/PEC

* NOTE
SEE SHEET E-5 FOR "RECORD DWG" LOCATIONS



POWER, LIGHTING AND GROUNDING PLAN

SCALE: 1/4" = 1'-0"

NOTES:

1. RACEWAY FOR HVAC CONTROL BY ELECTRICAL CONTRACTOR. CONTROL CIRCUITS BY HVAC CONTROL CONTRACTOR. RACEWAY REQUIRED BETWEEN CP-1, HVAC CONTROL PANEL AND GENERATOR CONTROL PANEL.
2. ~~CONNECT L-4 TO FLOOD ALARM IN CP-1~~
3. ALL WIRES NOT SPECIFICALLY CALLED OUT TO BE #12 THHN OR THWN UNLESS OTHERWISE NOTED.

NOTES:
1. SD SMOKE DETECTORS MTD INSIDE HVAC EFF DUCTS (3 TOTAL) & TO HVAC CONT.
2. THERMOSTATS FOR UNIT MTD ON UNIT HEATERS, NOT REMOTE WALL MOUNT
3. FLOOD ALARM W/ L-4 NOT TO BE USED

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SCALE: 1/4 " = 1'

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MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

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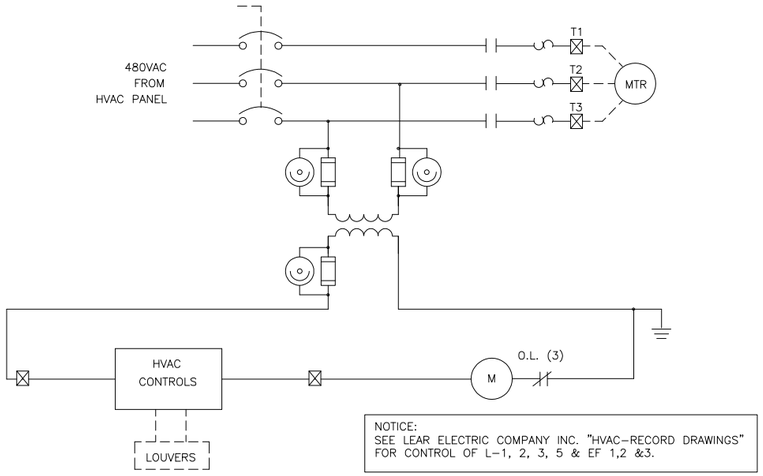
APPROVED _____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
ELECTRICAL
POWER, LIGHTING & GROUNDING PLAN

SHEET E-6 OF 40 SHEETS

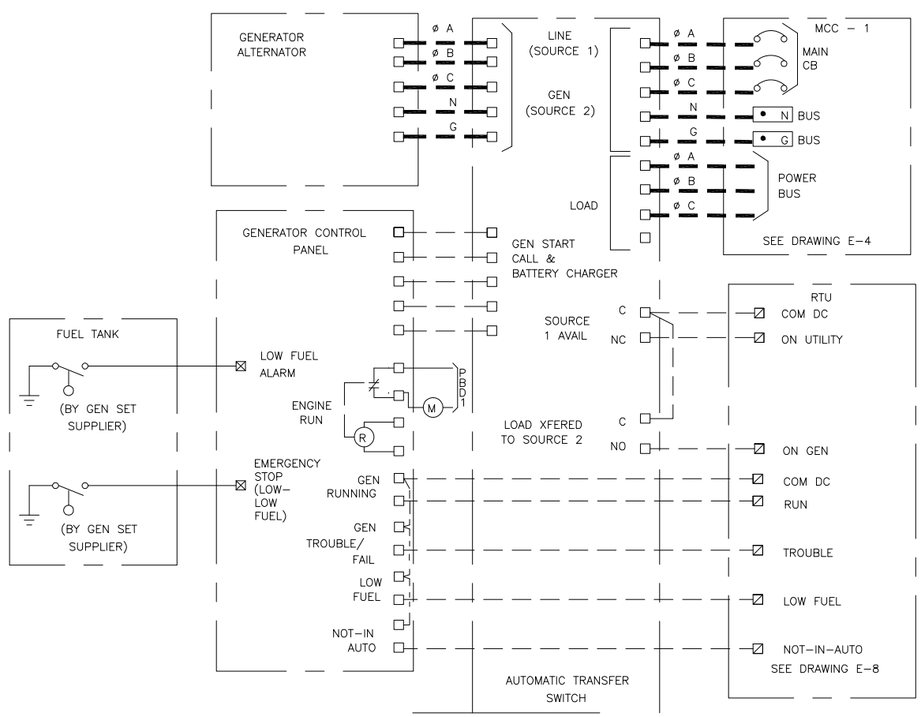
FILE: K:\WEST LINN, CITY OF\BOLTON PUMP STATION\MEC\BPSM0*.DGN

JOB No. 1065073.012580



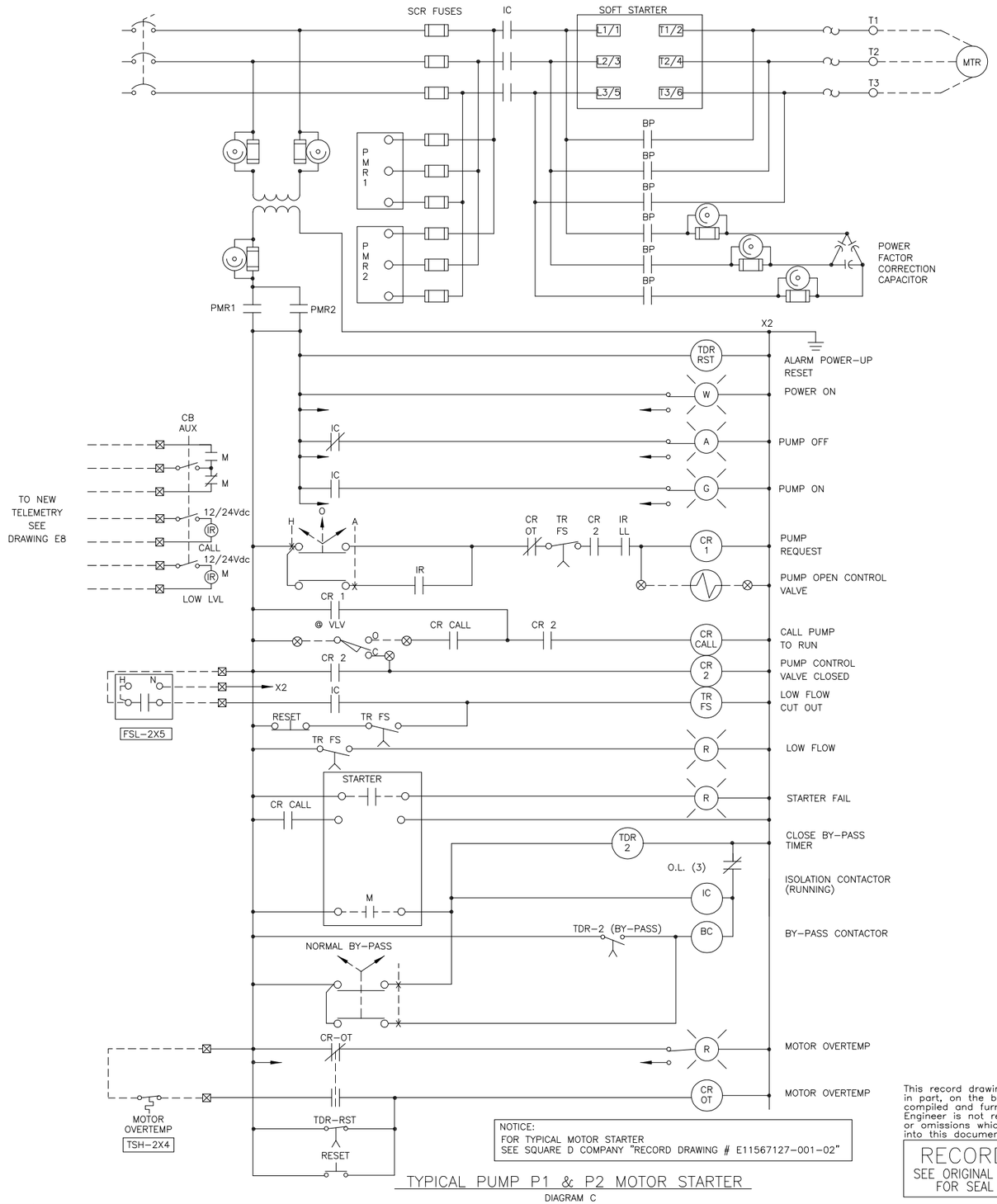
TYPICAL EXHAUST FAN STARTER/LOUVER CONTROL

DIAGRAM A



GENERATOR SCHEMATIC

DIAGRAM B



TYPICAL PUMP P1 & P2 MOTOR STARTER

DIAGRAM C

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SCALE:

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Portland, Oregon

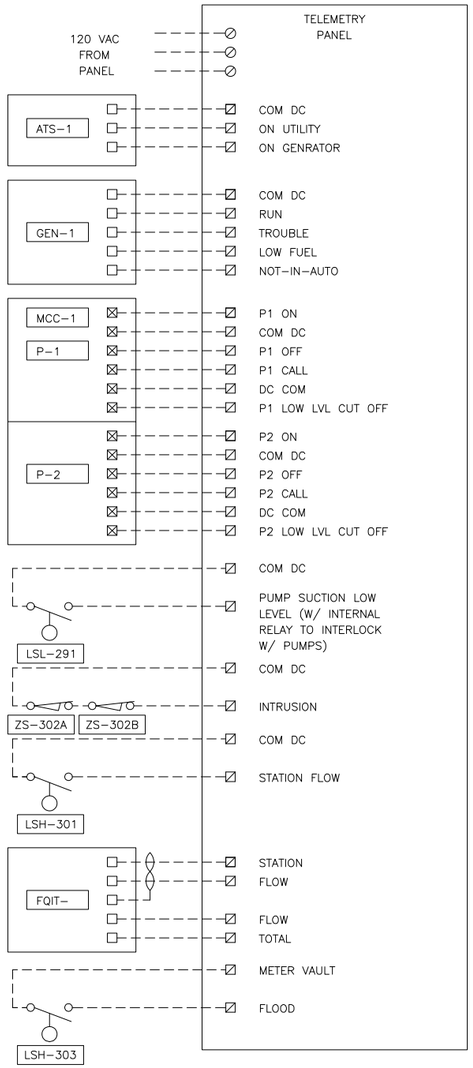
APPROVED ____ DATE
APPROVED ____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
CONTROL
SCHEMATICS - 1

SHEET
E-7
OF 40 SHEETS

JOB No. 1065073.012580

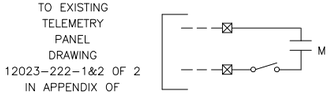
FILE K:\WEST LINN, CITY OF\BOLTON PUMP STATION\MEC\BPSM0*.DGN

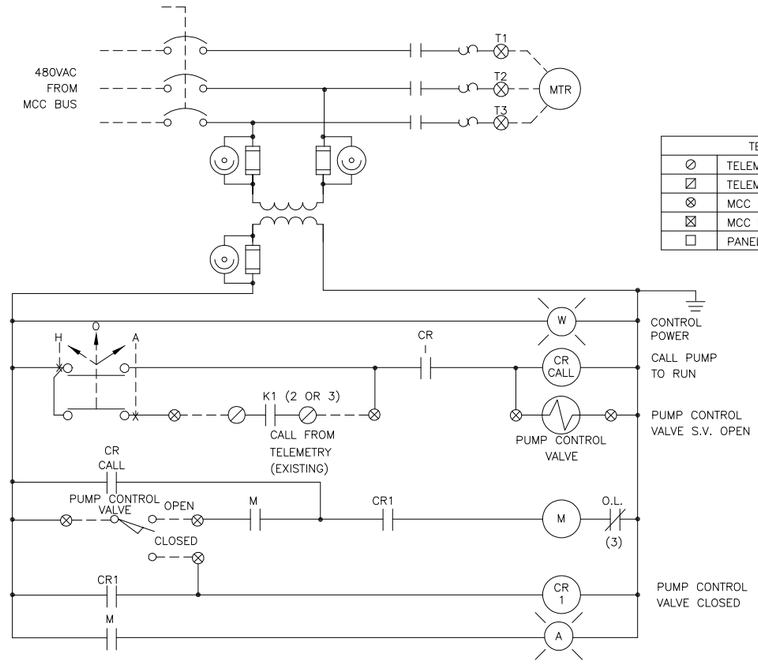


TELEMETRY CONNECTIONS

DIAGRAM A

NOTICE:
SEE S & B TELEM SHEETS FOR "RECORD DRAWINGS" (IN VOLUME III OF O&M MANUALS)





TERMINAL LEGEND	
⊘	TELEMETRY AC VOLTAGE
⊠	TELEMETRY DC VOLTAGE
⊗	MCC AC VOLTAGE
⊠	MCC DC VOLTAGE
□	PANEL/DEVICE AC/DC

PUMP EP-1,2 & 3 MOTOR STARTER

DIAGRAM D

NOTICE:
SEE SQUARE D "RECORD DRAWING" #E11567127-009-01 FOR EP 1, 2, & 3 STARTERS

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MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

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APPROVED ____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
CONTROL SCHEMATICS - 2

SHEET E-8 OF 40 SHEETS

JOB No. 1065073.012580
FILE: K:\WEST LINN, CITY OF\BOLTON PUMP STATION\MEC\BPSM0*.DGN

PIPING SYMBOLS

MECHANICAL EQUIPMENT SYMBOLS

- CENTRIFUGAL PUMP
- SUBMERSIBLE SUMP PUMP
- VERTICAL PUMP
- FAN
- PROGRESSIVE CAVITY PUMP
- METERING PUMP
- FAN
- COMPRESSOR
- SILENCER
- INTAKE FILTER
- VSD — VARIABLE SPEED DRIVE
- GENERATOR
- SIGHT GLASS
- TANK

PIPE LINE DEVICE SYMBOLS

- SLUICE GATE (NORMALLY OPEN)
- SLUICE GATE (NORMALLY CLOSED)
- INJECTOR
- FILTER OR SEPARATOR
- CAP OR PLUG
- BLIND FLANGE
- STRAINER
- REDUCER OR INCREASER
- BFP — BACK FLOW PREVENTER
- PIPED TO DRAIN (D)
- T — STEAM TRAP W/BY-PASS
- PIPE FLANGE CONNECTION TO TANK
- PD — PULSATION DAMPENER
- FLEXIBLE COUPLING
- EXPANSION JOINT
- HEAT TRACING

VALVE & ACTUATOR SYMBOLS

- GATE VALVE (N.O. / N.C.)
- GLOBE VALVE (N.O. / N.C.)
- PLUG VALVE (N.O. / N.C.)
- BALL VALVE (N.O. / N.C.)
- BUTTERFLY VALVE (N.O. / N.C.)
- CHECK VALVE
- BALL CHECK VALVE
- PINCH VALVE
- DIAPHRAGM VALVE
- NEEDLE VALVE
- PRESSURE RELIEF VALVE
- VACUUM RELIEF VALVE
- FLOAT VALVE

F.O. – FAIL OPEN
F.C. – FAIL CLOSED

- PRESSURE REDUCING VALVE
- BACK PRESSURE SUSTAINING VALVE
- VALVE WITH HAND OPERATOR
- S — SOLENOID OPERATED VALVE
- M — ELECTRICAL MOTOR OPERATED VALVE
- PISTON OPERATED VALVE
- DIAPHRAGM OPERATED VALVE
- FLOW BALANCING VALVE (HYDRONIC)
- THREE-WAY VALVE

INSTRUMENTATION SYMBOLS

PRIMARY ELEMENT SYMBOLS

- ORIFICE PLATE
- VENTURI OR FLOW TUBE
- AVERAGING PILOT TUBE
- PROPELLER OR TURBINE METER
- M — MAGNETIC FLOW ELEMENT
- FLUME
- WEIR
- FLOW METER (HYDRONIC)
- VARIABLE AREA FLOW METER (ROTAMETER)
- RUPTURE DISC
- FLOW STRAIGHTENING VANES
- DIAPHRAGM CHEMICAL SEAL
- ANNULAR CHEMICAL SEAL
- TEMPERATURE WELL
- DISPLACER FLOAT SWITCH
- GUIDED FLOAT SWITCH

PROCESS & SIGNAL LINE SYMBOLS

LINE	DESCRIPTION
	EXISTING
	MAIN PROCESS FLOW (WITH TYPICAL DIRECTION OF FLOW SHOWN)
	SECONDARY PROCESS FLOW
	INSTRUMENT SUPPLY, PROCESS TAPS, NON PROC. FLOW
// //	PNEUMATIC SIGNAL (ANALOG)
	ELECTRIC SIGNAL (ANALOG)
// //	PNEUMATIC SIGNAL (DISCRETE)
	ELECTRIC SIGNAL (DISCRETE)
× ×	CAPILLARY TUBE OR FILLED SYSTEM
~ ~	ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
~ ~	ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
o o	SOFTWARE OR DATA LINK
• •	MECHANICAL LINK
└ └	HYDRAULIC
ES	ELECTRIC POWER SUPPLY 120VAC, 60HZ U.O.N.
AS	AIR SUPPLY LINE (INSTRUMENT)
	UNGUIDED AIR FLOW

PIPING IDENTIFICATION

FUNCTION IDENTIFICATION

	FIRST LETTER(S)		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER(FLAME)				
C	CONDUCTIVITY			CONTROL	CLOSED
D	DENSITY	DIFFERENTIAL			
E	POTENTIAL (ELEC)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			
G	FIRE, SMOKE		GLASS		
H	HAND				HIGH
I	CURRENT(ELEC)		INDICATE		
J	POWER	SCAN			
K	TIME	TIME RATE CHANGE		CONTROL STATION	
L	LEVEL		PILOT LIGHT		LOW
M	MOISTURE	MOMENTARY			MIDDLE
N	EQUIPMENT STATUS				
O	UNCLASSIFIED		ORIFICE		OPEN
P	PRESSURE		TEST CONNECTION		
Q	QUANTITY	INTEGRATE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY SAFETY			SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTI-FUNCTION	MULTI-FUNCTION	MULTI-FUNCTION
V	VIBRATION			VALVE, DAMPER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	
Y	EVENT, STATUS			RELAY, COMPUTE	
Z	POSITION			MISC. ACTUATOR	

INSTRUMENT TAG NUMBERS

XX YYY NNNZ

- XX — OPTIONAL SUFFIX
- YYY — LOOP NUMBER
- NNN — PASSIVE &/OR OUTPUT FUNCTION LETTERS WITH OPTIONAL MODIFIER (SEE FUNCTION IDENTIFICATION TABLE)
- Z — MEASURED OR INITIATING VARIABLE LETTER WITH OPTIONAL MODIFIER (SEE FUNCTION IDENTIFICATION TABLE)

NOTES:

- # — INTERLOCK/LOGIC IDENTIFIER
- #### — FIRST NUMERIC LOOP WITH SPECIFIC FUNCTION; SUCCESSIVE NUMERIC LOOP WITH SAME FUNCTION AS FIRST

UON= UNLESS OTHERWISE NOTED

INSTRUMENT LOOP IDENTIFICATION

X NNN

- X — MEASURED OR INITIATING VARIABLE LETTER
- NNN — LOOP NUMBER

ABBREVIATIONS

PIPING DESIGNATIONS

SERVICE ABBREVIATIONS:

AW – ACID WASTE
ALW – ALKALINE WASTE
AIR – AIR (PROCESS)
BSAA – BORIC/SULFURIC ACID
C – CONDENSATE
CWR – COOLING WATER RETURN
CWS – COOLING WATER SUPPLY
CHW – CHILLED WATER
MPS – MED. PRESS. STEAM (15–125 PSIG)
TEA – TEA ETCH

PIPING CLASS:

A20 – ALLOY 20
BSP – BLACK STEEL PIPE
CPV – CPVC
CS – CARBON STEEL
GSP – GALVANIZED STEEL
IC – INSULATED (COLD)
IH – INSULATED (HOT)
IS – INSULATED (SAFETY)
PVC – PVC
SS1 – STAINLESS STEEL 304/304L
SS2 – STAINLESS STEEL 316/316L

INSTRUMENT ABBREVIATIONS

HOA – HAND–OFF–AUTO
I/O – ON/OFF

EQUIPMENT SPECIFICATIONS

Q – FLOW RATE
TDH – TOTAL DYNAMIC HEAD
HP – HORSE POWER
FT – FEET
GPM – GALLONS PER MINUTE
ACFM – ACTUAL CUBIC FEET PER MINUTE
B – BLOWER
E – EXCHANGER
FLT – FILTER
P – PUMP

INSTRUMENT & FUNCTION SYMBOLS

- DISCRETE INSTRUMENT
- MULTIFUNCTION INSTRUMENT WITH SHARED HARDWARE (USED FOR "DISTRIBUTED CONTROL SYSTEMS")
- COMPUTER FUNCTION
- INTERLOCKING OR SEQUENTIAL CONTROL FUNCTION
- PROGRAMMABLE LOGIC CONTROL

NOTE: ANY OF THE ABOVE SYMBOLS MAY BE SHOWN WITH HORIZONTAL BAR(S) TO INDICATE PANEL MOUNTING &/OR OPERATOR ACCESSIBLE

- FACE MOUNTED ON MAIN PANEL OPERATOR ACCESSIBLE
- MOUNTED ON/IN MAIN PANEL OPERATOR INACCESSIBLE
- FACE MOUNTED ON FIELD PANEL AT TANK (UON) OPERATOR ACCESSIBLE
- MOUNTED ON/IN MOTOR CONTROL CENTER OPERATOR INACCESSIBLE
- (E) FIELD INSTRUMENT (E) DENOTES EXISTING INSTRUMENTS (S&B) DENOTES DEVICES/ INSTRUMENTS PROVIDED BY S&B

RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

S ENGINEERING, INC.
Electrical, Control & SCADA Consultants
16030 Bothell Everett Hwy Suite # 100 - Mill Creek, WA. 98012
P.O. BOX 12884 - Mill Creek, WA. 98082-0884
(206) 338-2416 Fax: (206) 338-0827 ecseng@interserv.com

REV	DATE	BY	DESCRIPTION
4	4/99	DPR	RECORD DRAWING

SCALE:

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED LD
DRAWN MAR/HJ
CHECKED DMB

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE ____
APPROVED ____ DATE ____

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
INSTRUMENTATION SYMBOLS AND ABBREVIATIONS

SHEET I–1 OF 40 SHEETS

JOB No. 1065073.012580

FILE: K:\WEST LINN, CITY OF\BOLTON PUMP STATION\MEC\BPSM04.DGN

Plot Date/Time: $$$$date$$$$$$time$$

TELEMETRY HEADQUARTERS PANEL EXISTING DEVICES

CALL/OFF AUTO (TYPICAL OF 4)

HS (E)

OVERFLOW

LAH (E)

FQF (E) FI (E)

TELEMETRY UNITS (E)

TELEMETRY HEADQUARTERS PANEL NEW DEVICES (S&B)

STATION FLOOD INTRUSION — LAH 301

METER VAULT FLOOD — LSH 302

ZA 302 — STATION FLOW TOTAL — FQI 300

RECORD — FIR 300

PUMP 1 — YC 251 — COA HS 251 — I/O YL 251 — FAIL YAL 251

PUMP 2 — YC 261 — COA HS 261 — I/O YL 261 — FAIL YAL 261

PUMP 3 (SUPPLIED) — YC 271 — COA HS 271 — I/O YL 271 — FAIL YAL 281

PUMP 4 (SUPPLIED) — YC 281 — COA HS 281 — I/O YL 281 — FAIL YAL 281

RUN LAL 291 — RUN YA 305 — TROUBLE YA 308 — NOT IN AUTO UA 306 — ON GEN. YA 309 — ON UTILITY UA 307 — LOW FUEL UA 303

DAQ TELEMETRY UNITS (S&B)

EXISTING TELEMETRY PANEL

NEW TELEMETRY PANEL (S&B)

FI (E)

(S&B) LSH 301 — STATION FLOOD

(S&B) ZS 302 A,B — DOOR SWITCHES

0- 2000 GPM

1 PULSE/100GAL

ES — (S&B) FQIT 300 — M — (S&B) FE 300 — (S&B) LSH 303 — VAULT

ME-1 STAND-BY GENERATOR

ATS-1 AUTOMATIC TRANSFER SWITCH

PUMP CALL

PUMP RUNNING (TYPICAL OF 4)

(FUTURE) TO HORTON 16"

TO HORTON 14"

V-14

REMOTE SET POINT

LIC (E)

YC 211 @MCC

YC 221 @MCC

YC 222 @MCC

YC (E)

FQIT (E)

FE (E)

ZT (E)

LT (E)

LS (E)

EP-1 EP-2 EP-3 EP-4

BOLTON RESERVOIR

24"

V-12

DISCHARGE

YC 251 — YV 252 — PI 253 — ZSC 252 — M — S — TSH 254 — V-2 V-4 V-6 — PSL 253 — P-1

YC 261 — YV 262 — PI 263 — ZSC 262 — M — S — TSH 264 — V-1 V-3 V-5 — PSL 253 — P-2

FUTURE YC 271 — YV 272 — ZSC 272 — M — S — P-3 (FUTURE)

FUTURE YC 281 — YV 282 — ZSC 282 — M — S — P-4 (FUTURE)

V-7 V-8 V-9

(S&B) LSL 291 — RANGE: 0-20 FT SET EL. 437.50 FALLING

V-17

FROM SOUTH FORK WATER BOARD

V-19

18" X 14"

V-18

24"

SUCTION

EXISTING PUMP STATION

NEW PUMP STATION

This record drawing has been prepared, in part, on the basis of information compiled and furnished by others. The Engineer is not responsible for any errors or omissions which have been incorporated into this document as a result.

RECORD DRAWING
SEE ORIGINAL CONTRACT DRAWINGS FOR SEAL AND SIGNATURES

ENGINEERING, INC.
Electrical, Control & SCADA Consultants
16030 Bothell Everett Hwy Suite H 100 - Mill Creek, WA. 98012
P.O. BOX 12884 - Mill Creek, WA. 98082-0884
(206) 338-2416 Fax: (206) 338-0827 ecseng@interserv.com

REV	DATE	BY	DESCRIPTION
A	4/99	DPR	RECORD DRAWING

SCALE:

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED LD/DMB
DRAWN MAR/HJ
CHECKED DMB

SUBMITTED
PROJECT ENGINEER R. C. E. NO. DATE
MONTGOMERY WATSON R. C. E. NO. DATE

MONTGOMERY WATSON
Portland, Oregon

APPROVED ____ DATE
APPROVED ____ DATE

CITY OF WEST LINN
BOLTON PUMP STATION IMPROVEMENTS
PROCESS AND INSTRUMENTATION DIAGRAM

SHEET 1-2 OF 40 SHEETS

JOB No. 1065073.012580

FILE: K:\WEST LINN, CITY OF\BOLTON PUMP STATION\MEC\BPSMO#.DGN

CITY OF West Linn

22500 Salamo Road
West Linn, OR 97068

STAFF REPORT
FOR THE PLANNING COMMISSION

FILE NUMBER:	CUP-15-02/ DR 15-06 / DR 15-07
HEARING DATE:	July 1, 2015
REQUEST:	Conditional Use Permit for the replacement of the Municipal Water Storage Reservoir ("Reservoir") at 6111 Skyline Drive; Class II Design Review for new Reservoir; Class I Design Review for replacement of pump station roof.
APPROVAL CRITERIA:	Community Development Code (CDC) Chapters 11, 34, 41, 44, 54, 55, 60 and 99
STAFF REPORT PREPARED BY:	John Boyd AICP, Planning Manager

Planning Manager's Initials JB Development Review Engineer's Initials KQL

TABLE OF CONTENTS

GENERAL INFORMATION

OWNER:	City of West Linn, 22500 Salamo Road, West Linn, OR 97068
APPLICANT:	Public Works Department, City of West Linn, 22500 Salamo Road, West Linn, OR 97068
CONSULTANT:	Tom Boland, Murray, Smith & Associates, 121 SW Salmon, Portland, OR 97204
SITE LOCATION:	6111 Skyline Drive (Bolton Reservoir site), West Linn OR 97068
LEGAL DESCRIPTION:	Clackamas County Assessor's Map 2-1E-25AD, Tax Lot 7100
SITE SIZE:	3.23 Acres (140,700 square feet)
ZONING:	R-10 (Single Family Residential Detached/10,000 square foot minimum lot size) with a Willamette Falls Drive Commercial District Design Standards Overlay
COMP PLAN DESIGNATION:	Low Density Residential
120-DAY PERIOD:	This application became complete on June 5, 2015. The 120-day maximum application-processing period ends on October 3, 2015.
PUBLIC NOTICE:	Public notice was mailed to the Sunset, Bolton and Hidden Springs/Rosemont Summit neighborhood associations and to affected property owners on June 12, 2015. The property was posted with a sign on June 19, 2015. In addition, the application has been posted on the City's website and was published in the West Linn Tidings on June 19, 2015. The notice requirements have been met.

EXECUTIVE SUMMARY

Background: The applicant proposes to replace the existing 100 year old covered 2.5 million gallon drinking water reservoir with a new 4.0 million gallon partially buried pre-stressed concrete reservoir ("storage tank" or "replacement reservoir") meeting current seismic design standards. The proposal to replace the covered reservoir with a partially buried reservoir is a "Utilities, Major" and a Conditional Use Permit is required per CDC 11.060(9). The existing reservoir is over 100 years old, has not been reviewed as a conditional use and will be demolished. The standard of CDC Chapter 55, Design Review, applies for the Type II Design Review for the replacement reservoir. In addition, the applicant proposes to replace the existing pump station flat roof with a pitched roof. This new pitched roof will be in character with the adjacent residential neighborhood. Typically this is a Type I Design Review and is Planning Director decision. The requirements of CDC 99.070 require consolidation of proceedings and review all applications before the Planning Commission.

Site Conditions: The 3.23 acre site contains an existing covered 2.5 million gallon reservoir, an existing pump station and a storage building on site, all of which accesses from Skyline Drive. The existing structures occupy 29,000 square feet (or 0.66 acres). The site perimeter is fenced on three sides with a six foot tall chain link fence topped with three strands of barbed wire, and a sliding access gate off of Skyline Drive. The covered reservoir will be demolished and replaced with a new 4.0 million gallon reservoir. The interior parking and maneuvering access way is gravel. There are no sidewalks and curbs along the site.

Surrounding Land Use. The site is fully contained in the R-10 Zone and is surrounded by: the R-10 zone to the South, East and West, and the R-4.5 zone to the North.

Staff has determined that the applicant has met the criteria of Chapter 11 and Chapter 60. The reservoir replacement is considered a utility - major and is processed as a Conditional Use Permit. The replacement of the pump station roof is a review limited to the Class I Design Review criteria. Staff has determined that the applicant meets Chapter 55 criteria with the inclusion of the proposed conditions of approval for Class I Design Review. The construction of the new reservoir addresses the Class II Design Review criteria. Staff has also determined that with the inclusion of the conditions of approval the applicant meets the Class II Design Review criteria.

The Landscape Plan (Figure 7) in the Appendices identifies that existing trees along the frontage will be preserved to the maximum extent possible. Proposed site screening and landscaping will include removal of invasive English ivy and blackberry, removal of unhealthy or undesirable trees as recommended by the project arborist, and restoration with drought tolerant native species. The trees proposed for planting as landscaping and screening along the side and back property lines include Incense Cedar, Douglas-fir and Western Red Cedar, Vine Maples and assorted native shrubs are proposed for planting under the existing Douglas-fir stand to the

south and southeast of the reservoir, to replace the non-native grass with an appropriate understory to improve wildlife habitat.

The application notes that the site will be screened and buffered along the side and rear yards along the property line as shown on the Landscape Plan in the Appendices. The proposed replacement water storage reservoir will not involve generation or emission of noise, refuse, water pollution or impacts to air quality in any way. A noise study was not completed.

The Landscaping Plan also shows the perimeter fencing, and utilizes site lighting for security and to deter theft and vandalism. The directed lighting will be motion activated and photoelectric controlled. Appendix H contains a Light Coverage Plan that reveals the security lighting is shielded to assure onsite lighting only, thereby meeting City standards.

Staff has determined that with the recommended conditions of approval discussed below, the application meets the approval criteria.

Review of Conditions of Approval:
Condition of Approval 1 requires site plans to be substantially conformed to and ensures the completion of improvements is tied to building permit issuance. Condition of Approval 2 ensures that all forthcoming plans will conform to Engineering standards including for half-street improvements and other on- and off-site improvements. Condition of Approval 3 addresses required street improvements and a voluntary option provided to the applicant to meet the criteria by paying a fee in lieu of street improvements.

Public comments:

No public comments have been received to date.

RECOMMENDATION

Staff recommends approval of application CUP 15-03/DR 15-06/ DR 15-07 subject to the following proposed conditions and suggests the following motions:

Proposed Conditions of Approval

1. Site Plans. With the exception of modifications required by these conditions, the project shall substantially conform to the City of West Linn Site Plan (Figure 1), dated May 2015, and located on Attachment A of this Application and the Landscaping Plan (Figure 7) located on Attachment G of this Application.

2. Engineering Standards. The applicant shall submit updated engineering plans for review and approval by the City Engineer that address public improvements, on-site or off-site. These improvements, or payment of any fees-in-lieu, must be completed prior to building permit approval. All public improvements and facilities associated with public improvements including

grading, onsite stormwater design, street lighting, easements, and easement locations are subject to the City Engineer's review, modification, and approval.

3. Street Improvements. The applicant shall be required to pay a fee-in-lieu prior to building permit issuance of a sum that is sufficient to provide street improvements along the frontage of the property that meets the requirements for the Capital Improvement Plan transportation project for Skyline Drive from Firwood Drive to West A.

Alternative 1: Motion to approve.

I move to approve CUP 15-02 / DR 15-06 / DR 15-07, and direct staff to prepare a Final Decision and Order consistent with this decision based on the findings in the July 1, 2015, hearing Staff Report.

Alternate 2: Motion to approve subject to modified conditions of approval.

I move to approve CUP 15-02 / DR 15-06 / DR 15-07 subject to the following conditions of approval: (list proposed conditions), and direct staff to prepare a Final Decision and Order consistent with this decision based on the findings in the July 1, 2015, hearing Staff Report.

Alternate 3. Motion to deny

I move to deny CUP 15-02 / DR 15-06 / DR 15-07, and direct staff to prepare a Final Decision and Order adopting findings consistent with this decision, and specifically addressing criteria [INSERT CRITERIA SERVING AS THE BASIS FOR DENIAL HERE].

Notes to Applicant.

- Expiration of Approval. This approval shall expire three years from the effective date of this decision.

- Additional Permits Required. Your project may require the following additional permits:
  - Public improvement permit: contact Engineering at (503) 722-5501.
  - Public works permit: contact Engineering at (503) 722-5501.

  - On-Site Utilities: contact the Building Division at (503) 656-4211, or jnomie@westlinnoregon.gov. (Electrical permits are through Clackamas County, not the City of West Linn.)
  - Building permit, the final permit after others are completed and conditions of approval are fulfilled. Contact the Building Division at (503) 656-4211, or jnomie@westlinnoregon.gov.

Final inspection, for occupancy: Call the Building Division's Inspection Line at (503) 722-5509.

Public Works Department
22500 Salamo Road
West Linn, Oregon 97068
Telephone: (503) 722-5500
Fax: (503) 656-4106

Solicitation Number: PW-14-06

Volume 2 of 2

PLANS