



City of Puyallup

Office of the City Engineer
Capital Improvement Projects
333 S Meridian
Puyallup, WA 98371

Water Pollution Control Plant Third Secondary Clarifier Installation CIP NO. 20-018

Project Manual

June 6, 2023

Prepared by:
City of Puyallup
Office of the City Engineer

333 South Meridian
Puyallup, WA 98371

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CONTRACT PROVISIONS

for

Water Pollution Control Plant Third Secondary Clarifier Installation

June 2023

Prepared by:

*Gray & Osborne, Inc.
1130 Rainier Ave S, Suite 300
Seattle, WA 98144*

Prepared for:

*City of Puyallup
Office of the City Engineer
333 South Meridian
Puyallup, WA 98371*

The above-mentioned Contract Provisions have been reviewed and approved for advertisement. Such review includes all contract documents, specifications, and plans associated with the project.

Prepared by: _____

Checked by: _____

Approved by: _____

**CITY OF PUYALLUP
Approved for Construction
Office of the City Engineer**

By: _____
City Engineer

_____ Date

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LEGAL DOCUMENTS

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NOTICE TO CONTRACTORS

NOTICE IS HEREBY GIVEN that **electronic bids** for the **WATER POLLUTION CONTROL PLANT THIRD SECONDARY CLARIFIER INSTALLATION PROJECT** be received at QuestCDN until **2:00 p.m., March 25, 2022**. Bids will be opened, read, and tabulated immediately following via Skype meeting. Bids will not be accepted by the on-line bidding system after 2:00 p.m. Bids are to be submitted only in the format accepted by QuestCDN, and all bids must be accompanied by a bid bond submitted electronically, using the form supplied in the bid documents. The bid bond shall have a value not less than five percent (5%) of the total amount bid. The Skype meeting can be accessed by calling 253-841-5587, conference ID is 169349, and plan holders will be sent an invite via email in the event they would like to see the opening along with audio.

The improvements for which bids will be received are described as follows:

Project Description: The project includes work to install a third secondary clarifier at the City of Puyallup's Water Pollution Control Plant and associated work, including:

1. Potholing to establish the locations and pipe materials for pipe connections to the new secondary clarifier,
2. Shoring and Groundwater control by ground freezing.
3. Construction of the new secondary clarifier.
4. Installation of a new return activated sludge (RAS) pump.
5. Installation of a new magnetic flow meters on the new RAS pump suction pipe line and the new secondary clarifier effluent line in the effluent pump station/ultraviolet (UV) disinfection structure.
6. Conversion of an existing effluent flow meter manholes into a scum pump station.
7. Furnishing and installation of all required piping and appurtenances.
8. Furnishing and installation of all required electrical, instrumentation, and telemetry work.
9. Construction of required site grading and paving.
10. Furnishing and installation of required landscaping.
11. Restoration of surfaces disturbed by construction activities.
12. Providing testing, commissioning, and training as specified herein.
13. Providing all associated work as shown on the Plans and specified herein, for a complete and workable system

All work shall be physically complete within **two hundred fifty (250) working days** of receiving a Notice to Proceed. Time extensions may be granted for rainfall days that prevent work that is already in progress. The City of Puyallup reserves the right to accept a proposal of the lowest responsible bidder, reject any or all bids, and to waive irregularities in the bid or in the bidding.

Pre-Bid Site Visit: A mandatory site visit will be held on **Thursday, March, 11, 2022 at 10:00 a.m.** at 1602 18th Street West, Puyallup, WA 98371. Bidders who are not present at the mandatory site visit will be determined to be non-responsive and their bids rejected. Access to the site is normally restricted; no other

Notice to Contractors

site visits will be allowed.

All bidders shall download the digital plans as indicated below, Online Access/Bidding. Hard copies WILL NOT BE SOLD for this project. Due to the COVID-19 Restrictions, no plans will be available for viewing in person.

Online Access/Bidding: Complete digital Project Manual is available online for viewing at: www.QuestCDN.com. Plan holders shall register and download the digital plan documents at this website for **\$20**. Reference Job No. **6873268** on the website's Project Search page. Bidding will cost the registered plan holder an additional **\$20** to submit a bid.

Financing of the Project has been provided, and payment to the Contractor by regular monthly payments for labor and materials furnished will be by City check. The City expressly reserves the right to reject any and all Bids and to waive minor informalities.

The Engineer's estimated range for this project is between **\$5,300,000 - \$5,800,000**.

For technical information, contact Jessica Wilson, jjwilson@puyallupwa.gov.

Dates of publication in the Tacoma News Tribune: [REDACTED].

Dates of publication in the Seattle Daily Journal of Commerce: [REDACTED].

The City of Puyallup in accordance with Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. 2000d to 2000d-4 and Title 49, Code of Federal Regulations, Department of Transportation, Subtitle A, Office of the Secretary, Part 21, nondiscrimination in federally-assisted programs of the Department of Transportation issued pursuant to such Act, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises as defined at 49 CFR Part 26 will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, national origin, or sex in consideration for an award.

Americans with Disabilities Act (ADA) Information

The City of Puyallup in accordance with Section 504 of the Rehabilitation Act (Section 504) and the Americans with Disabilities Act (ADA), commits to nondiscrimination on the basis of disability, in all of its programs activities. This material can be made available in an alternate format by emailing Michelle Gehring at mgehring@puyallupwa.gov.

INSTRUCTIONS TO BIDDERS

1. PLANS, SPECIFICATIONS and ADDITIONAL INFORMATION

See attached.

2. EXAMINATION OF PLANS, SPECIFICATIONS and SITE

Bidders shall satisfy themselves by personal examination of Plans, Specifications, and site of the proposed improvements, and by any other examination and investigation that they may desire to make as to the accuracy of the estimate of quantities, the nature of the work, and the difficulties to be encountered.

3. DELIVERY OF PROPOSAL

Bids shall be submitted electronically as specified in the NOTICE TO CONTRACTORS.

4. MODIFICATION OF PROPOSAL

A Proposal will be considered irregular and will be rejected if the Proposal Form furnished by the Owner is not used or is altered, or if the completed Proposal Form contains any unauthorized additions, deletions, alternate Bids or conditions. No oral or telephonic proposals or modifications will be considered.

5. BID BOND

Each Proposal will be accompanied by a certified check, cashier's check, postal money order, or Proposal guaranty bond, as required by RCW 47, made payable without reservations to the Owner, or in the case of special districts, the County Treasurer, in amount not less than five percent (5%) of the total Bid for all Schedules. Said check or bond will be held as a guaranty that the successful Bidder will, within ten (10) days from the date of notification of award, enter into a Contract and furnish an approved Performance Bond, on form attached, in an amount equal to one hundred percent (100%) of the amount of the Contract, including state sales tax.

6. RETURN OF PROPOSAL GUARANTY

As soon as the bid prices have been compared, the Owner will return the good faith token accompanying such of the Proposals, as in the Owner's judgment, would not be considered in making award. All other Proposal guarantees will be held until the Contract and the Bond of the successful Bidder have been executed, after which they shall be returned to the Bidders whose Proposals they accompanied.

7. AWARD OF CONTRACT

A Contract will not be awarded until the Owner is satisfied that the successful Bidder is reasonably familiar with this class of work and has the necessary capital and tools to satisfactorily perform the same. The right is specifically reserved by the Owner to reject any or all Proposals, to accept the proposal of the lowest responsible bidder, or to re-advertise for new proposals.

The Bidder's attention is hereby directed to that portion of the Proposal that requires that the Bidder furnish information concerning his experience with work of a similar nature, equipment to be used on this Project, and general background information. Information that is incomplete, evasive, or of a general nature only shall be considered as grounds for rejection of the Bid.

Refer to Section 1-02.1 of the Special Provisions.

After the date and hour set for the opening of the Bids, no Bidder may withdraw his Proposal unless the award of the Contract is delayed for a period exceeding ninety (90) days.

8. FAILURE TO EXECUTE CONTRACT

In the event the successful Bidder fails to furnish an approved Performance Bond, execute the Contract, and comply with all other pertinent legal requirements within ten (10) days after notification by the Owner of the award of Contract, the certified check, bank draft, or money order accompanying the Bid shall be forfeited in the amount lost by the Owner in making the award to the next low, responsible Bidder, but said forfeiture not to exceed five percent (5%) of the amount bid by the Contractor failing or refusing to comply with the award requirements. In the event the bid bond is tendered as a "Good Faith" token, and the awardee fails or refuses to comply with the requirements of entering a Contract on the basis of his Proposal, said Contractor and his Surety shall be likewise held liable under the Bid Bond in an amount not to exceed five percent (5%) of his Bid for losses suffered by the Owner in being forced to award to the new low, responsible Bidder.

9. BID ERRORS

No consideration will be given by the Owner to a claim of error in a Proposal, unless such claim is made to the Owner within two (2) hours after the time stated in the advertisement for receiving proposals, and unless supporting evidence of such claim, including cost breakdown sheets, is delivered to the Owner within three (3) hours after the time stated in the advertisements for receiving Proposals.

BIDDER'S CHECKLIST

- 1.01 THE BIDDER'S ATTENTION IS ESPECIALLY CALLED TO THE FOLLOWING FORMS THAT MUST BE EXECUTED IN FULL AND SUBMITTED WITH THE PROPOSAL UNLESS SPECIFIED OTHERWISE:
- A. Bid Proposal Form:
The base bid, the price bid for each alternate (if any), and the unit prices must be shown in the space provided. Each unit price item shall have the unit price shown and the total (unit price times the number of units shown in the estimated quantity) amount shown for each schedule. The unit price shall be the same for each schedule. Each lump sum bid item shall have the lump sum amount entered in each schedule. The final sheet of the Proposal must be filled in and signed by the Bidder. The sheet identifying receipt of any and all Addenda must be completed as well.
 - B. Proposed Subcontractors.
 - C. Statement of Bidder Qualifications.
 - D. Bid Bond:
This form is to be executed by the surety company unless Bid is accompanied by a certified check. The amount of this bond shall not be less than five percent (5%) of the total amount of Bid for all Schedules and may be shown in dollars or on a percentage basis.
 - E. Non-Collusion Affidavit:
Complete and notarize.
 - F. Certificate of Compliance with Wage Payment Statutes:
Compete and Signed by Authorized Official.
 - G. Supplemental Bidder Responsibility Criteria (Appendix 3).
 - H. Prime Contractor Performance Report (Appendix 4).
 - I. Statement of Qualifications for Ground Freezing.
- 1.02 THE FOLLOWING FORMS ARE TO BE EXECUTED AFTER THE CONTRACT IS AWARDED, AND PRIOR TO NOTICE TO PROCEED:
- A. Public Works Contract:
This Contract to be executed by the successful Bidder and their surety company.
 - B. Retainage Bond (if applicable).
 - C. Performance and Payment Bond:
To be executed by the successful Bidder and their surety company.
 - D. Liability Certificate of Insurance:
To be executed by the successful Bidder and their insurance company.

- E. Liability Insurance Endorsement:
To be executed by the successful Bidder and their insurance company.
- F. Statement of Intent to Pay Prevailing Wages
- G. List of all DBE's who contacted the Prime during bidding (whether a quote was provided or not)
- H. Washington State Department of Ecology Transfer Form.

PROPOSAL

To the Honorable
Mayor and Council
Puyallup, Washington

WATER POLLUTION CONTROL PLANT THIRD SECONDARY CLARIFIER INSTALLATION

The undersigned has examined the site, General Stipulations, Engineering Specifications, Contract Drawings, laws, and ordinances covering the improvements contemplated. In accordance with the terms, provisions, and requirements of each of the foregoing, their respective terms and conditions are incorporated herein by this reference, and the following lump sums and unit prices are tendered as an offer to perform the work and furnish the equipment, materials, appurtenances, and guarantees, where required, complete in place and in good working order.

As evidence of good faith, cash, bid bond, cashier’s check, or certified check made payable to the City Treasurer, City of Puyallup, is attached hereto. The undersigned understands and hereby agrees that, should this offer be accepted, and the undersigned fails or refuses to enter into a contract and furnish the required construction performance bond and necessary liability insurance, the undersigned will forfeit to the City an amount for the “good faith token” equal to five percent (5%) of the amount bid as liquidated damages, all as provided for in the Specifications.

The undersigned fully understands and agrees that the unit prices here submitted shall apply to the quantity actually used, regardless of its relation to the quantity shown in the Proposal.

The undersigned freely states that he/she is familiar with the provisions of the Competitive Bidding Statutes of Washington State, specifically the provisions of RCW Chapter 9.18, and certifies that with respect to this Proposal, there has been no collusion or understanding with any other person, persons, or corporation to prevent or eliminate full and unrestricted competition upon Bidders on this public works project.

Signature of Contractor’s Representative

Date

Representative’s Printed Name

Name of Firm

Contact Email Address

Contact Phone

SCHEDULE OF PRICES

CITY OF PUYALLUP
 North Levee Road Pump Station Replacement Project
 BASE BID

Item No.	Unit	Estimated Quantity	Spec Section	Description of Item	Amount	
					Unit Price	Total Item Price
1	LS	1	01200	WPCP Third Secondary Clarifier		
2	LS	1	01200	Mobilization and Demobilization		
3	LS	1	01200	Trench Excavation Safety Systems		
4	LS	1	01200	Ground Freezing		
5	LS	1	01200	Dewatering		
6	LS	1	01200	Erosion Control		
7	CY	50	01200	Unsuitable Excavation		
8	CALC	1	01200	Minor Change	\$150,000	\$150,000
					Base Bid Subtotal	\$
					Sale Tax @ 10.0%	\$
					Total Base Bid with Tax	\$

Contract award will be based on the Total Base Bid, with tax, to determine the low-responsive bidder whose Proposal is in the best interest of the Owner.

Name of Firm

ADDENDA RECEIVED

Addendum Number	Date Received	Name of Recipient
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

PROPOSED SUBCONTRACTORS



Subcontractor List

Prepared in compliance with RCW 39.30.060 as amended

To Be Submitted with the Bid Proposal

Project Name _____

Failure to list subcontractors with whom the bidder, if awarded the contract, will directly subcontract for performance of the work of structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing, as described in Chapter 18.106 RCW, and electrical, as described in Chapter 19.28 RCW or naming more than one subcontractor to perform the same work will result in your bid being non-responsive and therefore void.

Subcontractor(s) with whom the bidder will directly subcontract that are proposed to perform the work of structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing, as described in Chapter 18.106 RCW, and electrical as described in Chapter 19.28 RCW must be listed below. The work to be performed is to be listed below the subcontractor(s) name.

To the extent the Project includes one or more categories of work referenced in RCW 39.30.060, and no subcontractor is listed below to perform such work, the bidder certifies that the work will either (i) be performed by the bidder itself, or (ii) be performed by a lower tier subcontractor who will not contract directly with the bidder.

Subcontractor Name _____
Work to be performed _____

Subcontractor Name _____
Work to be performed _____

Subcontractor Name _____
Work to be performed _____

Subcontractor Name _____
Work to be performed _____

Subcontractor Name _____
Work to be performed _____

* Bidder's are notified that it is the opinion of the enforcement agency that PVC or metal conduit, junction boxes, etc, are considered electrical equipment and therefore considered part of electrical work, even if the installation is for future use and no wiring or electrical current is connected during the project.

STATEMENT OF BIDDER QUALIFICATIONS

Name of Firm:	Address:
Phone:	City, State ZIP:
Contractor Registration #	UBI #
Industrial Insurance Account #	Employment Security Dept #
State Excise Tax Registration #	DUNS #

Contact Person for this Project: _____
 Number of years the Contractor has been engaged in the construction/painting business under the present firm name, as indicated above:

Gross dollar amount of work under contract: _____
 Gross dollar amount of contracts not completed: _____
 General character of work performed by firm: _____

List of five major projects of similar nature which have been completed by the Contractor within the last five (5) years, the gross dollar amount and brief description of each project:

1. Project Name: _____
 Amount: _____
 Owner: _____
 Engineer's Name: _____
 Engineer's Phone: _____
 Description: _____
2. Project Name: _____
 Amount: _____
 Owner: _____
 Engineer's Name: _____
 Engineer's Phone: _____
 Description: _____
3. Project Name: _____
 Amount: _____
 Owner: _____
 Engineer's Name: _____
 Engineer's Phone: _____
 Description: _____

4. Project Name: _____
Amount: _____
Owner: _____
Engineer's Name: _____
Engineer's Phone: _____
Description: _____

5. Project Name: _____
Amount: _____
Owner: _____
Engineer's Name: _____
Engineer's Phone: _____
Description: _____

List five major pieces of equipment that are anticipated to be used on this Project by the Contractor and note which items are owned by the Contractor and which are to be leased or rented from others:

Equipment	Own/Lease	Equipment	Own/Lease
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____		

Bank Reference: _____

How many general superintendents or other responsible employees in a supervisory position do you have at this time, and how long have they been with the firm?

Have you changed bonding companies within the last three (3) years? _____

If so, why? (Optional) _____

Have you ever been sued by the client or have you ever sued the client on any public work contract for a special district, municipality, county, or state government? _____

For what reason? _____

Disposition of case, if settled: _____

Do you have any outstanding payments due to the Department of Revenue?

Bidder agrees that the City shall retain the right to obtain any and all credit reports.

_____	_____
Yes	Signature
_____	_____
No	Signature

Bid Proposal Form

Subject to time lost due to inclement weather and delay in delivery of materials, should such delay not be the result of the undersigned's action, the undersigned agrees to complete all work in this Contract for the **WATER POLLUTION CONTROL PLANT THIRD SECONDARY CLARIFIER**, as specified in Section 1-08.5 of the Special Provisions.

The undersigned's Washington State Department of Labor and Industries Workman's Compensation Account No. is _____.

The undersigned has complied with the Washington State Department of Licenses requirements for bond, proof of insurance, and annual registration fee; and the undersigned's Washington State Department of Licenses Contractor's Registration No. is _____.

_____.

Very truly yours,

Signature

Print Name

Title

Firm Name

Address

Amount of "good faith token" \$ _____ Check No. _____ on _____ Bank

located at _____,

or bid bond in the amount of \$ _____,

issued through _____
(Name of Agency) (Mailing Address) (Telephone Number)

for _____
(Name of Bonding Company)

BID BOND

We, _____, as Contractor and _____, as Surety, jointly and severally, bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to:

PUYALLUP, WASHINGTON

(herein called the City) for payment of the sum of _____ Dollars (\$ _____),

lawful money of the United States. The Contractor has submitted the accompanying Bid for the construction of:

WATER POLLUTION CONTROL PLANT THIRD SECONDARY CLARIFIER INSTALLATION

If the Contractor is awarded the Contract and enters into a written contract, in the form prescribed by the City, at the price designated by their Bid, and files the bond with the City to guarantee faithful performance, in the time and manner specified by the City, and carries all insurance in type and amount that conforms to the Contract Documents, and furnishes required certificates and endorsements thereof, all written fifteen (15) days after the award of the Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

Forfeiture of this bond, or any deposit made in lieu thereof, shall not preclude the City from seeking all other remedies provided by law to cover losses sustained as a result of the Contractor’s failure to do any of the foregoing.

Executed on _____, 20____

(Contractor)

(Seal if Corporation)

By _____

Title _____

(Attach Acknowledgment of Authorized Representative of Contractor)

Any claims under this bond may be addressed to:

(Name and Address of Surety)

(Name and Address of Surety’s Agent for service of process in Washington, if different from above)

(Telephone Number of Surety’s Agent in Washington)

(Attach Acknowledgment)

SURETY
By _____
(Attorney-in-Fact)

NOTICE:
Sureties must be authorized to do business in and have an agent for service of process in Washington State. Certified copy of Power of Attorney must be attached.

NON-COLLUSION AFFIDAVIT

(This Affidavit to be fully executed)

STATE OF _____)
) SS.
COUNTY OF _____)

_____, affiant,

the _____
(President, Secretary, Manager, Firm Owner, or Representative)

of _____
(Name of Company or Corporation or Firm)

the person, corporation, or company who makes the accompanying Proposal, having first been duly sworn, deposes and says:

That such Proposal is genuine, and not sham or collusive, nor made in the interest or behalf of any person not herein named, and that the Bidder has not directly or indirectly induced or solicited any other Bidder to put in a sham bid, or any other person, firm, or corporation to refrain from bidding, and that the Bidder has not in any manner sought by collusion to secure for itself an advantage over any other Bidder.

Signature of: President, Secretary, Manager,
Owner, or Representative

Subscribed and sworn to before me

this _____ day of _____, 20__.

Signature of Notary Public in and for

the County of _____

State of _____

(this page intentionally left blank)

Certification of Compliance with Wage Payment Statutes

(this page intentionally left blank)

Statement of Qualifications for Ground Freezing

STATEMENT OF QUALIFICATIONS FOR GROUND FREEZING

This form shall be completed in its entirety and submitted with the bid. Failure to submit and meet the requirements as stated in Section 1-02.1 of the Special Provisions shall be grounds for rejection of the bid.

The City of Puyallup will be the sole judge in determining if the prospective contractor meets the minimum experience requirements.

The Contractor and the superintendent assigned to this project shall each have a minimum of 3 successfully completed projects of similar size and complexity that include Ground Freezing within the last 5 years. This requirement can be fulfilled by subcontractor completing the work.

Contractor:

Name: _____

Address: _____

Phone: _____ Contact Person: _____

List three projects of a similar nature which Contractor has completed within the last 5 years. Include contract amount and contact information for references:

Project Name	Amount	Owner/Agency	Contact	Phone	Year Completed

Superintendent:

Name: _____

List three projects of a similar nature which Contractor has completed within the last 5 years. This person shall be present at the preconstruction and pre-FDR meetings and shall oversee activities during Ground Freezing. Include contract amount and contact information for references:

Project Name	Amount	Owner/Agency	Contact	Phone	Year Completed

Statement of Qualifications for Ground Freezing

(this page intentionally left blank)

The following forms have been provided for information, and are not required to be submitted with the bid.

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PUBLIC WORKS CONTRACT

PUBLIC WORKS CONTRACT

1. Parties. This Public Works Contract is made by and between the City of Puyallup, a Washington State municipal corporation (City) and _____ (Contractor).

For and in consideration of the promises hereinafter made and exchanged, the City and Contractor agree as follows:

- 2. Contract.** The word “Contract” as used throughout this document shall include the following:
- a. This Contract;
 - b. Contractor’s submitted, and City accepted, bid packet which is on file with the City and incorporated herein by this reference. (The provisions of this Contract shall prevail over any conflicting provisions in the bid packet.); and
 - c. The project manual & bid documents for the Water Pollution Control Plant Third Secondary Clarifier Installation project, which are on file with the City, and are incorporated herein by this reference.

3. Term. This Contract shall be effective when both parties have executed this Contract and shall terminate upon the City’s final acceptance of the Contract Work, or a valid exercise of termination rights under the provisions of this Contract.

4. Contract Work. The provision of goods and services identified in the Contract constitute the contract work (Contract Work). Contractor shall perform the Contract Work pursuant to the terms of the Contract. Contractor shall furnish all labor, materials, equipment, tools, transportation, services, appliances and appurtenances for the Contract Work in strict conformity with this Contract, within the time-period prescribed by the City.

5. Manner of Work & Qualifications. Contractor shall provide, perform and complete the Contract Work in its entirety in a proper and workmanlike manner, and in conformance with the standard of care required of Contractor by law, and in accordance with, and as described in the incorporated plans and specifications, which are by this reference incorporated herein and made part hereof and shall perform any changes in the Contract Work in accord with the Contract.

Contractor warrants that its employees or those persons or entities that perform the Contract Work have sufficient education, training, skill, knowledge, ability, and experience to competently perform the Contract Work. Contractor further warrants that its employees or those persons or entities that perform the Contract Work have satisfied all statutory and regulatory requirements that are necessary to perform the Contract Work.

6. Time of Completion. Contractor shall commence to perform the Contract Work after execution of this Contract and when directed by the City. The City's authority to direct commencement shall include the authority to delay commencement of the Contract Work. Contractor shall complete the Contract Work by: _____ of receiving a Notice to Proceed.

7. Compensation. The City shall pay Contractor an amount up to, but **not to exceed** _____ dollars and _____ cents (\$_____) plus any applicable Washington State sales tax. Contractor shall submit regular statements to the City describing the portion of the Contract Work that has been provided with any necessary corresponding or supporting records. The City, upon receipt of a completed invoice or billing statement, shall promptly process said claims for payment. Contractor shall be responsible for the payment of any taxes imposed by any lawful jurisdiction as a result of the performance and payment of this Contract.

- a. Retainage.** The City shall hold back a retainage in the amount of five percent (5%) of any and all payments made to Contractor for a period of sixty (60) days after the date of final acceptance, or until receipt of all necessary releases from the State Department of Revenue and the State Department of Labor and Industries and until settlement of any liens filed under RCW 60.28, whichever is later. If Contractor plans to submit a bond in lieu of the retainage specified above, the bond must be in a form acceptable to the City and submitted upon entering into this Contract and shall be issued from a bonding company that satisfies the City.
- b. Defective or Unauthorized Work.** The City shall be entitled to withhold payment from Contractor for any defective or unauthorized work. If Contractor is unable, for any reason, to satisfactorily complete any portion of the Contract Work, the City may complete the work by contract or otherwise, and Contractor shall be liable to the City for costs incurred by the City. The City is entitled to deduct the cost to complete the Contract Work from any amounts that may be due and payable to Contractor. Notwithstanding the terms of this section, the City's payment to Contractor shall not be a waiver of any claims the City may have against Contractor for defective or unauthorized work.
- c. Final Payment—Contractor's Waiver of Claims.** CONTRACTOR'S ACCEPTANCE OF FINAL PAYMENT (EXCLUDING WITHHELD RETAINAGE) SHALL CONSTITUTE A WAIVER OF CONTRACTOR'S CLAIMS, EXCEPT THOSE PREVIOUSLY AND PROPERLY MADE AND IDENTIFIED BY CONTRACTOR AS UNSETTLED AT THE TIME REQUEST FOR FINAL PAYMENT IS MADE.

8. Changes. The City may issue a written change order for any change in the Contract Work during the performance of this Contract. Alternatively, if Contractor believes that a change order is necessary, Contractor must submit a written change order request to the City. If Contractor fails to request a change order before performing changes in the Contract Work, Contractor waives its right to make any claim or submit a subsequent change order request for that changed portion of the Contract Work. Contractor shall perform the change order work upon receiving either a written change order from the City or an oral order from the City that precedes a written change order.

If the City issues or authorizes the change order and determines that the change increases or decreases Contractor's costs or time for performance, the City will make an equitable adjustment to the terms of this Contract, which may include, but shall not be limited to, a change in compensation or extension of time. The City will attempt, in good faith, to reach agreement with Contractor on all equitable adjustments. However, if the parties are unable to agree, the City is entitled to establish an equitable adjustment that it deems appropriate. Contractor shall complete the change order work but may elect to protest the adjustment and assert a claim as provided in this Contract.

Contractor accepts all requirements of a change order by: (1) endorsing it, (2) issuing a separate acceptance, or (3) by failing to protest in accordance with the requirements of this Contract. Acceptance of payment for change order work under a change order that is accepted by Contractor as provided in this section shall constitute full payment and final settlement of all claims for compensation or costs and expenses that are related to the change.

9. Change Order Protests and Claims. If Contractor disagrees with any requirement of a change order or oral order from the City, Contractor may file a protest and assert a claim as provided in this section. Contractor shall give written notice to the City of any protest and claim within fourteen (14) calendar days of the occurrence of the events giving rise to the protest and claim, or within fourteen (14) calendar days of the date Contractor knew or should have known of the facts or events giving rise to the protest and claim, whichever occurs first. Any protest and claim shall be conclusively deemed to have been waived by Contractor unless timely notice is provided pursuant to this section.

FAILURE TO PROVIDE A COMPLETE, WRITTEN NOTIFICATION OF CLAIM WITHIN THE TIME ALLOWED SHALL CONSTITUTE A WAIVER OF ANY CLAIMS ARISING FROM OR RELATED TO THE FACTS OR EVENTS SURROUNDING THAT CLAIM OR CAUSED BY THAT DELAY.

If Contractor chooses to file a protest and assert a claim, Contractor's written protest and claim shall include the following:

- a. Notice of Protest and Claim. A signed written notice of protest and claim that provides the following information:
 - The date of the notice;
 - An accurate description of the nature of the claim and the circumstances that gave rise to the claim, including, if applicable, an analysis of the progress schedule showing the schedule impact or disruption;
 - The provisions in the Contract or change order that are the basis for, or apply to the claim; and
 - The proposed remedy, including, if any, the amount of the claim and the basis for its calculation;
- b. Records. Complete copies of all records that support the claim.

10. Laws and Rules. Contractor shall comply with all applicable state, federal, or local laws, regulations, rules, or any other sources of authority, including, but not limited to, court orders, administrative rulings and the following:

- a. Wage, Hour, Safety, and Health Laws. Contractor shall comply with the rules and regulations of the Fair Labor Standards Act, 29 U.S.C. 201 *et seq.*, the Occupational Safety and Health Act of 1970, 29 U.S.C. 651, *et seq.*, the Washington Industrial Safety and Health Act, RCW 49.17, and any other state or federal laws applicable to wage, hours, safety, or health standards.
- b. Prevailing Wages. Contractor shall file a "Statement of Intent to Pay Prevailing Wages", which shall include Contractor's registration certificate number and the prevailing rate of wage for each classification of workers entitled to prevailing wages under RCW 39.12.020, and the estimated number of workers in each classification. Contractor shall pay prevailing wages and comply with RCW 39.12 as well as any other applicable prevailing wage rate provisions. Contractor shall obtain the most current prevailing wage rate revision issued by the

Department of Labor and Industries. Contractor shall require all subcontractors to comply with RCW 39.12 and this section of the Contract.

11. Independent Contractor. Contractor shall be an independent contractor for all federal, state and other purposes.

12. Days and Time of Work. Contractor shall perform the Contract Work only during Monday through Friday and 7:00 a.m. to 5:00 p.m. unless otherwise authorized by the City or as identified in the contract specifications.

13. Audit of Contractor Records. Contractor shall maintain records which sufficiently and accurately reflect all the provision of goods and services and costs and expenses related to the performance of the Contract Work, and use such accounting procedures and practices as may be deemed necessary by the City to assure proper accounting of all funds paid pursuant to this Contract. Contractor shall make these records available to the City, at all reasonable times, for inspection, review or audit by the City, its authorized representative, the State Auditor or other governmental officials authorized by law to monitor this Contract.

14. Work Product. All originals and copies of work product related to the Contract Work, in whatever form, including, but not limited to, plans, sketches, layouts, designs, design specifications, records, files, computer disks, magnetic media or material, shall belong to the City. At the termination or expiration of this Contract, all originals and copies of any such work product in the possession of Contractor shall be delivered to the City. Contractor is entitled to retain copies of any work product for its own records.

15. Confidentiality. Contractor may use confidential information and other sensitive information gained by reason of its provision of services to the City, or by access to its property, when expressly authorized by the City, and only for City purposes. Contractor shall not disclose, transfer or sell any such information to any party except as provided by law or, in the case of personal information, without the prior written consent of the person to whom the personal information pertains. Contractor shall maintain the confidentiality of all personal information and other information gained by reason of its provision of services to the City, or by access to its property.

16. Insurance. Contractor shall procure and maintain for the duration of the Contract or activity associated with the Contract, whichever is longer, insurance against claims for injuries to persons or damage to property which may arise from or occur in connection with the performance of the work hereunder by Contractor, their agents, representatives, employees or subcontractors. Contractor's maintenance of insurance, its scope of coverage and limits as required herein shall not be construed to limit the liability of Contractor to the coverage provided by such insurance, or otherwise limit the City's recourse to any remedy available at law or in equity.

- a. Minimum Scope of Insurance. Contractor shall obtain insurance of the types and coverage as described below:
 - i. Automobile Liability insurance covering all owned, non-owned, hired and leased vehicles. Coverage shall be at least as broad as Insurance Services Office (ISO) form CA 00 0.
 - ii. Commercial General Liability insurance shall be at least as broad as ISO occurrence

form CG 00 01 and shall cover liability arising from premises, operations, stop gap liability, independent contractors, products-completed operations for a period of three years following substantial completion of the work for the benefit of the City, personal injury and advertising injury, and liability assumed under an insured contract. The Commercial General Liability insurance shall be endorsed to provide the Aggregate Per Project Endorsement ISO form CG 25 03 05 09 or substitute endorsement providing at least as broad coverage. There shall be no exclusion for liability arising from explosion, collapse or underground property damage. The City shall be named as an insured under Contractor's Commercial General Liability insurance policy with respect to the work performed for the City using ISO Additional Insured endorsement CG 20 10 10 01 and Additional Insured-Completed Operations endorsement CG 20 37 10 01 or substitute endorsements providing at least as broad coverage.

- iii. Workers' Compensation coverage as required by the Industrial Insurance laws of the State of Washington.
- iv. Builders Risk insurance covering interests of the City, Contractor, Subcontractors and Sub-subcontractors in the work. Builders Risk insurance shall be on a special perils policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including flood, earthquake, theft, vandalism, malicious mischief, or collapse. The Builders Risk insurance shall include coverage for temporary buildings, debris removal and damage to materials in transit or stored off site. This Builders Risk insurance covering the work will have a deductible of \$5,000 for each occurrence, which will be the responsibility of Contractor. Higher deductibles for flood and earthquake perils may be accepted by the City upon written request by Contractor and written acceptance by the City. Any increased deductibles accepted by the City will remain the responsibility of Contractor. The Builders Risk insurance shall be maintained until the City has granted substantial completion of the project. An installation floater may be acceptable in lieu of Builders Risk for renovation projects only if approved in writing by the City.

Builders Risk Insurance is is not required for this contract.

- b. Minimum Amounts of Insurance. Contractor shall maintain the following insurance limits:
 - i. Automobile Liability insurance with a minimum combined single limit for bodily injury and property damage of \$1,000,000 per accident.
 - ii. Commercial General Liability insurance shall be written with limits no less than \$2,000,000 each occurrence, \$2,000,000 general aggregate and a \$2,000,000 products-completed operations aggregate limit. Any combination of CGL and Excess/Umbrella coverage that meets the minimum limit requirements is acceptable.
 - iii. Builders Risk insurance shall be written in the amount of the completed value of the project with no coinsurance provisions.
- c. Other Insurance Provision. Contractor's Automobile Liability, Commercial General Liability and Builders Risk insurance policies are to contain, or be endorsed to contain, that they shall be primary insurance as respect to the City. Any Insurance, self-insurance or insurance pool coverage maintained by the City shall be in excess of Contractor's insurance and shall not contribute with it.

- d. Contractor's Insurance for Other Losses. Contractor shall assume full responsibility for all loss or damage from any cause whatsoever to any tools, Contractor's employee owned tools, machinery, equipment or motor vehicles owned or rented by Contractor, or Contractor's agents, suppliers or contractors as well as to any temporary structures, scaffolding and protective fences.
- e. Waiver of Subrogation. Contractor and the City waive all rights against each other, any of their Subcontractors, sub-subcontractors, agents and employees, each of the other, for damages caused by fire or other perils to the extent covered by Builders Risk insurance or other property insurance obtained pursuant to the Insurance Requirements Section of this Contract or other property insurance applicable to the work. The policies shall provide such waivers by endorsement or otherwise.
- f. Acceptability of Insurers. Insurance is to be placed with insurers with a current A.M. Best rating of not less than A: VII.
- g. Verification of Coverage: Contractor shall furnish the City with original certificates and a copy of the amendatory endorsements, including but not necessarily limited to the additional insured endorsements, evidencing the Automobile Liability and Commercial General Liability insurance of Contractor before commencement of the work. Before any exposure to loss may occur, Contractor shall file with the City a copy of the Builders Risk insurance policy that includes all applicable conditions, exclusions, definitions, terms and endorsements related to this project. Upon request by the City, the Contractor shall furnish certified copies of all required insurance policies, including endorsements, required in this contract and evidence of all subcontractors' coverage.
- h. Subcontractors: The Contractor shall cause each and every Subcontractor to provide insurance coverage that complies with all applicable requirements of the Contractor-provided insurance as set forth herein, except the Contractor shall have sole responsibility for determining the limits of coverage required to be obtained by Subcontractors. The Contractor shall ensure that the City is an additional insured on each and every Subcontractor's Commercial General liability insurance policy using an endorsements at least as broad as ISO Additional Insured endorsement CG 20 10 10 01 for ongoing operations and CG 20 37 10 01 for completed operations.
- i. Notice of Cancellation. Contractor shall provide the City and all Additional Insureds for this work with written notice of any policy cancellation within two business days of their receipt of such notice.
- j. Failure to Maintain Insurance. Failure on the part of Contractor to maintain the insurance as required shall constitute a material breach of contract, upon which the City may, after giving five business days' notice to Contractor to correct the breach, immediately terminate the contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the City on demand, or at the sole discretion of the City, offset against funds due Contractor from the City. Contractor is to ensure that insurance coverage is adequate for the scope of work as defined in the RFP (Request for Proposal) and design drawings.
- k. City's Full Availability of Contractor's Limits. If the Contractor maintains higher insurance limits than the minimums shown above, the City shall be insured for the full available limits of Commercial General and Excess or Umbrella liability maintained by the Contractor, irrespective of whether such limits maintained by the Contractor are greater than those

required by this contract or whether any certificate of insurance furnished to the City evidences limits of liability lower than those maintained by the Contractor.

17. Performance & Payment Bond. At such time as Contractor enters into this Contract, Contractor shall provide a performance and labor and materials payment bond in an amount that equals the Contract compensation as security for the faithful performance and payment of all Contractor's obligations under this Contract. The amount of the bond shall be increased for each change order in an amount that equals the amount of the change order. The bond shall be in a form that is acceptable to the City's attorney. The surety shall be licensed to conduct business in the State of Washington and shall be named in the current list of "Surety Companies Acceptable in Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Department.

In the event that the compensation called for in this Contract is less than \$150,000.00, which sum shall be determined after the addition of applicable Washington state sales tax, Contractor may, in lieu of the above mentioned bond, elect to have the City retain 10% of the contract amount for a period of either thirty (30) days after final acceptance, or until receipt of all necessary releases from the Department of Revenue and the Department of Labor and Industries and settlement of any liens filed under RCW 60.28, whichever is later.

18. Warranty. Contractor warrants that it shall correct all defects in workmanship and materials that occur within one (1) year from the date of the City's final acceptance of the Contract Work, or within the product or manufacturer's warranty period, whichever is longer. The expiration of this warranty shall be tolled for any defects in workmanship and materials until the defects are corrected. Thereafter, the warranty for the corrected portion of the Contract Work shall extend for one (1) year from the date that such correction is completed and accepted by the City. Contractor shall begin to correct any defects within the timeframe set forth in the notice of defect from the City. If Contractor does not accomplish the corrections within a reasonable time as determined by the City, the City may complete the corrections and Contractor shall pay all costs incurred by the City to achieve the correction.

Upon the City's final acceptance of the Contract Work, Contractor shall, at the option and upon demand of the City, provide the City with a warranty bond in a form and amount that is acceptable to the City.

19. Debarment. Contractor certifies that it is neither excluded nor disqualified as defined in 2 CFR Part 180. Contractor shall refrain from becoming excluded or disqualified and shall fully comply with the requirements of Subpart C of 2 CFR Part 180 and any applicable parts of 2 CFR Parts 300 through 5899. Contractor shall require each person or entity with whom Contractor enters into a covered transaction at the next lowest tier, as defined in 2 CFR Part 180, to fully comply with the requirements of Subpart C of 2 CFR Part 180, and any applicable parts of 2 CFR Parts 300 through 5899. If Contractor or a person or entity with whom Contractor enters into a covered transaction is excluded or debarred, Contractor shall immediately notify the City in writing.

20. Indemnification and Hold Harmless. Contractor shall defend, indemnify and hold the City, its officers, officials, employees and volunteers harmless from any and all claims, injuries, damages, losses or suits including attorney fees, arising out of or in connection with the performance of this Contract, except for injuries and damages caused by the sole negligence of the City.

However, should a court of competent jurisdiction determine that this Contract is subject to RCW 4.24.115, then, in the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of Contractor and the City, its officers, officials, employees and volunteers, Contractor's liability hereunder shall be only to the extent of Contractor's negligence.

It is further specifically and expressly understood that the indemnification provided herein constitutes Contractor's waiver of immunity under Industrial Insurance, Title 51 RCW, solely for the purposes of this indemnification. This waiver has been mutually negotiated by the parties. The provisions of this section shall survive the expiration or termination of this Contract.

21. Work Performed at Contractor's Risk. Contractor shall take all precautions necessary and shall be responsible for the safety of its employees, agents, and subcontractors in the performance of this Contract. All work shall be done at Contractor's own risk, and Contractor shall be responsible for any loss of or damage to materials, tools, or other articles used or held for use in connection with the work.

22. Termination. The City shall be entitled to terminate this Contract for good cause. "Good cause" shall include, but shall not be limited to, any one or more of the following events:

- a. Contractor's refusal or failure to supply a sufficient number of properly skilled workers or proper materials for completion of the Contract Work;
- b. Contractor's failure to make timely progress or complete the work within the timeframe required by the City;
- c. Contractor's failure to make full and prompt payment to subcontractors or for material or labor;
- d. Contractor's failure to comply with Federal, state or local laws, rules or regulations;
- e. Contractor's filing for bankruptcy or becoming adjudged bankrupt;
- f. Contractor's breach of any portion of this Contract; or
- g. Changes in budgetary allocations or funding.

23. Liquidated Damages. Contractor acknowledges and agrees as follows: The Contract Work is ultimately for the benefit of the public, and as such, there is a compelling need to complete the Contract Work in the time specified in the Contract. Due to the expenditure of public funds for the Contract Work, and the need to complete the Contract Work for the health, safety and welfare of the public, the failure to complete the Contract Work within the time specified in the Contract will result in loss and damage to the City. A delay will likely result in damages that arise as a consequence of, or are incidental to, the delay, additional costs and expenses to the City that are difficult to determine, tangible and intangible detriments to the City and loss of use and inconvenience to the public. However, damages for delay in the performance or completion of the Contract Work are and will be difficult to ascertain.

Although difficult to quantify and ascertain, the sum listed as liquidated damages represents a fair and reasonable forecast or estimation of the actual damage caused by a delay in the performance or completion of the Contract Work. In addition, the liquidated damages set forth below are intended to compensate the City for its loss and damage caused by delay. The liquidated damages are not intended to induce the performance of Contractor.

Accordingly, for each day that the Contract Work is not completed beyond the completion date specified in the Contract, or the completion date as directed by the City, the sum of \$_____ (calculated per WSDOT standard specification 1-08.9) shall be deducted from the amount to be paid Contractor and shall be retained by City as damages. In the event that the Contract is terminated by City for good cause pursuant to the general conditions of the Contract, this liquidated damages section shall apply, but only to the extent that the Contract Work is delayed. In addition to liquidated damages, City shall be permitted to recover from Contractor the cost of completion of the work if the cost of completion exceeds the original sum of money agreed upon.

24. Remedies Cumulative. Any remedies provided for under the terms of this Contract are not intended to be exclusive, but shall be cumulative with all other remedies available to the City at law, in equity or by statute.

25. Subcontractors. All subcontractors or use of subcontractors shall require the prior written approval of the City. Contractor shall incorporate the terms and conditions of this Contract into any subcontract used in connection with this project.

26. Assignment. Contractor shall not assign any interest in this Contract and shall not transfer any interest in same (whether by assignment or notation), without the prior written consent of the City thereto; provided, however, that claims for payment under this Contract may be assigned.

27. Notices. Any notices required to be given by City to Contractor or by Contractor to City shall be in writing and delivered to the parties at the addresses listed at the end of this Contract.

28. Waiver. Failure of the City to insist upon strict compliance with any terms, covenants or conditions of this Contract shall not be deemed a waiver of such, nor shall any waiver or relinquishment of such right or power at any time be taken to be a waiver of any other breach.

29. Applicable Law and Venue. This Contract shall be construed and interpreted in accordance with the laws of the State of Washington and, in the event of dispute, the venue of any action brought hereunder shall exclusively be in the Pierce County Superior Court.

30. Discrimination Prohibited. In all Contractor services, programs or activities, and all Contractor hiring and employment made possible, directly, indirectly, by or resulting from this Contract, Contractor shall not discriminate against any protected class or on any basis prohibited by federal or state law, including, but not limited to, sex, race, color, creed, religion, national origin, disability, use of a guide dog or service animal by a person with a disability, HIV/AIDS or hepatitis C status, sexual orientation, gender identity or honorably discharged veteran and military status.

31. Modification. No waiver, alteration, or modification of any of the provisions of this Contract shall be binding unless in writing and signed by a duly authorized representative of the City and Contractor.

32. Equal Opportunity to Draft. The parties have participated and had an equal opportunity to participate in the drafting of this Contract, and the incorporated documents, if any. No ambiguity shall be construed against any party upon a claim that that party drafted the ambiguous language.

33. Severability. If any term, provision, covenant or condition of this Contract is held by a court of competent jurisdiction to be invalid, void, or unenforceable, the remainder of the provisions hereof shall remain in full force and effect and shall in no way be affected, impaired or invalidated as a result of such decision, unless the purpose and intent of this Contract is made materially ineffective or destroyed.

34. Entire Agreement. The written provisions and terms of this Contract, together with any attachments, supersede all prior verbal statements by any representative of the City, and those statements shall not be construed as forming a part of or altering in any manner this Contract. This Contract and any attachments contain the entire Contract between the parties. Should any language in any attachment conflict with any language contained in this Contract, the terms of this Contract shall prevail.

35. Concurrent Originals. This Contract may be executed in any number of counterparts, which counterparts shall collectively constitute the entire Contract.

IN WITNESS WHEREOF, the parties below have executed this Contract, and by doing so, acknowledge that they have read this Contract understand its terms, and enter this Contract in a knowing, intelligent, and voluntary manner.

Dated: _____
By: _____
Its: _____

City of Puyallup

Dated: _____
Steve Kirkelie
City Manager

Approved as to form: _____ Attest:

Joseph N. Beck
City Attorney

Brenda Fritsvold
City Clerk

Notices to be sent to:	Notices to be sent to:
	City of Puyallup
Attn:	Attn: Michelle Gehring
	Contract Specialist
	333 South Meridian
	Puyallup, WA 98371

SAMPLE

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SAMPLE

Bond No. ____

RETAINAGE BOND

Contract No.

KNOW ALL BY THESE PRESENTS: That _____, a corporation existing under and by virtue of the laws of the State of _____ and authorized to do business in the State of Washington, as Principal, and _____, a corporation organized and existing under the laws of the State of _____ and authorized to transact the business of surety in the State of Washington, as Surety, are jointly and severally held and bound unto City of Puyallup (City) and the State of Washington (State), and are similarly held and bound unto the beneficiaries of the trust fund created by Chapter 60.28 Revised Code of Washington (RCW), and their heirs, executors, administrators, successors and assigns in the penal sum of _____ Dollars (\$ _____), plus 5% of any increases in the contract amount that have occurred or may occur, due to change orders, increases in the quantities or the addition of any new item of work.

WHEREAS, the Principal has executed Contract for _____ (Project Number _____) with the City; and

WHEREAS, said Contract and Chapter 60.28 RCW require the City to withhold from the Principal the sum of five percent (5%) from monies earned by the Principal on estimates during the progress of the work, hereinafter referred to as earned retained funds; and

WHEREAS, the Principal/Surety has requested that the City accept a bond in lieu of earned retained funds as allowed under Chapter 60.28 RCW.

NOW, THEREFORE, this obligation is such that the Surety, its successors and assigns, are held and bound unto City, State and unto all beneficiaries of the trust fund created by RCW 60.28.011(1) in the aforesaid sum. This bond, including any proceeds therefrom, is subject to all claims and liens and in the same manner and priority as set forth for retained percentages in Chapter 60.28 RCW. The condition of this obligation is such that if the Principal shall satisfy all payment obligations to persons who may lawfully claim under the trust fund created pursuant to Chapter 60.28 RCW, to the State of Washington, and to the City, and indemnify and hold the City harmless from any and all loss, costs, and damages that the City may sustain by release of said retainage to Principal/Surety, then this obligation shall be null and void provided the Surety is notified by City that the requirements of RCW 60.28.021 have been satisfied and the obligation is duly released by City; otherwise it shall remain in full force and effect.

IT IS HEREBY DECLARED AND AGREED that the Surety shall be liable under this obligation as Principal. The Surety will not be discharged or released from liability for any act, omission, or defense of any kind or nature that would not also discharge the Principal.

IT IS HEREBY FURTHER DECLARED AND AGREED that this obligation shall be binding upon and inure to the benefit of the Principal, the Surety, the City, State and, the beneficiaries of the trust fund created by Chapter 60.28, Revised Code of Washington (RCW) and their respective heirs, executors, administrators, successors and assigns.

SIGNED AND SEALED this _____ day of _____, 20____.

Principal:

Surety:

By: _____

By: _____

Name:

Name:

Title:

Title:

Address:

Address:

City / State / Zip Code:

City / State / Zip Code:

Telephone No.:

Telephone No.:

Witness: _____

Witness: _____

Note: A power of attorney must be provided which appoints the Surety's true and lawful attorney-in-fact to make, execute, seal and deliver this bond.

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PERFORMANCE AND PAYMENT BOND

CITY OF PUYALLUP

CONTRACT NAME: WATER POLLUTION CONTROL PLANT THIRD SECONDARY CLARIFIER INSTALLATION,

JOB NUMBER: CIP 20-018

KNOW ALL MEN BY THESE PRESENTS that _____,
as Principal, and _____ Company, as Surety,
licensed to do business within Washington State, are held and firmly bound under the City of Puyallup,
State of Washington, in the full sum of _____ Dollars
(\$_____) lawful money of the United States, for the payment of which well and
truly to be made, we bind ourselves, our heirs, executors and administrators, successors and assigns,
jointly and severally, firmly by these presents.

The conditions of the obligations are such that,

WHEREAS, the Principal has entered into an Agreement in writing with the City of Puyallup dated
_____, 20___, for the **WATER POLLUTION CONTROL PLANT**

THIRD SECONDARY CLARIFIER INSTALLATION PROJECT, according to the terms, conditions, and
covenants specified in the Agreement including all of the Contract Documents therein referred to, which
are hereby referred to and made a part hereof as fully and completely as though set forth in detail herein;
and

WHEREAS, it is understood and a part of the consideration for this obligation that the City of
Puyallup shall have the right to sue on this Bond in its own name to recover for any loss, injury, damage,
or liability whatsoever sustained or incurred by it, by reason of any breach of the Contract Documents, or
of any provision in this Bond; and

WHEREAS, suit on this Bond, if brought for breach of performance by Principal as to a condition
hereof (including any condition or performance responsibility incorporated by reference), may be
commenced against both the Principal and Surety as joint and several obligators, with or without prior
notice of such breach of performance by Principal having been given to Surety;

NOW, THEREFORE, if the Principal shall well, truly, and faithfully perform all of the provisions and
fulfill all of the undertakings, covenants, terms, conditions, and agreements of said Contract during the
period of the original Contract, and any extension thereof that may be granted by the City of Puyallup,
with or without notice to the Surety, and during the life of any guarantee required under the Contract and
shall also well and truly perform and fulfill all of the undertakings, covenants, terms, conditions, and
agreements of any and all duly authorized modifications of said Contract that may hereafter be made,
notice of which modifications to the Surety being hereby waived; and furthermore, shall pay all laborers,
mechanics, subcontractors and materialmen, and all persons who shall supply such person or persons,
and such Principal or subcontractors with the provisions and supplies for the carrying on of such work,
shall indemnify and save harmless the City of Puyallup from all cost and damage by reason of the
Principal’s default or failure to do so and shall pay Washington State sales and use taxes and the amounts
due said State pursuant to Titles 50 and 51 of the Revised Code of Washington, and shall further indemnify
the workmanship or materials entering into any part of the work as defined in the Agreement that shall
develop or be discovered within two (2) years after the final acceptance of such work, then this obligation
shall be null and void, otherwise, to remain in full force and effect; provided, that the provisions of this
Bond shall not apply to any money loaned or advanced to the Principal or any subcontractor or other
person in the performance of any such work.

IT IS FURTHER DECLARED AND AGREED that nothing of any kind or nature whatsoever that will not discharge the Principal, shall operate as a discharge or release of liability of the Surety, any law, rule of equity, or usage relating to the liability of sureties to the contrary notwithstanding.

SEALED AND DATED THIS _____ day of _____, 20__.

PRINCIPAL:
By: _____
Signature

Print or Type Name

Title: _____

SURETY:
By: _____
Signature

Print or Type Name

Title: _____

Address:

Note: If Attorney-in-Fact signs for Surety, a certified copy of the Power of Attorney must be attached.

STATE OF WASHINGTON)
) SS.
COUNTY OF PIERCE)

On this day personally appeared before me _____

to me known to be the individual described in and who executed the within and foregoing instrument and acknowledged to me that he/she signed the same as his/her free and voluntary act and deed for the uses and purposes therein mentioned.

GIVEN UNDER MY HAND AND OFFICIAL SEAL this _____ day of _____, 20__.

NOTARY PUBLIC in and for the State of Washington
Washington, residing at _____

STATE OF WASHINGTON)
) SS.
COUNTY OF PIERCE)

On this day personally appeared before me _____,
to me known to be the Attorney-in-Fact of the _____ Company, a surety,
that executed the within and foregoing instrument, and acknowledged the said corporation for the
purposes therein mentioned, and on oath, stated that he/she was authorized to execute said instrument
on behalf of said Surety, and the seal affixed thereto is the corporate seal of said Surety corporation.

NOTARY PUBLIC in and for the State of Washington
Washington, residing at _____

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LIABILITY CERTIFICATE OF INSURANCE

Description of Contract: **WATER POLLUTION CONTROL PLANT THIRD SECONDARY CLARIFIER INSTALLATION PROJECT,**

Type of Insurance: Liability Insurance

THIS IS TO CERTIFY that the following policies have been issued by the below-stated company in conformance with the requirements of the General Conditions and are in force at this time:

Policy Number	Expiration Date	Liability	Limits of Liability in Thousands (000)	
			Each Occurrence	Aggregate
GENERAL LIABILITY				
_____	_____	<u>Bodily Injury</u>	\$ _____	\$ _____
_____	_____	<u>Property Damage</u>	\$ _____	\$ _____
_____	_____	<u>Personal Injury</u>	\$ _____	\$ _____
		or		
_____	_____	<u>Bodily Injury, Personal Injury, and Property Damage, Combined</u>	\$ _____	\$ _____
		<u>Excess General Liability</u>	\$ _____	\$ _____
AUTOMOBILE LIABILITY				
			Each Occurrence	
_____	_____	<u>Bodily Injury (Each Person)</u>	\$ _____	
_____	_____	<u>Bodily Injury (Each Accident)</u>	\$ _____	
			Each Occurrence	Aggregate
		<u>Property Damage</u>	\$ _____	\$ _____
		or		
		<u>Bodily Injury and Property Damage, Combined</u>	\$ _____	\$ _____
_____	_____	<u>EXCESS AUTOMOBILE LIABILITY</u>	\$ _____	\$ _____

The following types of coverage are included in said policies (indicated by "X" in space):

A. GENERAL LIABILITY

- Comprehensive Form..... Yes _____ No _____
- Premises Operations..... Yes _____ No _____
- Explosion and Collapse Hazard Yes _____ No _____
- Underground Hazard Yes _____ No _____

Products/Completed Operations Hazard..... Yes _____ No _____
 Contractual Insurance..... Yes _____ No _____
 Broad Form Property Damage
 Including Completed Operations Yes _____ No _____
 Independent Contractors..... Yes _____ No _____
 Personal Injury Yes _____ No _____

B. AUTOMOBILE LIABILITY

Comprehensive Form Including Loading and Unloading Yes _____ No _____
 Owned..... Yes _____ No _____
 Hired..... Yes _____ No _____
 Non-Owned..... Yes _____ No _____

C. EXCESS LIABILITY

Umbrella Form Yes _____ No _____
 Other Than Umbrella Form..... Yes _____ No _____

This certificate or verification of insurance is not an insurance policy and does not amend, extend, or alter the coverage afforded by the policies listed herein. Notwithstanding any requirement, term, or condition of any contract or other document with respect to which this certificate or verification of insurance may be issued or may pertain, the insurance afforded by the policies described herein is subject to all the terms, exclusions, and conditions of such policies.

The Contractor will give at least thirty (30) days written notice by certified mail to the City prior to any material change or cancellation of said policy.

_____	_____
Named Insured (Contractor)	Insurance Company
_____	_____
Street Number	Street Number
_____	_____
City and State	City and State
	By _____
	Company Representative
	(SEE NOTICE ON PAGE 4 OF THIS FORM)

State of _____)
) SS.
 County of _____)
 On this _____ day of _____, 20____, before me personally came _____, to me known _____ (name)
 to be the _____ of _____ (title) (company)

and, being duly sworn, acknowledged to me that he/she executed the within instrument on behalf of said insurance company.

IN WITNESS WHEREOF, I have signed and affixed my official seal on the date in this certificate first above written.

NOTARY PUBLIC
in and for the State of Washington, residing at

Insurance Company Agent for Service of Process in Washington.

Name

Name

Street Number

Street Number

City and State

City and State

Telephone Number

Telephone Number

NOTICE:

If the insurance called for is provided by more than one insurance company, a separate certificate in the exact above form shall be provided for each insurance company.

Insurers must be authorized to do business and have an agent for service of process in Washington and have an "A" policyholder's rating and a financial rating of at least Class XI in accordance with the most current Best's rating.

(this page intentionally left blank)

LIABILITY INSURANCE ENDORSEMENT

Description of Contract: **WATER POLLUTION CONTROL PLANT THIRD SECONDARY CLARIFIER INSTALLATION,**

Type of Insurance: Liability Insurance

This Endorsement forms a part of Policy No. _____.

ENDORSEMENT

The City, as included as additional insureds under said policies but only while acting in the capacity as such and only as respects operations of the named insured, Contractor, subcontractors, suppliers, anyone directly or indirectly employed by and of them, or anyone for whose acts and of them may be liable in the performance of the above-referenced Contract. This insurance shall not apply if the loss or damage is ultimately determined to be the result of the sole and exclusive negligence (including and connected with the preparation or approval of maps, drawings, opinions, reports, survey, designs, or Specifications) of one or more of the aforesaid additional insureds. The insurance afforded to any loss, the amount of this insurance shall not be reduced or prorated by the existence of such other insurance.

The Contractual Liability Insurance afforded is sufficiently broad to insure all of the matters set forth in the article entitled "Indemnity" in the General Conditions of the above-referenced Contract except those matters set forth in the fourth paragraph thereof.

This endorsement does not increase the Company's total limits of liability.

_____	_____
Named Insured (Contractor)	Insurance Company
_____	_____
Street Number	Street Number
_____	_____
City and State	City and State
_____	By _____
Date	Company Representative

State of _____)
) SS.
 County of _____)

On this _____ day of _____, 20____, before me personally came _____, to me known, and being duly sworn did depose and say that he/she is an authorized representative of _____, and acknowledged to me that he/she executed the within instrument on behalf of said insurance company.

IN WITNESS WHEREOF, I have signed and affixed my official seal on the date in this certificate first above written.

NOTARY PUBLIC
in and for the State of Washington, residing at

NOTICE

If the insurance called for is provided by more than one policy, a separate endorsement in the exact above form shall be provided for each policy.

Insurers must be authorized to do business and have an agent for service of process in Washington and have an "A" policyholder's rating and financial rating of at least Class XI in accordance with the most current Best's rating.

The Contractual Liability Insurance afforded is sufficiently broad to insure all of the matters set forth in the article entitle "Indemnity" in the General Conditions of the above-referenced Contract except those matters set forth in the fourth paragraph thereof.

This endorsement does not increase the Company's total limits of liability.

_____ Named Insured (Contractor)	_____ Insurance Company
_____ Street Number	_____ Street Number
_____ City and State	_____ City and State
_____ Date	By _____ Company Representative

State of _____)
) SS.
 County of _____)
 On this _____ day of _____, 20____, before me personally came _____, to me known, and being duly sworn did depose and say that he/she is an authorized representative of _____, and acknowledged to me that he/she executed the within instrument on behalf of said insurance company.

IN WITNESS WHEREOF, I have signed and affixed my official seal on the date in this certificate first above written.

NOTARY PUBLIC
in and for the State of Washington, residing at

STATEMENT OF INTENT TO PAY PREVAILING WAGES

(Public Works Contract)

RCW 39.12.040

Statement of intent to pay prevailing wages, affidavit of wages paid — Duty of public agencies to require — Approval — Prerequisite to payment — Alternative procedure.

- (1) Except as provided in subsection (2) of this section, before payment is made by or on behalf of the state, or any county, municipality, or political subdivision created by its laws, of any sum or sums due on account of a public works contract, it shall be the duty of the officer or person charged with the custody and disbursement of public funds to require the contractor and each and every subcontractor from the contractor or a subcontractor to submit to such officer a “Statement of Intent to Pay Prevailing Wages.” For a contract in excess of ten thousand dollars, the statement of intent to pay prevailing wages shall include:
 - (a) The contractor’s registration certificate number; and
 - (b) The prevailing rate of wage for each classification of workers entitled to prevailing wages under RCW 39.12.020 and the estimated number of workers in each classification.

Each statement of intent to pay prevailing wages must be approved by the industrial statistician of the department of labor and industries before it is submitted to said officer. Unless otherwise authorized by the department of labor and industries, each voucher claim submitted by a contractor for payment on a project estimate shall state that the prevailing wages have been paid in accordance with the prefiled statement or statements of intent to pay prevailing wages on file with the public agency. Following the final acceptance of a public works project, it shall be the duty of the officer charged with the disbursement of public funds, to require the contractor and each and every subcontractor from the contractor or a subcontractor to submit to such officer an “Affidavit of Wages Paid” before the funds retained according to the provisions of RCW 60.28.010 are released to the contractor. Each affidavit of wages paid must be certified by the industrial statistician of the department of labor and industries before it is submitted to said officer.

- (2) As an alternate to the procedures provided for in subsection (1) of this section, for public works projects of two thousand five hundred dollars or less:
 - (a) An awarding agency may authorize the contractor or subcontractor to submit the statement of intent to pay prevailing wages directly to the officer or person charged with the custody or disbursement of public funds in the awarding agency without approval by the industrial statistician of the department of labor and industries. The awarding agency shall retain such statement of intent to pay prevailing wages for a period of not less than three years.
 - (b) Upon final acceptance of the public works project, the awarding agency shall require the contractor or subcontractor to submit an affidavit of wages paid. Upon receipt of the affidavit of wages paid, the awarding agency may pay the contractor or subcontractor in full, including funds that would otherwise be retained according to the provisions of RCW 60.28.010. Within thirty days of receipt of the affidavit of wages paid, the awarding agency shall submit the affidavit of wages paid to the industrial statistician of the department of labor and industries for approval.
 - (c) A statement of intent to pay prevailing wages and an affidavit of wages paid shall be on forms approved by the department of labor and industries.

- (d) In the event of a wage claim and a finding for the claimant by the department of labor and industries where the awarding agency has used the alternative process provided for in subsection (2) of this section, the awarding agency shall pay the wages due directly to the claimant. If the contractor or subcontractor did not pay the wages stated in the affidavit of wages paid, the awarding agency may take action at law to seek reimbursement from the contractor or subcontractor of wages paid to the claimant, and may prohibit the contractor or subcontractor from bidding on any public works contract of the awarding agency for up to one year.
- (e) Nothing in this section shall be interpreted to allow an awarding agency to subdivide any public works project of more than two thousand five hundred dollars for the purpose of circumventing the procedures required by RCW 39.12.040(1).

Statement of Intent to Pay Prevailing Wages

Department of Labor and Industries
 Prevailing Wage
 (360) 902-5335
www.lni.wa.gov/TradesLicensing/PrevWage



**STATEMENT OF INTENT TO
 PAY PREVAILING WAGES**

**Public Works Contract
 \$40.00 Filing Fee Required**

Intent ID # (Assigned by L&I) _____

- This form **must** be typed or printed in ink.
- **Fill in all blanks or the form will be returned for correction (see instructions).**
- Please allow a **minimum** of 10 working days for processing.
- Once approved, your form will be posted online at <https://fortress.wa.gov/lmi/pwipub/SearchFor.asp>

Your Company Information				Awarding Agency Information			
Your Company Name				Project Name		Contract Number	
Your Address				Awarding Agency			
City		State	Zip+4	Awarding Agency Address			
Your Contractor Registration Number		Your UBI Number		City		State	Zip+4
Your Industrial Insurance Account Number				Awarding Agency Contact Name		Phone Number	
Your Email Address (required for notification of approval)		Your Phone Number		County Where Work Will Be Performed		City Where Work Will Be Performed	
Additional Detail:				Contract Details:			
Your Expected Job Start Date (mm/dd/yyyy)				Bid Due Date (Prime Contractor's)		Award Date (Prime Contractor's)	
Job Site Address/Directions				Total Dollar Amount of Your Contract (including sales tax) or indicate time and materials, if applicable.		\$	<input type="checkbox"/> T&M
ARRA Funds:				Weatherization or Energy Efficient Funds:			
Does this project utilize American Recovery and Reinvestment Act (ARRA) funds? <input type="checkbox"/> Yes <input type="checkbox"/> No				Does this project utilize any weatherization or energy efficiency upgrade funds (ARRA or otherwise)? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Prime Contractor's Company Information				Hiring Contractor's Company Information			
Prime Contractor's Company Name		Prime Contractor's Intent Number		Hiring Contractor's Company Name			
Prime Contractor's Registration Number		Prime Contractor's UBI Number		Hiring Company's Contractor Registration Number		Hiring Contractors UBI Number	
Employment Information							
Do you intend to use ANY subcontractors?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	Will employees perform work on this project?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Will ALL work be subcontracted?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	Do you intend to use apprentice employees?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Number of Owner/Operators who own at least 30% of the company who will perform work on this project:				<input type="checkbox"/> None (0)	<input type="checkbox"/> One (1)	<input type="checkbox"/> Two (2)	<input type="checkbox"/> Three (3)
Crafts/Trades/Occupations – (Do not list apprentices. They are listed on the Affidavit of Wages Paid only.) If an employee works in more than one trade, ensure that all hours worked in each trade are reported below. For additional crafts/trades/occupations please use Addendum A.				Number of Workers	Rate of Hourly Pay	Rate of Hourly Usual ("Fringe") Benefits	
Signature Block:							
I hereby certify that I have read and understand the instructions to complete this form and that the information, including any addenda, are correct and that all workers I employ on this Public Works Project will be paid no less than the Prevailing Wage Rate(s) as determined by the Industrial Statistician of the Department of Labor and Industries.							
Print Name:		Print Title:		Signature:		Date:	
For L&I Use Only							
Approved by signature of the Department of Labor and Industries Industrial Statistician							

NOTICE: If the prime contract is at a cost of over one million dollars (\$1,000,000.00), RCW 39.04.370 requires you to complete the EHB 2805 (RCW 39.04.370) Addendum and attach it to your Affidavit of Wages of Paid when your work on the project concludes. This is only a notice. The EHB 2805 Addendum is not submitted with this Intent. F700-029-000 Statement of Intent to Pay Prevailing Wages 03-2011

AFFIDAVIT OF WAGES PAID

Department of Labor and Industries
 Prevailing Wage Program
 (360) 902-5335
www.Lni.wa.gov/TradesLicensing/PrevWage/default.asp



Affidavit of Wages Paid
Public Works Contract
\$40.00 Filing Fee Required*

*Exemption may apply. See instruction 9.

Affidavit ID # (Assigned by L&I):

This form must be typed or printed in ink.
Fill in ALL blanks or the form will be returned for correction (see instructions).
 Please allow a minimum of 10 business days for processing.
 Once approved, your form will be posted online at:
<https://fortress.wa.gov/lni/wagelookup/searchforms.aspx>

Your Company Information 1				Awarding Agency Information 2			
Your Company Name				Project Name		Contract Number	
Your Company Address				Awarding Agency			
City		State	Zip+4	Awarding Agency Address			
Your Contractor Registration Number		Your UBI Number		City		State	Zip+4
Your Industrial Insurance Account Number				Awarding Agency Contact Name		Phone Number	
Your Email Address (required for notification of approval)		Your Phone Number		County Where Work Was Performed		City Where Work Was Performed	
Additional Details 3				Contract Details 4			
Your Job Start Date (mm/dd/yyyy)		Your Date Work Completed (mm/dd/yyyy)		Bid Due Date (Prime Contractor's)		Award Date (Prime Contractor's)	
Job Site Address/Directions		Your Approved Intent ID #		Indicate Total Dollar Amount of Your Contract (including sales tax).		\$	
EHB 2805 (RCW 39.04.370) – Is the Prime Contractor's contract at a cost of over one million dollars (\$1,000,000)? <input type="checkbox"/> No <input type="checkbox"/> Yes				If "Yes" to the EHB 2805 question and the Award Date is 9/1/2010 or later you must complete and submit the EHB 2805 (RCW 39.04.370) Addendum.			
ARRA Funds 6				Weatherization or Energy Efficient Funds 6			
Does this project utilize American Recovery and Reinvestment Act (ARRA) funds? <input type="checkbox"/> Yes <input type="checkbox"/> No				Does this project utilize any weatherization or energy efficiency upgrade funds (ARRA or otherwise)? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Prime Contractor's Company Information 7				Hiring Contractor's Company Information 8			
Prime Contractor's Company Name				Hiring Contractor's Company Name			
Prime Contractor's Registration Number		Prime Contractor's UBI Number		Hiring Contractor's Registration Number		Hiring Contractor's UBI Number	
Employment Information 9							
Did you use ANY subcontractors?		<input type="checkbox"/> Yes (Addendum B Required) <input type="checkbox"/> No		Did employees perform work on this project?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Was ALL work subcontracted?		<input type="checkbox"/> Yes (Addendum B Required) <input type="checkbox"/> No		Did you use apprentice employees?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Number of Owner/Operators who own at least 30% of the company who performed work on this project: You must list the First and Last Name(s) of any Owner/Operator performing work below				<input type="checkbox"/> None (0) <input type="checkbox"/> One (1) <input type="checkbox"/> Two (2) <input type="checkbox"/> Three (3)			
List your Crafts/Trades/Occupations Below - For Journey Level Workers you must provide all of the information below. Owner/Operators - must provide their First and Last name no other information required. **Apprentices are not recorded below. You must use Addendum D to list Apprentices.				Number of Workers	Total # of Hours Worked	Rate of Hourly Pay	Rate of Hourly Usual ("Fringe") Benefits
				10	11	12	13
Signature Block							
I hereby certify that I have read and understand the instructions to complete this form and that the information on the form and any addenda is correct and that all workers I employed on this Public Works Project were paid no less than the Prevailing Wage Rate(s) as determined by the Industrial Statistician of the Department of Labor and Industries.							
Print Name:		Print Title:		Signature:		Date:	
For L&I Use Only							
Department of Labor and Industries APPROVED BY: _____ Industrial Statistician							

SPECIAL PROVISIONS

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INTRODUCTION TO THE SPECIAL PROVISIONS

(*****)

The work on this project shall be accomplished in accordance with the *Standard Specifications for Road, Bridge and Municipal Construction*, 2023 edition, as issued by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), Washington State Chapter (hereafter “Standard Specifications”). The Standard Specifications, as modified or supplemented by these Special Provisions, all of which are made a part of the Contract Documents, shall govern all of the Work.

These Special Provisions are made up of both General Special Provisions (GSPs) from various sources, which may have project-specific fill-ins; project-specific Special Provisions and Technical Provisions. Each Provision either supplements, modifies, or replaces the comparable Standard Specification, or is a new Provision. The deletion, amendment, alteration, or addition to any subsection or portion of the Standard Specifications is meant to pertain only to that particular portion of the section, and in no way should it be interpreted that the balance of the section does not apply.

The project-specific Special Provisions are not labeled as such. The GSPs are labeled under the headers of each GSP, with the effective date of the GSP and its source. For example:

(March 8, 2013 APWA GSP)

(April 1, 2013 WSDOT GSP)

(June 1, 2015 Puyallup GSP)

Technical Provisions. The Technical Provisions are unique specifications in that the format is not the same as the *Standard Specifications* (WSDOT Standard Format). Generally, the Technical Provisions specify only the materials and construction requirements for items of work not typically described in the *Standard Specifications*.

Also incorporated into the Contract Documents by reference are:

- *Manual on Uniform Traffic Control Devices for Streets and Highways*, currently adopted edition, with Washington State modifications, if any
- *Standard Plans for Road, Bridge and Municipal Construction*, WSDOT/APWA, current edition
- *Stormwater Management Manual for Western Washington, 2019*, Washington State Department of Ecology
- *City of Puyallup Standard Plans*
- *Puyallup City Standards for Public Works Engineering and Construction*

Contractor shall obtain copies of these publications, at Contractor’s own expense.

DIVISION 1

GENERAL REQUIREMENTS

DESCRIPTION OF WORK

(March 13, 1995 WSDOT GSP)

This Contract provides for the improvement of **Water Pollution Control Plant Third Secondary Clarifier Installation Project** and other work, all in accordance with the attached Contract Plans, these Contract Provisions, and the Standard Specifications.

1-01 DEFINITIONS AND TERMS

1-01.3 Definitions

(January 4, 2016 APWA GSP)

Delete the heading **Completion Dates** and the three paragraphs that follow it, and replace them with the following:

Dates

Bid Opening Date

The date on which the Contracting Agency publicly opens and reads the Bids.

Award Date

The date of the formal decision of the Contracting Agency to accept the lowest responsible and responsive Bidder for the Work.

Contract Execution Date

The date the Contracting Agency officially binds the Agency to the Contract.

Notice to Proceed Date

The date stated in the Notice to Proceed on which the Contract time begins.

Substantial Completion Date

The day the Engineer determines the Contracting Agency has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, any remaining traffic disruptions will be rare and brief, and only minor incidental work, replacement of temporary substitute facilities, plant establishment periods, or correction or repair remains for the Physical Completion of the total Contract.

Physical Completion Date

The day all of the Work is physically completed on the project. All documentation required by the Contract and required by law does not necessarily need to be furnished by the Contractor by this date.

Completion Date

The day all the Work specified in the Contract is completed and all the obligations of the Contractor under the contract are fulfilled by the Contractor. All documentation required by the Contract and required by law must be furnished by the Contractor before establishment of this date.

Final Acceptance Date

The date on which the Contracting Agency accepts the Work as complete.

Supplement this Section with the following:

All references in the Standard Specifications, Amendments, or WSDOT General Special Provisions, to the terms “Department of Transportation”, “Washington State Transportation Commission”, “Commission”, “Secretary of Transportation”, “Secretary”, “Headquarters”, and “State Treasurer” shall be revised to read “Contracting Agency”.

All references to the terms “State” or “state” shall be revised to read “Contracting Agency” unless the reference is to an administrative agency of the State of Washington, a State statute or regulation, or the context reasonably indicates otherwise.

All references to “State Materials Laboratory” shall be revised to read “Contracting Agency designated location”.

All references to “final contract voucher certification” shall be interpreted to mean the Contracting Agency form(s) by which final payment is authorized, and final completion and acceptance granted.

Additive

A supplemental unit of work or group of bid items, identified separately in the Bid Proposal, which may, at the discretion of the Contracting Agency, be awarded in addition to the base bid.

Alternate

One of two or more units of work or groups of bid items, identified separately in the Bid Proposal, from which the Contracting Agency may make a choice between different methods or material of construction for performing the same work.

Business Day

A business day is any day from Monday through Friday except holidays as listed in Section 1-08.5.

Contract Bond

The definition in the Standard Specifications for “Contract Bond” applies to whatever bond form(s) are required by the Contract Documents, which may be a combination of a Payment Bond and a Performance Bond.

Contract Documents

See definition for “Contract”.

Contract Time

The period of time established by the terms and conditions of the Contract within which the Work must be physically completed.

Notice of Award

The written notice from the Contracting Agency to the successful Bidder signifying the Contracting Agency’s acceptance of the Bid Proposal.

Notice to Proceed

The written notice from the Contracting Agency or Engineer to the Contractor authorizing and directing the Contractor to proceed with the Work and establishing the date on which the Contract time begins.

Traffic

Both vehicular and non-vehicular traffic, such as pedestrians, bicyclists, wheelchairs, and equestrian traffic.

(June 1, 2015 Puyallup GSP)

Supplement this section with the following:

City Attorney

The City of Puyallup City Attorney who is duly authorized to act for the Owner in matters pertaining to this Contract.

City, District, or Owner

The City, District, or Owner, a municipal corporation, existing under and by virtue of the laws of Washington State, herein designated as the "Owner". Actions designated as taken by the City, District, or Owner are the acts of the Commission or Council acting through the Chairman, Mayor, and/or the Clerk.

City Engineer

The City Engineer, or his/her designee, shall manage the Contract for the Owner. The City Engineer is the approval authority for changes to the Contract.

Clerk

The duly elected or appointed Clerk of the Commission or Council.

Commission or Council

The duly elected or appointed Council or Commission of the Owner.

1-02 BID PROCEDURES AND CONDITIONS**1-02.1 Prequalification of Bidders**

Delete this section and replace it with the following:

1-02.1 Qualifications of Bidder

(January 24, 2011 APWA GSP)

Before award of a public works contract, a bidder must meet at least the minimum qualifications of RCW 39.04.350(1) to be considered a responsible bidder and qualified to be awarded a public works project.

Add the following new section:

1-02.1(1) Supplemental Qualifications Criteria

(July 31, 2017 APWA GSP)

In addition, the Contracting Agency has established Contracting Agency-specific and/or project-specific supplemental criteria, in accordance with RCW 39.04.350(3), for determining Bidder responsibility, including the basis for evaluation and the deadline for appealing a determination that a Bidder is not responsible. These criteria are contained in Section 1-02.14 Option C of these Special Provisions.

1-02.2 Plans and Specifications

(June 27, 2011 APWA GSP)

Delete this section and replace it with the following:

Information as to where Bid Documents can be obtained or reviewed can be found in the Call for Bids (Advertisement for Bids) for the work.

After award of the contract, plans and specifications will be issued to the Contractor at no cost as detailed below:

To Prime Contractor	No. of Sets	Basis of Distribution
Reduced plans (11" x 17")	4	Furnished automatically upon award.
Contract Provisions	6	Furnished automatically upon award.
Large plans (e.g., 22" x 34")	2	Furnished automatically upon award.

Additional plans and Contract Provisions may be obtained by the Contractor from the source stated in the Call for Bids, at the Contractor's own expense.

1-02.4 Examination of Plans, Specifications and Site Work

1-02.4(1) General

(December 30, 2022 APWA GSP Option B)

The first sentence of the ninth paragraph, beginning with “Prospective Bidder desiring...”, is revised to read:

Prospective Bidders desiring an explanation or interpretation of the Bid Documents, shall request the explanation or interpretation in writing by close of business 10 business days preceding the bid opening to allow a written reply to reach all prospective Bidders before the submission of their Bids.

1-02.4(2) Subsurface Information

(March 8, 2013 APWA GSP)

The second sentence in the first paragraph is revised to read:

The Summary of Geotechnical Conditions and the boring logs, if and when included as an appendix to the Special Provisions, shall be considered as part of the Contract.

1-02.5 Proposal Forms

(July 31, 2017 APWA GSP)

Delete this section and replace it with the following:

The Proposal Form will identify the project and its location and describe the work. It will also list estimated quantities, units of measurement, the items of work, and the materials to be furnished at the unit bid prices. The bidder shall complete spaces on the proposal form that call for, but are not limited to, unit prices; extensions; summations; the total bid amount; signatures; date; and, where applicable, retail sales taxes and acknowledgment of addenda; the bidder’s name, address, telephone number, and signature; the bidder’s UDBE/DBE/M/WBE commitment, if applicable; a State of Washington Contractor’s Registration Number; and a Business License Number, if applicable. Bids shall be completed by typing or shall be printed in ink by hand, preferably in black ink. The required certifications are included as part of the Proposal Form.

The Contracting Agency reserves the right to arrange the proposal forms with alternates and additives, if such be to the advantage of the Contracting Agency. The bidder shall bid on all alternates and additives set forth in the Proposal Form unless otherwise specified.

1-02.6 Preparation of Proposal

(July 11, 2018 APWA GSP)

Supplement the second paragraph with the following:

4. If a minimum bid amount has been established for any item, the unit or lump sum price must equal or exceed the minimum amount stated.

5. Any correction to a bid made by interlineation, alteration, or erasure, shall be initialed by the signer of the bid.

Delete the last two paragraphs, and replace them with the following:

If no Subcontractor is listed, the Bidder acknowledges that it does not intend to use any Subcontractor to perform those items of work.

The Bidder shall submit with their Bid a completed Contractor Certification Wage Law Compliance form, provided by the Contracting Agency. Failure to return this certification as part of the Bid Proposal package will make this Bid Nonresponsive and ineligible for Award. A Contractor Certification of Wage Law Compliance form is included in the Proposal Forms.

The Bidder shall make no stipulation on the Bid Form, nor qualify the bid in any manner.

A bid by a corporation shall be executed in the corporate name, by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign).

A bid by a partnership shall be executed in the partnership name, and signed by a partner. A copy of the partnership agreement shall be submitted with the Bid Form if any UDBE requirements are to be satisfied through such an agreement.

A bid by a joint venture shall be executed in the joint venture name and signed by a member of the joint venture. A copy of the joint venture agreement shall be submitted with the Bid Form if any UDBE requirements are to be satisfied through such an agreement.

1-02.7 Bid Deposit

(March 8, 2013 APWA GSP)

Supplement this section with the following:

Bid bonds shall contain the following:

1. Contracting Agency-assigned number for the project;
2. Name of the project;
3. The Contracting Agency named as obligee;
4. The amount of the bid bond stated either as a dollar figure or as a percentage which represents five percent of the maximum bid amount that could be awarded;
5. Signature of the bidder's officer empowered to sign official statements. The signature of the person authorized to submit the bid should agree with the signature on the bond, and the title of the person must accompany the said signature;
6. The signature of the surety's officer empowered to sign the bond and the power of attorney.

If so stated in the Contract Provisions, bidder must use the bond form included in the Contract Provisions.

If so stated in the Contract Provisions, cash will not be accepted for a bid deposit.

1-02.9 Delivery of Proposal

(*****)

Delete this section and replace it with the following:

Each Proposal shall be submitted to the City electronically via QuestCDN, with the Project Name as stated in the Call for Bids noted on the subject line, or as otherwise required in the Bid Documents, to ensure proper handling and delivery. All electronic documents shall be in PDF format.

If submitted after the Bid Proposal is due, the document(s) must be submitted via email to jjwilson@puyallupwa.gov, with “Supplemental Information” noted in the subject line. All other information required to be submitted with the Bid Proposal must be submitted with the Bid Proposal itself, at the time stated in the Call for Bids and will be flagged as such with the bid not able to be submitted until the required information is uploaded to QuestCDN.

Proposals that are received as required will be publicly opened and read as specified in Section 1-02.12. The Contracting Agency will open the Bid Proposals that are received by the time specified in the Call for Bids via Skype Meeting immediately following the closing date and time. To call in, dial (253) 841-5587 and the Conference ID is: 31349. An invite will be sent to the companies listed on QuestCDN as plan holders, which will provide an option to see the bid information that will be read aloud or you can call in and listen to the values as they are read aloud. The Contracting Agency will not open or consider any “Supplemental Information” (UDBE confirmations, or GFE documentation) that is received after the time specified above, or received in a location other than that specified in the Call for Bids.

If an emergency or unanticipated event interrupts normal work processes of the Contracting Agency so that Proposals cannot be received at the office designated for receipt of bids as specified in Section 1-02.12, an Addendum will be issued and the time for the submittals will be extended on Quest CDN.

1-02.10 Withdrawing, Revising, or Supplementing Proposal

(*****)

Delete this section, and replace it with the following:

The Contracting Agency will not accept request to revise or withdraw electronic Bid Proposals. Such requests shall be furnished directly to QuestCDN and in accordance with their terms and conditions.

The supplemented Bid Proposal (if any) shall be received by the Contracting Agency before the time set for receipt of Bid Proposals or the bid shall be considered withdrawn.

The Bidder’s supplemented Bid Proposal must be accompanied by the supplemented package in its entirety. If the Bidder does not submit a supplemented package, then its bid shall be considered withdrawn.

1-02.12 Public Opening of Proposals

(*****)

The first paragraph of this section shall be deleted and replaced with the following:

Proposals will be opened and publicly read via Skype at the time indicated in the call for Bids unless the Bid opening has been delayed or cancelled. The link for the Skype meeting is listed in Section 1-02.9 as well as on the Notice to Contractors which is posted on the City of Puyallup website under invitation to bid/bid results at <http://www.cityofpuyallup.org/Bids>.

1-02.13 Irregular Proposals

(October 1, 2020 APWA GSP)

Delete this section and replace it with the following:

A Proposal will be considered irregular and will be rejected if:

1. The Bidder is not prequalified when so required:
 - a. The authorized Proposal form furnished by the Contracting Agency is not used or is altered;
 - b. The completed Proposal form contains any unauthorized additions, deletions, alternate Bids, or conditions;
 - c. The Bidder adds provisions reserving the right to reject or accept the award, or enter into the Contract;
 - d. A price per unit cannot be determined from the Bid Proposal;
 - e. The Proposal form is not properly executed;
 - f. The Bidder fails to submit or properly complete a Subcontractor list, if applicable, as required in Section 1-02.6;
 - g. The Bidder fails to submit or properly complete a Disadvantaged Business Enterprise Certification, if applicable, as required in Section 1-02.6;
 - h. The Bidder fails to submit written confirmation from each DBE firm listed on the Bidder's completed DBE Utilization Certification that they are in agreement with the bidder's DBE participation commitment, if applicable, as required in Section 1-02.6, or if the written confirmation that is submitted fails to meet the requirements of the Special Provisions;
 - i. The Bidder fails to submit DBE Good Faith Effort documentation, if applicable, as required in Section 1-02.6, or if the documentation that is submitted fails to demonstrate that a Good Faith Effort to meet the Condition of Award was made;
 - j. The Bidder fails to submit a DBE Bid Item Breakdown form, if applicable, as required in Section 1-02.6, or if the documentation that is submitted fails to meet the requirements of the Special Provisions;

- k. The Bidder fails to submit DBE Trucking Credit Forms, if applicable, as required in Section 1-02.6, or if the documentation that is submitted fails to meet the requirements of the Special Provisions;
 - l. The Bid Proposal does not constitute a definite and unqualified offer to meet the material terms of the Bid invitation; or
 - m. More than one Proposal is submitted for the same project from a Bidder under the same or different names.
2. A Proposal may be considered irregular and may be rejected if:
- a. The Proposal does not include a unit price for every Bid item;
 - b. Any of the unit prices are excessively unbalanced (either above or below the amount of a reasonable Bid) to the potential detriment of the Contracting Agency;
 - c. Receipt of Addenda is not acknowledged;
 - d. A member of a joint venture or partnership and the joint venture or partnership submit Proposals for the same project (in such an instance, both Bids may be rejected); or
 - e. If Proposal form entries are not made in ink.

(June 1, 2015 Puyallup GSP)

Supplement this Section with the following:

The Owner specifically reserves the right to reject any and/or all Bids, and to waive minor informalities.

1-02.14 Disqualification of Bidders

*(*****)*

Delete this section and replace it with the following:

A Bidder will be deemed not responsible if the Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or does not meet Supplemental Criteria 1 through 8 in this Section:

The Contracting Agency will verify that the Bidder meets the mandatory bidder responsibility criteria in RCW 39.04.350(1), and Supplemental Criteria 1. Evidence that the Bidder meets Supplemental Criteria 2 through 8 shall be provided by the Bidder as stated later in this Section.

1. Federal Debarment

- A. Criterion: The Bidder shall not currently be debarred or suspended by the Federal government.

B. Documentation: The Bidder shall not be listed as having an “active exclusion” on the U.S. government’s “System for Award Management” database (www.sam.gov).

2. **Delinquent State Taxes**

A. Criterion: The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.

B. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Contracting Agency) that the Bidder does not owe delinquent taxes to the Department of Revenue. If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Contracting Agency by the deadline listed below.

3. **Subcontractor Responsibility**

A. Criterion: The Bidder’s standard subcontract form shall include the subcontractor responsibility language required by RCW 39.06.020, and the Bidder shall have an established procedure which it utilizes to validate the responsibility of each of its subcontractors. The Bidder’s subcontract form shall also include a requirement that each of its subcontractors shall have and document a similar procedure to determine whether the sub-tier subcontractors with whom it contracts are also “responsible” subcontractors as defined by RCW 39.06.020.

B. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder complies with the subcontractor responsibility requirements of RCW 39.06.020.

4. **Claims Against Retainage and Bonds**

A. Criterion: The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects in the 3 years prior to the bid submittal date, that demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its subcontractors, suppliers, and workers, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Contracting Agency.

B. Documentation: The Bidder shall, if and when required as detailed below, sign a statement (on a form to be provided by the Contracting Agency) that the Bidder has not had claims against retainage and bonds in the 3 years prior to the bid submittal date. If the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date, they shall submit a list of the public works projects completed in the 3 years prior to the bid submittal date that have had claims against retainage and bonds and include for each project the following information:

- Name of project
- The owner and contact information for the owner;

- A list of claims filed against the retainage and/or payment bond for any of the projects listed;
- A written explanation of the circumstances surrounding each claim and the ultimate resolution of the claim.

5. **Public Bidding Crime**

- A. **Criterion:** The Bidder and/or its owners shall not have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.
- B. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder and/or its owners have not been convicted of a crime involving bidding on a public works contract.

6. **Termination for Cause/Termination for Default**

- A. **Criterion:** The Bidder shall not have had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Contracting Agency.
- B. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder has not had any public works contract terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date; or if Bidder was terminated, describe the circumstances.

7. **Lawsuits**

- A. **Criterion:** The Bidder shall not have lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Contracting Agency.
- B. **Documentation:** The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, or shall submit a list of all lawsuits with judgments entered against the Bidder in the five years prior to the bid submittal date, along with a written explanation of the circumstances surrounding each such lawsuit. The Contracting Agency shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet of terms of construction related contracts.

8. Contract Time (Liquidated Damages)

- A. Criterion: The Bidder shall not have had liquidated damages assessed on any projects it has completed 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet contract time, unless there are extenuating circumstances and such circumstances are deemed acceptable to the Contracting Agency.
- B. Documentation: The Bidder, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder has not had liquidated damages assessed on any projects it has completed within the 5 years prior to the bid submittal date, or shall submit a list of Projects with assessed liquidated damages along with Owner contact information, and number of days assessed liquidated damages.

9. Capacity and Experience

- A. Criterion: The Bidder shall have sufficient current capacity and the project superintendent assigned to the project shall have experience to meet the requirements of this Project. The Bidder and the project superintendent shall have successfully completed at least two projects as prime contractor and at least one public works project for a city or municipality, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.
- B. Documentation: The Bidder shall, if and when required as detailed below, on a form to be provided by the Contracting Agency, provide the Bidder's gross dollar amount of work currently under contract, the Bidder's gross dollar amount of contracts currently not completed, five major pieces of equipment anticipated to be on the project and whether the equipment is leased or owned, name of superintendent assigned to this project and their number of years of experience, and two project references of similar size and scope during the 5-year period immediately preceding the bid submittal deadline for this project. The Contracting Agency may check owner references for the previous projects and may evaluate the owner's assessment of the Bidder performance.

As evidence that the Bidder meets Supplemental Responsibility Criteria 2 through 9 stated above, the apparent two lowest Bidders must submit to the Contracting Agency by 12:00 P.M. (noon) of the second business day following the bid submittal deadline, a written statement verifying that the Bidder meets Supplemental Criteria 2 through 9 together with supporting documentation (sufficient in the sole judgment of the Contracting Agency) demonstrating compliance with Supplemental Responsibility Criteria 2 through 9. The Contracting Agency reserves the right to request further documentation as needed from the low bidder and documentation from other Bidders as well to assess Bidder responsibility and compliance with all bidder responsibility criteria. The Contracting Agency also reserves the right to obtain information from third-parties and independent sources of information concerning a Bidder's compliance with the mandatory and supplemental criteria, and to use that information in their evaluation. The Contracting Agency may consider mitigating factors in determining whether the Bidder complies with the requirements of the Supplemental Criteria.

The basis for evaluation of Bidder compliance with these mandatory and Supplemental Criteria shall include any documents or facts obtained by Contracting Agency (whether from the Bidder or third parties) including but not limited to: (i) financial, historical, or operational data from the Bidder; (ii) information obtained directly by the Contracting Agency from others for whom the Bidder has worked, or other public agencies or private enterprises; and (iii) any additional information obtained by the Contracting Agency which is believed to be relevant to the matter.

If the Contracting Agency determines the Bidder does not meet the bidder responsibility criteria above and is therefore not a responsible Bidder, the Contracting Agency shall notify the Bidder in writing, with the reasons for its determination. If the Bidder disagrees with this determination, it may appeal the determination within 2 business days of the Contracting Agency's determination by presenting its appeal and any additional information to the Contracting Agency. The Contracting Agency will consider the appeal and any additional information before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Contracting Agency will not execute a contract with any other Bidder until at least 2 business days after the Bidder determined to be not responsible has received the Contracting Agency's final determination.

Request to Change Supplemental Bidder Responsibility Criteria Prior To Bid: Bidders with concerns about the relevancy or restrictiveness of the Supplemental Bidder Responsibility Criteria may make or submit requests to the Contracting Agency to modify the criteria. Such requests shall be in writing, describe the nature of the concerns, and propose specific modifications to the criteria. Bidders shall submit such requests to the Contracting Agency no later than 5 business days prior to the bid submittal deadline and address the request to the Project Engineer or such other person designated by the Contracting Agency in the Bid Documents.

1-02.15 Pre Award Information

(August 14, 2013 APWA GSP)

Revise this section to read:

Before awarding any contract, the Contracting Agency may require one or more of these items or actions of the apparent lowest responsible bidder:

1. A complete statement of the origin, composition, and manufacture of any or all materials to be used,
2. Samples of these materials for quality and fitness tests,
3. A progress schedule (in a form the Contracting Agency requires) showing the order of and time required for the various phases of the work,
4. A breakdown of costs assigned to any bid item,
5. Attendance at a conference with the Engineer or representatives of the Engineer,
6. Obtain, and furnish a copy of, a business license to do business in the city or county where the work is located.
7. Any other information or action taken that is deemed necessary to ensure that the bidder is the lowest responsible bidder.

1-03 AWARD AND EXECUTION OF CONTRACT

1-03.1 Consideration of Bids

(January 23, 2006 APWA GSP)

Revise the first paragraph to read:

After opening and reading proposals, the Contracting Agency will check them for correctness of extensions of the prices per unit and the total price. If a discrepancy exists between the price per unit and the extended amount of any bid item, the price per unit will control. If a minimum bid amount has been established for any item and the bidder's unit or lump sum price is less than the minimum specified amount, the Contracting Agency will unilaterally revise the unit or lump sum price, to the minimum specified amount and recalculate the extension. The total of extensions, corrected where necessary, including sales taxes where applicable and such additives and/or alternates as selected by the Contracting Agency, will be used by the Contracting Agency for award purposes and to fix the Awarded Contract Price amount and the amount of the contract bond.

1-03.3 Execution of Contract

(October 1, 2005 APWA GSP)

Revise this section to read:

Copies of the Contract Provisions, including the unsigned Form of Contract, will be available for signature by the successful bidder on the first business day following award. The number of copies to be executed by the Contractor will be determined by the Contracting Agency.

Within 20 calendar days after the award date, the successful bidder shall return the signed Contracting Agency-prepared contract, an insurance certification as required by Section 1-07.18, and a satisfactory bond as required by law and Section 1-03.4. Before execution of the contract by the Contracting Agency, the successful bidder shall provide any pre-award information the Contracting Agency may require under Section 1-02.15.

Until the Contracting Agency executes a contract, no proposal shall bind the Contracting Agency nor shall any work begin within the project limits or within Contracting Agency-furnished sites. The Contractor shall bear all risks for any work begun outside such areas and for any materials ordered before the contract is executed by the Contracting Agency.

If the bidder experiences circumstances beyond their control that prevents return of the contract documents within the calendar days after the award date stated above, the Contracting Agency may grant up to a maximum of 20 additional calendar days for return of the documents, provided the Contracting Agency deems the circumstances warrant it.

1-03.4 Contract Bond

(July 23, 2015 APWA GSP)

Delete the first paragraph and replace it with the following:

The successful bidder shall provide executed payment and performance bond(s) for the full contract amount. The bond may be a combined payment and performance bond; or be separate payment and performance bonds. In the case of separate payment and performance bonds, each shall be for the full contract amount. The bond(s) shall:

1. Be on Contracting Agency-furnished form(s);
2. Be signed by an approved surety (or sureties) that:
 - a. Is registered with the Washington State Insurance Commissioner, and
 - b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner,
3. Guarantee that the Contractor will perform and comply with all obligations, duties, and conditions under the Contract, including but not limited to the duty and obligation to indemnify, defend, and protect the Contracting Agency against all losses and claims related directly or indirectly from any failure:
 - a. Of the Contractor (or any of the employees, subcontractors, or lower tier subcontractors of the Contractor) to faithfully perform and comply with all contract obligations, conditions, and duties, or
 - b. Of the Contractor (or the subcontractors or lower tier subcontractors of the Contractor) to pay all laborers, mechanics, subcontractors, lower tier subcontractors, material person, or any other person who provides supplies or provisions for carrying out the work;
4. Be conditioned upon the payment of taxes, increases, and penalties incurred on the project under titles 50, 51, and 82 RCW; and
5. Be accompanied by a power of attorney for the Surety's officer empowered to sign the bond; and
6. Be signed by an officer of the Contractor empowered to sign official statements (sole proprietor or partner). If the Contractor is a corporation, the bond(s) must be signed by the president or vice president, unless accompanied by written proof of the authority of the individual signing the bond(s) to bind the corporation (i.e., corporate resolution, power of attorney, or a letter to such effect signed by the president or vice president).

1-03.7 Judicial Review

(June 1, 2015 Puyallup GSP)

Section 1-03.7 is deleted in its entirety and replaced with the following:

Any decision made by the City of Puyallup regarding the award and execution of the Contract or Bid rejection shall be conclusive subject to the scope of judicial review permitted under Washington State Law. Such review, if any shall be timely filed in the Superior Court of Pierce County, Washington.

1-04 SCOPE OF WORK

1-04.2 Coordination of Contract Documents, Plans, Special Provisions, Specifications, and Addenda *(December 30, 2022 APWA GSP)*

Revise the second paragraph to read:

Any inconsistency in the parts of the contract shall be resolved by following this order of precedence (e.g., 1 presiding over 2, 2 over 3, 3 over 4, and so forth):

1. Addenda,
2. Proposal Form,
3. Special Provisions,
4. Contract Plans,
5. Standard Specifications,
6. Contracting Agency's Standard Plans or Details (if any), and
7. WSDOT Standard Plans for Road, Bridge, and Municipal Construction.

1-04.6 Variation in Estimated Quantities *(July 23, 2015 APWA GSP, Option B)*

Revise the first paragraph to read:

Payment to the Contractor will be made only for the actual quantities of Work performed and accepted in conformance with the Contract. When the accepted quantity of Work performed under a unit item varies from the original Proposal quantity, payment will be at the unit Contract price for all Work unless the total accepted quantity of any Contract item, adjusted to exclude added or deleted amounts included in change orders accepted by both parties, increases or decreases by more than 25 percent from the original Proposal quantity, and if the total extended bid price for that item at time of award is equal to or greater than 10 percent of the total contract price at time of award. In that case, payment for contract work may be adjusted as described herein.

1-05 CONTROL OF WORK

1-05.4 Conformity With and Deviations From Plans and Stakes *(*****)*

Delete this section in its entirety. See Technical Provisions Section 01150, Survey.

1-05.7 Removal of Defective and Unauthorized Work *(October 1, 2005 APWA GSP)*

Supplement this section with the following:

If the Contractor fails to remedy defective or unauthorized work within the time specified in a written notice from the Engineer, or fails to perform any part of the work required by the Contract

Documents, the Engineer may correct and remedy such work as may be identified in the written notice, with Contracting Agency forces or by such other means as the Contracting Agency may deem necessary.

If the Contractor fails to comply with a written order to remedy what the Engineer determines to be an emergency situation, the Engineer may have the defective and unauthorized work corrected immediately, have the rejected work removed and replaced, or have work the Contractor refuses to perform completed by using Contracting Agency or other forces. An emergency situation is any situation when, in the opinion of the Engineer, a delay in its remedy could be potentially unsafe, or might cause serious risk of loss or damage to the public.

Direct or indirect costs incurred by the Contracting Agency attributable to correcting and remedying defective or unauthorized work, or work the Contractor failed or refused to perform, shall be paid by the Contractor. Payment will be deducted by the Engineer from monies due, or to become due, the Contractor. Such direct and indirect costs shall include in particular, but without limitation, compensation for additional professional services required, and costs for repair and replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor's unauthorized work.

No adjustment in contract time or compensation will be allowed because of the delay in the performance of the work attributable to the exercise of the Contracting Agency's rights provided by this Section.

The rights exercised under the provisions of this section shall not diminish the Contracting Agency's right to pursue any other avenue for additional remedy or damages with respect to the Contractor's failure to perform the work as required.

1-05.11 Final Inspections and Operational Testing

(*****)

1-05.11(1) Substantial Completion Date

When the Contractor considers the work to be substantially complete, the Contractor shall so notify the Engineer and request the Engineer establish the Substantial Completion Date. The Contractor's request shall list the specific items of work that remain to be completed in order to reach physical completion. The Engineer will schedule an inspection of the work with the Contractor to determine the status of completion. The Engineer may also establish the Substantial Completion Date unilaterally.

If, after this inspection, the Engineer concurs with the Contractor that the work is substantially complete and ready for its intended use, the Engineer, by written notice to the Contractor, will set the Substantial Completion Date. If, after this inspection the Engineer does not consider the work substantially complete and ready for its intended use, the Engineer will, by written notice, so notify the Contractor giving the reasons therefor.

Upon receipt of written notice concurring in or denying substantial completion, whichever is applicable, the Contractor shall pursue vigorously, diligently and without unauthorized interruption, the work

necessary to reach Substantial and Physical Completion. The Contractor shall provide the Engineer with a revised schedule indicating when the Contractor expects to reach substantial and physical completion of the work.

The above process shall be repeated until the Engineer establishes the Substantial Completion Date and the Contractor considers the work physically complete and ready for final inspection.

1-05.11(2) Final Inspection and Physical Completion Date

When the Contractor considers the work physically complete and ready for final inspection, the Contractor by written notice, shall request the Engineer to schedule a final inspection. The Engineer will set a date for final inspection. The Engineer and the Contractor will then make a final inspection and the Engineer will notify the Contractor in writing of all particulars in which the final inspection reveals the work incomplete or unacceptable. The Contractor shall immediately take such corrective measures as are necessary to remedy the listed deficiencies. Corrective work shall be pursued vigorously, diligently, and without interruption until physical completion of the listed deficiencies. This process will continue until the Engineer is satisfied the listed deficiencies have been corrected.

If action to correct the listed deficiencies is not initiated within 7 days after receipt of the written notice listing the deficiencies, the Engineer may, upon written notice to the Contractor, take whatever steps are necessary to correct those deficiencies pursuant to Section 1-05.7.

The Contractor will not be allowed an extension of contract time because of a delay in the performance of the work attributable to the exercise of the Engineer's right hereunder.

Upon correction of all deficiencies, the Engineer will notify the Contractor and the Contracting Agency, in writing, of the date upon which the work was considered physically complete. That date shall constitute the Physical Completion Date of the contract, but shall not imply acceptance of the work or that all the obligations of the Contractor under the contract have been fulfilled.

1-05.13 Superintendents, Labor, and Equipment of Contractor

(*****)

Add the following to the third paragraph:

Superintendent may not be substituted without Owner approval. Provide resume and reference for proposed substitution for Owner approval.

1-05.15 Method of Serving Notices

(March 25, 2009 APWA GSP)

Revise the second paragraph to read:

All correspondence from the Contractor shall be directed to the Project Engineer. All correspondence from the Contractor constituting any notification, notice of protest, notice of dispute, or other correspondence constituting notification required to be furnished under the Contract, must be in

paper format, hand delivered or sent via mail delivery service to the Project Engineer's office. Electronic copies such as e-mails or electronically delivered copies of correspondence will not constitute such notice and will not comply with the requirements of the Contract.

Add the following new section:

1-05.16 Water and Power

(October 1, 2005 APWA GSP)

The Contractor shall make necessary arrangements, and shall bear the costs for power and water necessary for the performance of the work, unless the contract includes power and water as a pay item.

1-06 CONTROL OF MATERIAL

*(*****)*

Delete this section in its entirety and replace with Technical Provisions Section 01300, Submittals and Section 01400, Quality Control.

1-07 LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC

1-07.1 Laws to be Observed

(October 1, 2005 APWA GSP)

Supplement this section with the following:

In cases of conflict between different safety regulations, the more stringent regulation shall apply.

The Washington State Department of Labor and Industries shall be the sole and paramount administrative agency responsible for the administration of the provisions of the Washington Industrial Safety and Health Act of 1973 (WISHA).

The Contractor shall maintain at the project site office, or other well known place at the project site, all articles necessary for providing first aid to the injured. The Contractor shall establish, publish, and make known to all employees, procedures for ensuring immediate removal to a hospital, or doctor's care, persons, including employees, who may have been injured on the project site. Employees should not be permitted to work on the project site before the Contractor has established and made known procedures for removal of injured persons to a hospital or a doctor's care.

The Contractor shall have sole responsibility for the safety, efficiency, and adequacy of the Contractor's plant, appliances, and methods, and for any damage or injury resulting from their failure, or improper maintenance, use, or operation. The Contractor shall be solely and completely responsible for the conditions of the project site, including safety for all persons and property in the performance of the work. This requirement shall apply continuously, and not be limited to normal working hours. The required or implied duty of the Engineer to conduct construction review of the Contractor's performance does not, and shall not, be intended to include review and adequacy of the Contractor's safety measures in, on, or near the project site.

This Section is supplemented with the following:

(May 13, 2020 WSDOT GSP, Option 4)

In response to COVID-19, the Contractor shall prepare a project specific COVID-19 health and safety plan (CHSP) in conformance with Section 1-07.4(2) as supplemented in these specifications, COVID-19 Health and Safety Plan (CHSP).

1-07.2 State Taxes

Delete this section, including its sub-sections, in its entirety and replace it with the following:

1-07.2 State Sales Tax

(June 27, 2011 APWA GSP)

The Washington State Department of Revenue has issued special rules on the State sales tax. Sections 1-07.2(1) through 1-07.2(3) are meant to clarify those rules. The Contractor should contact the Washington State Department of Revenue for answers to questions in this area. The Contracting Agency will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability.

The Contractor shall include all Contractor-paid taxes in the unit bid prices or other contract amounts. In some cases, however, state retail sales tax will not be included. Section 1-07.2(2) describes this exception.

The Contracting Agency will pay the retained percentage (or release the Contract Bond if a FHWA-funded Project) only if the Contractor has obtained from the Washington State Department of Revenue a certificate showing that all contract-related taxes have been paid (RCW 60.28.051). The Contracting Agency may deduct from its payments to the Contractor any amount the Contractor may owe the Washington State Department of Revenue, whether the amount owed relates to this contract or not. Any amount so deducted will be paid into the proper State fund.

1-07.2(1) State Sales Tax — Rule 171

WAC 458-20-171, and its related rules, apply to building, repairing, or improving streets, roads, etc., which are owned by a municipal corporation, or political subdivision of the state, or by the United States, and which are used primarily for foot or vehicular traffic. This includes storm or combined sewer systems within and included as a part of the street or road drainage system and power lines when such are part of the roadway lighting system. For work performed in such cases, the Contractor shall include Washington State Retail Sales Taxes in the various unit bid item prices, or other contract amounts, including those that the Contractor pays on the purchase of the materials, equipment, or supplies used or consumed in doing the work.

1-07.2(2) State Sales Tax — Rule 170

WAC 458-20-170, and its related rules, apply to the constructing and repairing of new or existing buildings, or other structures, upon real property. This includes, but is not limited to, the construction of streets, roads, highways, etc., owned by the state of Washington; water mains and their appurtenances; sanitary sewers and sewage disposal systems unless such sewers and disposal systems are within, and a part of, a street or road drainage system; telephone, telegraph, electrical power distribution lines, or other conduits or lines in or above streets or roads, unless such power lines become a part of a street or road lighting system; and installing or attaching of any article of tangible personal property in or to real property, whether or not such personal property becomes a part of the realty by virtue of installation.

For work performed in such cases, the Contractor shall collect from the Contracting Agency, retail sales tax on the full contract price. The Contracting Agency will automatically add this sales tax to each payment to the Contractor. For this reason, the Contractor shall not include the retail sales tax in the unit bid item prices, or in any other contract amount subject to Rule 170, with the following exception.

Exception: The Contracting Agency will not add in sales tax for a payment the Contractor or a subcontractor makes on the purchase or rental of tools, machinery, equipment, or consumable supplies not integrated into the project. Such sales taxes shall be included in the unit bid item prices or in any other contract amount.

1-07.2(3) Services

The Contractor shall not collect retail sales tax from the Contracting Agency on any contract wholly for professional or other services (as defined in Washington State Department of Revenue Rules 138 and 244).

1-07.4 Sanitation

1-07.4(2) Health Hazards

Section 1-07.4(2) is supplemented with the following:
(May 13, 2020, WSDOT GSP, Option 2)

COVID-19 Health and Safety Plan (CHSP)

The Contractor shall prepare a project specific COVID-19 health and safety plan (CHSP). The CHSP shall be prepared and submitted as a Type 2 Working Drawing prior to beginning physical Work. The CHSP shall be based on the most current State and Federal requirements. If the State and Federal requirements are revised, the CHSP shall be updated as necessary to conform to the current requirements.

The Contractor shall update and resubmit the CHSP as the work progresses and new activities appear on the look ahead schedule required under Section 1-08.3(2)D. If the conditions change on

the project, or a particular activity, the Contractor shall update and resubmit the CHSP. Work on any activity shall cease if conditions prevent full compliance with the CHSP.

The CHSP shall address the health and safety of all people associated with the project including State workers in the field, Contractor personnel, consultants, project staff, subcontractors, suppliers and anyone on the project site, staging areas, or yards.

COVID-19 Health and Safety Plan (CHSP) Inspection

The Contractor shall grant full and unrestricted access to the Engineer for CHSP Inspections. The Engineer (or designee) will conduct periodic compliance inspection on the project site, staging areas, or yards to verify that any ongoing work activity is following the CHSP plan. If the Engineer becomes aware of a noncompliance incident either through a site inspection or other means, the Contractor will be notified immediately (within 1 hour). The Contractor shall immediately remedy the noncompliance incident or suspend all or part of the associated work activity. The Contractor shall satisfy the Engineer that the noncompliance incident has been corrected before the suspension will end.

(*****)

Supplement this section with the following:

Work necessary to provide and maintain a safe worksite, including preparation and implementation of the health and safety plans and coordinating with CHSP inspectors, shall be incidental to associated items of Contract Work and not be considered for extra payment.

1-07.9 Wages

1-07.9(5) Required Documents

(January 3, 2020 APWA GSP)

Delete this section and replace it with the following:

General

All “Statements of Intent to Pay Prevailing Wages”, “Affidavits of Wages Paid” and Certified Payrolls, including a signed Statement of Compliance for Federal-aid projects, shall be submitted to the Engineer and the State L&I online Prevailing Wage Intent & Affidavit (PWIA) system.

Intents and Affidavits

On forms provided by the Industrial Statistician of State L&I, the Contractor shall submit to the Engineer the following for themselves and for each firm covered under RCW 39.12 that will or has provided Work and materials for the Contract:

1. The approved “Statement of Intent to Pay Prevailing Wages” State L&I’s form number F700-029-000. The Contracting Agency will make no payment under this Contract until this statement has been approved by State L&I and reviewed by the Engineer.
2. The approved “Affidavit of Prevailing Wages Paid”, State L&I’s form number F700-007-000. The Contracting Agency will not grant Completion until all approved Affidavit of Wages paid for the Contractor and all Subcontractors have been received by the Engineer. The Contracting Agency

will not release to the Contractor any funds retained under RCW 60.28.011 until “Affidavit of Prevailing Wages Paid” forms have been approved by State L&I and all of the approved forms have been submitted to the Engineer for every firm that worked on the Contract.

The Contractor is responsible for requesting these forms from State L&I and for paying any fees required by State L&I.

Certified Payrolls

Certified payrolls are required to be submitted by the Contractor for themselves, all Subcontractors and all lower tier subcontractors. The payrolls shall be submitted weekly on all Federal-aid projects and no less than monthly on State funded projects.

Penalties for Noncompliance

The Contractor is advised, if these payrolls are not supplied within the prescribed deadlines, any or all payments may be withheld until compliance is achieved. In addition, failure to provide these payrolls may result in other sanctions as provided by State laws (RCW 39.12.050) and/or Federal regulations (29 CFR 5.12).

1-07.15 Temporary Water Pollution Prevention

(April 18, 2018 Puyallup GSP)

Supplement this section with the following:

Contractor shall take necessary measures to prevent siltation of downstream facilities, adjacent properties, and the Puyallup River. When submitting erosion control plan, as outline in Standard Specification 8-01, the Contractor shall address the following items:

1. Protection of existing storm sewer system.
2. Disposal of water from dewatering systems.
3. Disposal of water from normal trench dewatering.

Stormwater or dewatering water that has come in contact with concrete rubble, concrete pours, or cement treated soils shall be maintained to pH 8.5 or less before it is allowed to enter waters of the State or the City stormwater system. If pH exceeds 8.5, the Contractor shall immediately discontinue work and initiate treatment according to the plan to lower the pH. Work may resume, with treatment, once the pH of the stormwater is 8.5 or less or it can be demonstrated that the runoff will not reach surface waters or the City stormwater system.

High pH process water shall not be discharged to waters of the State or the City stormwater system. Unless specific measures are identified in the Special Provisions, high pH water may be infiltrated, dispersed in vegetation or compost, or discharged to a sanitary sewer system. Water being infiltrated or dispersed shall have no chance of discharging directly to waters of the State or the City stormwater system, including wetlands or conveyances that indirectly lead to waters of the State. High pH process water shall be treated to within a range of 6.5 to 8.5 pH units prior to infiltration to ensure the discharge does not cause a violation of groundwater quality standards. If water is discharged to the sanitary sewer, the Contractor shall provide a copy of permits and requirements for placing the material into a sanitary sewer system prior to beginning the work. Process water may be collected

and disposed of by the Contractor off the project site. The Contractor shall provide a copy of the permit for an approved waste site for the disposal of the process water prior to the start of work that generates the process water. A discharge permit shall be required for all discharges to the sanitary sewer system.

*1-07.15(1) Spill Prevention, Control, and Countermeasures Plan
(April 18, 2018 Puyallup GSP)*

Section 1-07.15(1) is supplemented with the following:

Costs associated with cleanup of spills resulting from Contractor's operations, negligence, or omissions shall not be measured for payment.

1-07.16 Protection and Restoration of Property

*1-07.16(1) Public/Private Property
(June 1, 2015 Puyallup GSP)*

Supplement this section with the following:

Stockpiling in City right-of-way or on existing or new improvements shall not occur unless approved by the Engineer. All stockpile sites shall be restored to as good or better condition.

The Contractor shall contact all property owners and tenants in the vicinity of this project, via newsletter/ mailing, a minimum of one (1) week prior to start of construction. The Contractor shall submit a draft of the property owner notification for approval prior to posting/ mailing.

1-07.17 Utilities and Similar Facilities

(April 18, 2018 Puyallup GSP)

Section 1-07.17 is supplemented with the following:

The locations and dimensions shown on the Plans for existing facilities are in accordance with best available information obtained without uncovering, measuring, or other verification. The Contractor shall be responsible for any breakage of the existing utilities or services, publicly or privately owned, resulting from Contractor's operations, and shall hold the Owner and its agents harmless from any claim resulting from disruption of or damage to the same.

The Contractor is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor incurred as a result of this law shall be at the Contractor's expense.

No excavation shall begin until all known facilities in the vicinity of the excavation area have been located and marked.

The Contractor shall maintain the operational service of water distribution, storm drainage, and sanitary sewer service systems in as continuous a manner as possible. Where services are to be shut

down, affected parties shall be notified in writing a minimum of three working days in advance of the time and period of shutdown. The Contractor shall make every effort to keep shutdown schedules to periods of anticipated minimum usage and for the least period of time. No utility service will be allowed to be shut down for more than four hours per day.

Should a shutdown of any utility be required for a period in excess of four hours, the Contractor at no expense to the Owner shall take necessary measures to provide temporary service. The method of all temporary utility services shall first be approved by the City of Puyallup.

The following addresses and telephone numbers of utility companies known or suspected of having facilities within the project limits are supplied for the Contractor's convenience:

Utilities

Comcast	(253) 864-4293
Centurylink	(206) 733-8862
Puget Sound Energy	(253) 476-6037
AT&T Cable	(253) 503-8000
Buried Cable Locating Assistance	811
Fruitland Mutual Water Company	(253) 848-5519
American Traffic Solutions	(817) 726-2944

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Utility Maintenance and Operations	(253) 841-5505
Water Pollution Control Plant	(253) 841-5511
Water Department	(253) 841-5512
Sewer/Storm Department	(253) 841-5469
Traffic Signals	(253) 841-5403

If any damage is done to an existing utility, the Contractor shall notify an authority of the particular utility company involved, who will dispatch a crew to repair the damages at the Contractor's expense, or authorize the Contractor to repair the damage at the Contractor's expense. The Contractor shall repair all damaged City-owned utilities in accordance with the Contract Documents or per the direction of the City. The Contractor shall immediately notify the City of Puyallup Construction Inspector when any damage occurs to any existing utility.

1-07.18 Public Liability and Property Damage Insurance

Delete this section in its entirety, and replace it with the following:

1-07.18 Insurance

(January 4, 2016 APWA GSP)

1-07.18(1) General Requirements

- A. The Contractor shall procure and maintain the insurance described in all subsections of section 1-07.18 of these Special Provisions, from insurers with a current A. M. Best rating of not less than A-:

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VII and licensed to do business in the State of Washington. The Contracting Agency reserves the right to approve or reject the insurance provided, based on the insurer's financial condition.

- B. The Contractor shall keep this insurance in force without interruption from the commencement of the Contractor's Work through the term of the Contract and for thirty (30) days after the Physical Completion date, unless otherwise indicated below.
- C. If any insurance policy is written on a claims made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract. The policy shall state that coverage is claims made, and state the retroactive date. Claims-made form coverage shall be maintained by the Contractor for a minimum of 36 months following the Completion Date or earlier termination of this Contract, and the Contractor shall annually provide the Contracting Agency with proof of renewal. If renewal of the claims made form of coverage becomes unavailable, or economically prohibitive, the Contractor shall purchase an extended reporting period ("tail") or execute another form of guarantee acceptable to the Contracting Agency to assure financial responsibility for liability for services performed.
- D. The Contractor's Automobile Liability, Commercial General Liability and Excess or Umbrella Liability insurance policies shall be primary and non-contributory insurance as respects the Contracting Agency's insurance, self-insurance, or self-insured pool coverage. Any insurance, self-insurance, or self-insured pool coverage maintained by the Contracting Agency shall be excess of the Contractor's insurance and shall not contribute with it.
- E. The Contractor shall provide the Contracting Agency and all additional insureds with written notice of any policy cancellation, within two business days of their receipt of such notice.
- F. The Contractor shall not begin work under the Contract until the required insurance has been obtained and approved by the Contracting Agency
- G. Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of contract, upon which the Contracting Agency may, after giving five business days' notice to the Contractor to correct the breach, immediately terminate the Contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the Contracting Agency on demand, or at the sole discretion of the Contracting Agency, offset against funds due the Contractor from the Contracting Agency.
- H. All costs for insurance shall be incidental to and included in the unit or lump sum prices of the Contract and no additional payment will be made.

1-07.18(2) Additional Insured

All insurance policies, with the exception of Workers Compensation, and of Professional Liability and Builder's Risk (if required by this Contract) shall name the following listed entities as additional insured(s) using the forms or endorsements required herein:

- the Contracting Agency and its officers, elected officials, employees, agents, and volunteers
- Gray & Osborne, Inc.
- Connetix Engineering, Inc.
- PanGEO, Inc.

The above-listed entities shall be additional insured(s) for the full available limits of liability maintained by the Contractor, irrespective of whether such limits maintained by the Contractor are greater than

those required by this Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor pursuant to 1-07.18(4) describes limits lower than those maintained by the Contractor.

For Commercial General Liability insurance coverage, the required additional insured endorsements shall be at least as broad as ISO forms CG 20 10 10 01 for ongoing operations and CG 20 37 10 01 for completed operations.

1-07.18(3) Subcontractors

The Contractor shall cause each Subcontractor of every tier to provide insurance coverage that complies with all applicable requirements of the Contractor-provided insurance as set forth herein, except the Contractor shall have sole responsibility for determining the limits of coverage required to be obtained by Subcontractors.

The Contractor shall ensure that all Subcontractors of every tier add all entities listed in 1-07.18(2) as additional insureds, and provide proof of such on the policies as required by that section as detailed in 1-07.18(2) using an endorsement as least as broad as ISO CG 20 10 10 01 for ongoing operations and CG 20 37 10 01 for completed operations.

Upon request by the Contracting Agency, the Contractor shall forward to the Contracting Agency evidence of insurance and copies of the additional insured endorsements of each Subcontractor of every tier as required in 1-07.18(4) Verification of Coverage.

1-07.18(4) Verification of Coverage

The Contractor shall deliver to the Contracting Agency a Certificate(s) of Insurance and endorsements for each policy of insurance meeting the requirements set forth herein when the Contractor delivers the signed Contract for the work. Failure of Contracting Agency to demand such verification of coverage with these insurance requirements or failure of Contracting Agency to identify a deficiency from the insurance documentation provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

Verification of coverage shall include:

1. An ACORD certificate or a form determined by the Contracting Agency to be equivalent.
2. Copies of all endorsements naming Contracting Agency and all other entities listed in 1-07.18(2) as additional insured(s), showing the policy number. The Contractor may submit a copy of any blanket additional insured clause from its policies instead of a separate endorsement.
3. Any other amendatory endorsements to show the coverage required herein.
4. A notation of coverage enhancements on the Certificate of Insurance shall not satisfy these requirements – actual endorsements must be submitted.

Upon request by the Contracting Agency, the Contractor shall forward to the Contracting Agency a full and certified copy of the insurance policy(s). If Builders Risk insurance is required on this Project, a full and certified copy of that policy is required when the Contractor delivers the signed Contract for the work.

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1-07.18(5) Coverages and Limits

The insurance shall provide the minimum coverages and limits set forth below. Contractor’s maintenance of insurance, its scope of coverage, and limits as required herein shall not be construed to limit the liability of the Contractor to the coverage provided by such insurance, or otherwise limit the Contracting Agency’s recourse to any remedy available at law or in equity.

All deductibles and self-insured retentions must be disclosed and are subject to approval by the Contracting Agency. The cost of any claim payments falling within the deductible or self-insured retention shall be the responsibility of the Contractor. In the event an additional insured incurs a liability subject to any policy’s deductibles or self-insured retention, said deductibles or self-insured retention shall be the responsibility of the Contractor.

1-07.18(5)A Commercial General Liability

Commercial General Liability insurance shall be written on coverage forms at least as broad as ISO occurrence form CG 00 01, including but not limited to liability arising from premises, operations, stop gap liability, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract. There shall be no exclusion for liability arising from explosion, collapse or underground property damage.

The Commercial General Liability insurance shall be endorsed to provide a per project general aggregate limit, using ISO form CG 25 03 05 09 or an equivalent endorsement.

Contractor shall maintain Commercial General Liability Insurance arising out of the Contractor’s completed operations for at least three years following Substantial Completion of the Work.

Such policy must provide the following minimum limits:

\$1,000,000	Each Occurrence
\$2,000,000	General Aggregate
\$2,000,000	Products & Completed Operations Aggregate
\$1,000,000	Personal & Advertising Injury each offence
\$1,000,000	Stop Gap / Employers’ Liability each accident

1-07.18(5)B Automobile Liability

Automobile Liability shall cover owned, non-owned, hired, and leased vehicles; and shall be written on a coverage form at least as broad as ISO form CA 00 01. If the work involves the transport of pollutants, the automobile liability policy shall include MCS 90 and CA 99 48 endorsements.

Such policy must provide the following minimum limit:

\$1,000,000	Combined single limit each accident
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1-07.18(5)C Workers' Compensation

The Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the State of Washington.

*1-07.18(5)D Excess or Umbrella Liability
(January 4, 2016 APWA GSP)*

The Contractor shall provide Excess or Umbrella Liability insurance with limits of not less than 1 million each occurrence and annual aggregate. This excess or umbrella liability coverage shall be excess over and as least as broad in coverage as the Contractor's Commercial General and Auto Liability insurance

All entities listed under 1-07.18(2) of these Special Provisions shall be named as additional insureds on the Contractor's Excess or Umbrella Liability insurance policy.

This requirement may be satisfied instead through the Contractor's primary Commercial General and Automobile Liability coverages, or any combination thereof that achieves the overall required limits of insurance.

*1-07.18(5)E LHWCA Insurance
(January 4, 2016 APWA GSP)*

If this Contract involves work on or adjacent to Navigable Waters of the United States, the Contractor shall procure and maintain insurance coverage in compliance with the statutory requirements of the U.S. Longshore and Harbor Workers' Compensation Act (LHWCA).

Such policy must provide the following minimum limits:

\$1,000,000	Bodily Injury by Accident – each accident
\$1,000,000	Bodily Injury by Disease – each employee
\$1,000,000	Bodily Injury by Disease – policy limits

*1-07.18(5)H Builder's Risk
(January 4, 2016 APWA GSP)*

Contractor shall purchase and maintain Builder's Risk insurance covering interests of the Contracting Agency, the Contractor, and Subcontractors of every tier, as Named Insureds, in the Work. An Installation Floater instead of Builders Risk is acceptable for renovation projects. Builder's Risk insurance shall be on a special form policy, and shall insure against the perils of fire and extended coverage and physical loss or damage, theft, vandalism, malicious mischief and collapse; and flood and earthquake when shown below. The Builder's Risk insurance shall include coverage for temporary buildings, debris removal, and damage to materials in transit or stored off-site. Such insurance shall cover resulting "soft costs" including but not limited to design costs, licensing fees, architect's and engineer's fees, and costs due to delay in completion.

Builder's Risk insurance shall be written in the amount of the completed value of the project, with no coinsurance provisions. Such policy must provide coverage and deductibles that comply with the following:

Coverage:

Total Cost of Project to be Insured: \$4,000,000
Soft Costs: \$1,000,000
Flood: \$4,000,000
Earthquake: \$4,000,000

Deductibles not to exceed:

Flood: 2% of the Value at Time of Loss, subject to a \$250,000 Minimum
Earthquake: 5% of the Value at Time of Loss, subject to a \$250,000 Minimum
Earth Movement: 5% of the Value at Time of Loss, subject to a \$250,000 Minimum
All Other Perils: \$50,000
Soft Costs: \$50,000, with no more than 7-day waiting period

The Builders Risk insurance covering the work shall have maximum deductibles as listed above for each occurrence. The deductible(s) shall be the responsibility of the Contractor.

The Contractor shall provide the Contracting Agency with a full and certified copy of the insurance policy when the Contractor delivers the signed Contract for the work. Failure of Contracting Agency to demand such verification of coverage with these insurance requirements or failure of Contracting Agency to identify a deficiency from the insurance documentation provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

The Builders Risk insurance shall be maintained until final acceptance of the Work by the Contracting Agency.

The Contractor and the Contracting Agency waive all rights against each other and any of their Subcontractors of every tier, agents, and employees, officers, and officials, for damages caused by fire or other perils to the extent covered by Builder's Risk insurance or other property insurance applicable to the work. The policies shall provide such waivers by endorsement.

*1-07.18(5)K Professional Liability
(January 4, 2016 APWA GSP)*

The Contractor and/or its Subcontractor(s) and/or its design consultant providing construction management, value engineering, or any other design-related non-construction professional services shall provide evidence of Professional Liability insurance covering professional errors and omissions.

Such policy shall provide the following minimum limits:

\$1,000,000 per claim and annual aggregate

If the scope of such design-related professional services includes work related to pollution conditions, the Professional Liability insurance shall include coverage for Environmental Professional Liability.

If insurance is on a claims made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract.

1-07.23 Public Convenience and Safety

(June 1, 2015 Puyallup GSP)

Supplement this section with the following:

No driveway, may be closed without prior approval of the Owner, project supervisor, or Engineer unless written authority has been given by the affected property owner. The Contractor shall be responsible for notifying the affected property owners 2 working days in advance of scheduled interruptions to access.

1-07.23(1) Construction Under Traffic

(May 2, 2017 APWA GSP)

Revise the third sentence of the second paragraph to read:

Accessibility to existing or temporary pedestrian push buttons shall not be impaired; if approved by the Contracting Agency activating pedestrian recall timing or other accommodation may be allowed during construction.

Section 1-07.23(1) is supplemented with the following:

(April 18, 2018 Puyallup GSP)

Lane closures are subject to the following restrictions:

- Lane closures shall not be allowed during the Washington State Fair (Spring), April 16, 2020, through April 19, 2020.
- Lane closures shall not be allowed during the Washington State Fair (Fall), September 4, 2020, through September 27, 2020.
- Lane closures shall not be allowed during Meeker Days; June 19, 2020, through June 21, 2020.
- Lane closures shall not be allowed during the Daffodil Parade; April 4, 2020.

The City Engineer has the authority to approve or reject all requests to work during these posted lane closure restrictions. The restricted areas are shown on the following maps:

- Construction Restriction Zone and Routes – Weekday events
- Construction Restriction Zone and Routes – Friday, Saturday, Sunday

These maps are maintained on the City website and can be accessed through the below links:

<https://www.cityofpuyallup.org/DocumentCenter/View/6072> (Weekdays)

<https://www.cityofpuyallup.org/DocumentCenter/View/6073> (Weekends)

If the Engineer determines the permitted closure hours adversely affect traffic, the Engineer may adjust the hours accordingly. The Engineer will notify the Contractor in writing of any change in the closure hours.

Lane closures are not allowed on any of the following:

1. A holiday,
2. A holiday weekend; holidays that occur on Friday, Saturday, Sunday or Monday are considered a holiday weekend. A holiday weekend includes Saturday, Sunday, and the holiday.
3. After 1:00 PM on the day prior to a holiday or holiday weekend, and
4. Before 9:00 AM on the day after the holiday or holiday weekend.
5. All work within the traveled way of any roadway shall be limited to the hours between 9:00 a.m. to 3:00 p.m., unless otherwise approved by the City Engineer.

1-07.23(2) Construction and Maintenance of Detours

Section 1-07.23(2) is supplemented with the following:
(April 18, 2018 Puyallup GSP)

The Contractor shall also maintain streets and walking paths adjacent to the project limits when affected by the Contractor's operations.

The Contractor shall notify all property owners and tenants of detours, street and alley closures, or other restrictions that may interfere with their access. Notification shall be at least twenty-four (24) hours in advance for residential property, and at least two working days in advance for commercial property.

Emergency traffic, such as police, fire, and disaster units, shall be provided access at all times. In addition, the Contractor shall coordinate Contractor activities with all disposal firms, school bus service, and transit bus service that may be operating in the project area.

Pedestrian Control and Protection

When the work area encroaches upon a sidewalk, walkway or crosswalk area, special consideration must be given to pedestrian safety. Maximum effort must be made to separate pedestrians from the work area. Protective barricades, fencing, pathways, and bridges, together with warning and guidance devices and signs, shall be utilized so that the passageway for pedestrians is safe and well-defined. Whenever pedestrian walkways are provided across excavations, they shall be provided with suitable handrails. Footbridges shall be safe, strong, free of bounce and sway, have a slip-resistant coating, and be free of cracks, holes, and irregularities that could cause tripping. Ramps shall be provided at the entrance and exit of all raised footbridges, again to prevent tripping. Illumination and reflectorization to the levels and uniformity specified on Exhibit 1040-25 of the WSDOT Design Manual shall be provided during hours of darkness. All walkways shall be maintained with at least 5 feet clear width, if possible, or 4 feet clear width with 5 foot passing zones as specified below.

Where walks are closed by construction, an alternate walkway shall be provided, preferably within the planting strip.

Where it is necessary to divert pedestrians into the roadway, jersey-style barricades shall be provided to separate the pedestrian walkway from the adjacent vehicular traffic lane. At no time shall pedestrians be diverted into a portion of a street used concurrently by moving vehicular traffic.

At locations where adjacent alternate walkways cannot be provided, appropriate signs shall be posted at the limits of construction and in advance of the closure at the nearest crosswalk or intersection to divert pedestrians across the street.

Physical barricades shall be installed to prevent visually impaired people from inadvertently entering a closed area. Pedestrian walkways shall be wheelchair accessible at all times. Pedestrian access shall be maintained to all properties adjacent to the construction site.

Pedestrian-Related Elements of the Traffic Control Plan

The Traffic Control Plan shall outline how pedestrian routes and access points will be maintained through the project site for the duration of construction. Traffic Control Plan elements regarding pedestrian routes and access shall address the following:

- All pedestrians, including persons with disabilities, shall be provided with a safe and accessible route through or around the project site.
- A smooth, continuous hard surface shall be provided throughout the entire length and width of the pedestrian route throughout construction.
- The width of the existing pedestrian facility shall be maintained if possible. When it is not possible to maintain a minimum width of 60-inches throughout the entire length of the pedestrian route, a minimum width of 48-inches shall be provided with 60-inch x 60-inch passing zones spaced at maximum intervals of 200-feet to allow individuals in wheelchairs to pass.
- Traffic control devices and other construction materials and features shall not intrude into the usable width of the sidewalk, alternate accessible pedestrian route, or other pedestrian facility.
- Signs and other devices mounted lower than 84-inches above the temporary accessible pedestrian route shall not project more than 4-inches into the accessible pedestrian route.
- When channelization is used to delineate a pedestrian pathway, a continuous detectable edging shall be provided throughout the length of the facility such that pedestrians using a cane can follow it. Edging shall protrude at least 6-inches above the surface of the sidewalk or pathway with the bottom of the edging a maximum of 2-1/2 inches above the surface.
- Temporary ramps shall be provided when an alternate accessible pedestrian route crosses a curb and no permanent curb ramps are in place. The width of the curb ramp shall be a minimum of 48-inches and the maximum slope of the ramp shall be 8.3%. The maximum cross slope shall be 2.0%.
- When possible, an alternate accessible pedestrian route shall be provided on the same side of the street as the disrupted route. When it is not possible, the alternate route shall be clearly identified at the nearest intersection crossing prior to the closure area.
- Information regarding closed pedestrian routes, alternate crossings, and sign and signal information shall be communicated to pedestrians with visual disabilities by providing devices such as audible information devices, accessible pedestrian signals, or barriers and channelizing

devices that are detectable to the pedestrians traveling with the aid of a cane or who have low vision.

- It is desirable that pedestrians cross to the opposite side of the roadway at intersections rather than mid-block. Pedestrians shall be crossed at an intersection unless approved by the Traffic Engineering Division. Appropriate signing shall be placed at the intersections prior to any pedestrian route closure.
- If not otherwise stated in the Contract provisions, access to transit stops shall be provided and maintained at all times. Transit stops may be temporarily relocated with approval of the transit agency and the Engineer.

At locations where adjacent alternate walkways cannot be provided, appropriate signs shall be posted at the limits of construction and in advance of the closure at the nearest crosswalk or intersection, to divert pedestrians across the street. Physical barricades shall be installed to prevent visually impaired people from inadvertently entering a closed area.

Measurement and Payment

All costs related to work described in this Section 1-07.23 including but not limited to pedestrian access and safety, developing an approved Traffic Control Plan with pedestrian elements; construction, maintenance, and removal of pathways, protective barricades, fencing, and bridges; warning guidance devices; signing; temporary striping or structures; traffic control labor; and providing and maintaining temporary, alternative, or existing pedestrian routes and access points will not be measured for separate payment, but shall be included in the lump sum Bid item "Project Temporary Traffic Control."

1-07.24 Rights of Way

(July 23, 2015 APWA GSP)

Delete this section and replace it with the following:

Street Right of Way lines, limits of easements, and limits of construction permits are indicated in the Plans. The Contractor's construction activities shall be confined within these limits, unless arrangements for use of private property are made.

Generally, the Contracting Agency will have obtained, prior to bid opening, all rights of way and easements, both permanent and temporary, necessary for carrying out the work. Exceptions to this are noted in the Bid Documents or will be brought to the Contractor's attention by a duly issued Addendum.

Whenever any of the work is accomplished on or through property other than public Right of Way, the Contractor shall meet and fulfill all covenants and stipulations of any easement agreement obtained by the Contracting Agency from the owner of the private property. Copies of the easement agreements may be included in the Contract Provisions or made available to the Contractor as soon as practical after they have been obtained by the Engineer.

Whenever easements or rights of entry have not been acquired prior to advertising, these areas are so noted in the Plans. The Contractor shall not proceed with any portion of the work in areas where right of way, easements or rights of entry have not been acquired until the Engineer certifies to the

Contractor that the right of way or easement is available or that the right of entry has been received. If the Contractor is delayed due to acts of omission on the part of the Contracting Agency in obtaining easements, rights of entry or right of way, the Contractor will be entitled to an extension of time. The Contractor agrees that such delay shall not be a breach of contract.

Each property owner shall be given 48 hours notice prior to entry by the Contractor. This includes entry onto easements and private property where private improvements must be adjusted.

The Contractor shall be responsible for providing, without expense or liability to the Contracting Agency, any additional land and access thereto that the Contractor may desire for temporary construction facilities, storage of materials, or other Contractor needs. However, before using any private property, whether adjoining the work or not, the Contractor shall file with the Engineer a written permission of the private property owner, and, upon vacating the premises, a written release from the property owner of each property disturbed or otherwise interfered with by reasons of construction pursued under this contract. The statement shall be signed by the private property owner, or proper authority acting for the owner of the private property affected, stating that permission has been granted to use the property and all necessary permits have been obtained or, in the case of a release, that the restoration of the property has been satisfactorily accomplished. The statement shall include the parcel number, address, and date of signature. Written releases must be filed with the Engineer before the Completion Date will be established.

(June 1, 2015 Puyallup GSP)

Supplement this section with the following:

Staging/storage of equipment or materials will not be allowed within the City right-of-way or any temporary property rights areas without written permission from the City.

1-08 PROSECUTION AND PROGRESS

Add the following new section:

1-08.0 Preliminary Matters

(May 25, 2006 APWA GSP)

Add the following new section:

1-08.0(1) Preconstruction Conference

(October 10, 2008 APWA GSP)

Prior to the Contractor beginning the work, a preconstruction conference will be held between the Contractor, the Engineer and such other interested parties as may be invited. The purpose of the preconstruction conference will be:

1. To review the initial progress schedule;

2. To establish a working understanding among the various parties associated or affected by the work;
3. To establish and review procedures for progress payment, notifications, approvals, submittals, etc.;
4. To establish normal working hours for the work;
5. To review safety standards and traffic control; and
6. To discuss such other related items as may be pertinent to the work.

The Contractor shall prepare and submit at the preconstruction conference the following:

1. A breakdown of all lump sum items;
2. A preliminary schedule of working drawing submittals; and
3. A list of material sources for approval if applicable.

Add the following new section:

*1-08.0(2) Hours of Work
(December 8, 2014 APWA GSP)*

Except in the case of emergency or unless otherwise approved by the Engineer, the normal working hours for the Contract shall be any consecutive 8-hour period between 7:00 a.m. and 6:00 p.m. Monday through Friday, exclusive of a lunch break. If the Contractor desires different than the normal working hours stated above, the request must be submitted in writing prior to the preconstruction conference, subject to the provisions below. The working hours for the Contract shall be established at or prior to the preconstruction conference.

All working hours and days are also subject to local permit and ordinance conditions (such as noise ordinances).

If the Contractor wishes to deviate from the established working hours, the Contractor shall submit a written request to the Engineer for consideration. This request shall state what hours are being requested, and why. Requests shall be submitted for review no later than noon prior to the day the Contractor is requesting to change the hours.

If the Contracting Agency approves such a deviation, such approval may be subject to certain other conditions, which will be detailed in writing. For example:

1. On non-Federal aid projects, requiring the Contractor to reimburse the Contracting Agency for the costs in excess of straight-time costs for Contracting Agency representatives who worked during such times. (The Engineer may require designated representatives to be present during the work. Representatives who may be deemed necessary by the Engineer include, but are not limited to: survey crews; personnel from the Contracting Agency's material testing lab; inspectors; and other Contracting Agency employees or third party consultants when, in the opinion of the Engineer, such work necessitates their presence.)
2. Considering the work performed on Saturdays, Sundays, and holidays as working days with regard to the contract time.

3. Considering multiple work shifts as multiple working days with respect to contract time even though the multiple shifts occur in a single 24-hour period.
4. If a 4-10 work schedule is requested and approved the non working day for the week will be charged as a working day.
5. If Davis Bacon wage rates apply to this Contract, all requirements must be met and recorded properly on certified payroll.

1-08.3(2)A Type A Progress Schedule

(March 13, 2012 APWA GSP)

Revise this section to read:

The Contractor shall submit five copies of a Type A Progress Schedule no later than at the preconstruction conference, or some other mutually agreed upon submittal time. The schedule may be a critical path method (CPM) schedule, bar chart, or other standard schedule format. Regardless of which format used, the schedule shall identify the critical path. The Engineer will evaluate the Type A Progress Schedule and approve or return the schedule for corrections within 15 calendar days of receiving the submittal.

1-08.4 Prosecution of Work

Delete this section and replace it with the following:

1-08.4 Notice to Proceed and Prosecution of Work

(July 23, 2015 APWA GSP)

Notice to Proceed will be given after the contract has been executed and the contract bond and evidence of insurance have been approved and filed by the Contracting Agency. The Contractor shall not commence with the work until the Notice to Proceed has been given by the Engineer. The Contractor shall commence construction activities on the project site within ten days of the Notice to Proceed Date, unless otherwise approved in writing. The Contractor shall diligently pursue the work to the physical completion date within the time specified in the contract. Voluntary shutdown or slowing of operations by the Contractor shall not relieve the Contractor of the responsibility to complete the work within the time(s) specified in the contract.

When shown in the Plans, the first order of work shall be the installation of high visibility fencing to delineate all areas for protection or restoration, as described in the Contract. Installation of high visibility fencing adjacent to the roadway shall occur after the placement of all necessary signs and traffic control devices in accordance with 1-10.1(2). Upon construction of the fencing, the Contractor shall request the Engineer to inspect the fence. No other work shall be performed on the site until the Contracting Agency has accepted the installation of high visibility fencing, as described in the Contract.

1-08.5 Time for Completion

(*****)

This section is supplemented with the following:

All work shall be physically complete within 250 working days of receiving a Notice to Proceed.

(November 30, 2018 APWA GSP, Option B)

Revise the third and fourth paragraphs to read:

Contract time shall begin on the first working day following the 10 calendar days after the Notice to Proceed date. If the Contractor starts work on the project at an earlier date, then contract time shall begin on the first working day when onsite work begins.

Each working day shall be charged to the contract as it occurs, until the contract work is physically complete. If substantial completion has been granted and all the authorized working days have been used, charging of working days will cease. Each week the Engineer will provide the Contractor a statement that shows the number of working days: (1) charged to the contract the week before; (2) specified for the physical completion of the contract; and (3) remaining for the physical completion of the contract. The statement will also show the nonworking days and any partial or whole day the Engineer declares as unworkable. Within 10 calendar days after the date of each statement, the Contractor shall file a written protest of any alleged discrepancies in it. To be considered by the Engineer, the protest shall be in sufficient detail to enable the Engineer to ascertain the basis and amount of time disputed. By not filing such detailed protest in that period, the Contractor shall be deemed as having accepted the statement as correct. If the Contractor is approved to work 10 hours a day and 4 days a week (a 4-10 schedule) and the fifth day of the week in which a 4-10 shift is worked would ordinarily be charged as a working day, then the fifth day of that week will be charged as a working day whether or not the Contractor works on that day.

Revise the sixth paragraph to read:

The Engineer will give the Contractor written notice of the completion date of the contract after all the Contractor's obligations under the contract have been performed by the Contractor. The following events must occur before the Completion Date can be established:

1. The physical work on the project must be complete; and
2. The Contractor must furnish all documentation required by the contract and required by law, to allow the Contracting Agency to process final acceptance of the contract. The following documents must be received by the Project Engineer prior to establishing a completion date:
 - a. Certified Payrolls (per Section 1-07.9(5)).
 - b. Material Acceptance Certification Documents
 - c. Monthly Reports of Amounts Credited as DBE Participation, as required by the Contract Provisions.
 - d. Final Contract Voucher Certification
 - e. Copies of the approved "Affidavit of Prevailing Wages Paid" for the Contractor and all Subcontractors

- f. A copy of the Notice of Termination sent to the Washington State Department of Ecology (Ecology); the elapse of 30 calendar days from the date of receipt of the Notice of Termination by Ecology; and no rejection of the Notice of Termination by Ecology. This requirement will not apply if the Construction Stormwater General Permit is transferred back to the Contracting Agency in accordance with Section 8-01.3(16).
- g. Property owner releases per Section 1-07.24

1-08.6 Suspension of Work

(*****)

This Section is supplemented with the following:

Add the following to the end of the bulleted list:

- 4. Delayed delivery of Contractor-supplied equipment.

Add the following after the fourth paragraph of this section:

The Contractor may request a suspension of work if a delay is caused by the delivery of the Contractor-supplied equipment with demonstrated long lead times. The Contractor's schedule shall include the expected Suspension of Work based on the anticipated delivery date.

1-08.9 Liquidated Damages

(August 14, 2013 APWA GSP)

Revise the fourth paragraph to read:

When the Contract Work has progressed to Substantial Completion as defined in the Contract, the Engineer may determine that the work is Substantially Complete. The Engineer will notify the Contractor in writing of the Substantial Completion Date. For overruns in Contract time occurring after the date so established, the formula for liquidated damages shown above will not apply. For overruns in Contract time occurring after the Substantial Completion Date, liquidated damages shall be assessed on the basis of direct engineering and related costs assignable to the project until the actual Physical Completion Date of all the Contract Work. The Contractor shall complete the remaining Work as promptly as possible. Upon request by the Project Engineer, the Contractor shall furnish a written schedule for completing the physical Work on the Contract.

1-09 MEASUREMENT AND PAYMENT

1-09.6 Force Account

(October 10, 2008 APWA GSP)

Supplement this Section with the following:

The Contracting Agency has estimated and included in the Proposal, dollar amounts for all items to be paid per force account, only to provide a common proposal for Bidders. All such dollar amounts are to become a part of Contractor's total bid. However, the Contracting Agency does not warrant

expressly or by implication, that the actual amount of work will correspond with those estimates. Payment will be made on the basis of the amount of work actually authorized by the Engineer.

1-09.8 Payment for Material on Hand

(June 1, 2015 Puyallup GSP)

The first sentence of the last paragraph is revised to read:

A Contracting Agency will not pay for material on hand when the invoice cost for an individual material is less than \$10,000.

1-09.9 Payments

(March 13, 2012 APWA GSP)

Supplement this section with the following:

Payment shall be in accordance with Technical Provisions Section 01200, Measurement and Payment and Section 01290, Schedule of Values.

1-09.11 Disputes and Claims

1-09.11(3) Time Limitation and Jurisdiction

(November 30, 2018 APWA GSP)

Revise this section to read:

For the convenience of the parties to the Contract it is mutually agreed by the parties that any claims or causes of action which the Contractor has against the Contracting Agency arising from the Contract shall be brought within 180 calendar days from the date of final acceptance (Section 1-05.12) of the Contract by the Contracting Agency; and it is further agreed that any such claims or causes of action shall be brought only in the Superior Court of the county where the Contracting Agency headquarters is located, provided that where an action is asserted against a county, RCW 36.01.050 shall control venue and jurisdiction. The parties understand and agree that the Contractor's failure to bring suit within the time period provided, shall be a complete bar to any such claims or causes of action. It is further mutually agreed by the parties that when any claims or causes of action which the Contractor asserts against the Contracting Agency arising from the Contract are filed with the Contracting Agency or initiated in court, the Contractor shall permit the Contracting Agency to have timely access to any records deemed necessary by the Contracting Agency to assist in evaluating the claims or action.

1-09.13(3) Claims \$250,000 or Less

(October 1, 2005 APWA GSP)

Delete this section and replace it with the following:

The Contractor and the Contracting Agency mutually agree that those claims that total \$250,000 or less, submitted in accordance with Section 1-09.11 and not resolved by nonbinding ADR processes,

shall be resolved through litigation unless the parties mutually agree in writing to resolve the claim through binding arbitration.

1-09.13(3)A Administration of Arbitration

(November 30, 2018 APWA GSP)

Revise the third paragraph to read:

The Contracting Agency and the Contractor mutually agree to be bound by the decision of the arbitrator, and judgment upon the award rendered by the arbitrator may be entered in the Superior Court of the county in which the Contracting Agency's headquarters is located, provided that where claims subject to arbitration are asserted against a county, RCW 36.01.050 shall control venue and jurisdiction of the Superior Court. The decision of the arbitrator and the specific basis for the decision shall be in writing. The arbitrator shall use the Contract as a basis for decisions.

1-10 TEMPORARY TRAFFIC CONTROL

1-10.2(2) Traffic Control Plans

(June 1, 2015 Puyallup GSP)

Supplement this section with the following:

The Contractor shall prepare site specific Traffic Control Plans for all phases of the work and submit them for approval to the Engineer. The Contractor's proposed Traffic Control Plans shall show the necessary lane closures, lane shifts, construction signs, flaggers, spotters, and other traffic control devices required to support each phase of the construction. The Contractor-provided plans shall be prepared by the Contractor's Traffic Control Supervisor or an engineer licensed in the State of Washington and shall conform to the requirements contained in the latest version of the Manual on Uniform Traffic Control Devices (MUTCD) and the latest version of the Work Zone Traffic Control Guidelines published by the Washington State Department of Transportation. WSDOT 'K' Plans are acceptable and will be approved, as and if applicable.

Traffic Control Plans shall also specify how accessible pedestrian routes shall be maintained through the project site as discussed in Section 1-07.23.

Traffic Control Plans shall provide detail on how existing driveway access will be maintained throughout the duration of construction. Plans should indicate the method(s) by which access will be maintained during roadway excavation to prevent vehicle bumpers dragging and during paving operations.

Prior to submitting the initial Traffic Control Plans for review by the Engineer, the Contractor shall meet with the Engineer and provide a detailed explanation of the Contractor's proposed construction schedule, construction phasing and associated temporary traffic control implementation. The plan must be acceptable to the Engineer prior to the Contractor submitting the initial set of Traffic Control Plans. No construction will be allowed until the Traffic Control Plans are acceptable to the Engineer. Payment for developing an approved Traffic Control Plan, including pedestrian-related elements, shall

be considered incidental to the lump sum price in the Proposal for “Project Temporary Traffic Control” and no additional compensation will be made.

1-10.5 Payment

Delete this section and replace with the following:

No separate or additional payment will be made for Temporary Traffic Control. The cost of traffic control shall be considered to be incidental to the project and shall be included in other bid items.

END OF DIVISION 1

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TECHNICAL PROVISIONS

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DIVISION 1 – GENERAL TECHNICAL REQUIREMENTS

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SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.1 SCOPE OF WORK

The work specified in this Section consists of furnishing all labor, materials, and equipment necessary for construction of the Water Pollution Control Plant Third Secondary Clarifier Installation, as shown on the Plans, and hereinafter specified, at the existing Water Pollution Control Plan (WPCP) site. Work shall include, but not be limited to, the following:

- A. Potholing to establish the locations and pipe materials for pipe connections to the new secondary clarifier,
- B. Groundwater control by ground freezing.
- C. Construction of the new secondary clarifier.
- D. Installation of a new return activated sludge (RAS) pump at the Secondary Clarifier Splitter Box and RAS / WAS Pump Station structure.
- E. Installation of a new magnetic flow meter in the ultraviolet (UV) disinfection structure.
- F. Conversion of an existing flow meter facility to a scum pump station.
- G. Provide specified surface preparation of all interior concrete surfaces as specified, prior to applying the new coating system on all interior concrete grout surfaces.
- H. Furnishing and installation of all required piping and appurtenances.
- I. Furnishing and installation of all required electrical, instrumentation, and telemetry work.
- J. Construction of required site grading and paving.
- K. Installation of new landscaping.
- L. Restoration of surfaces disturbed by construction activities.
- M. Providing testing, commissioning, and training as specified herein.

- N. Providing all associated work as shown on the Plans and specified herein, for a complete and workable system.

1.2 PROJECT INFORMATION

The Contract Documents show the location, arrangement, and type of work to be performed under the proposed project. Should any conflict appear to exist between the Plans and Specifications, these Specifications shall govern.

With the exceptions of extensions of time and delays granted under Section 1-08.8 of the Standard Specifications, the Contractor shall complete all work embraced in this Contract within 250 working days.

All material and labor are to be furnished by the Contractor, unless otherwise specifically provided in the Specifications or shown on the Plans. All workmanship, equipment, and materials incorporated in the work covered by this Contract shall be new, unless otherwise noted to use salvaged existing materials, and shall be best available grade or quality. All installed equipment shall be able to withstand lateral loads in accordance with IBC requirements.

The Washington State Department of Ecology has prohibited bypassing of sewage to state waters. The Contractor shall ensure that the existing Water Pollution Control Plant remains operational during construction at all times, or provide bypass pumping facilities with system redundancy and capacity equal to or greater than the existing lift station during construction of the third secondary clarifier and associated work. The Contractor shall pay all costs of any damages and/or Regulatory Agency penalties resulting from sewage overflows caused by their activities or inactions, all costs of which shall be included in the prices bid for the various items as indicated in the Proposal.

Bidders are directed to familiarize themselves with the Plans, Specifications, and the potential difficulties to be encountered during this Project. The submission of a bid indicates that the bidder has done so.

The bidders are advised that there is a geotechnical report for the Project. The report is appended to these Contract Provisions; it is for information only and is not a warranty of subsurface conditions. The Contractor shall be held responsible for determining the actual field conditions. If the conditions described as follows are found on the site, the Contractor shall notify the Owner promptly in writing and shall not disturb the conditions, except in an emergency:

- A. Subsurface or latent physical conditions differ materially from those indicated in the Contract Documents, and

- B. Unknown, unusual physical conditions differing materially from those typically encountered and generally recognized as inherent in the type of work indicated in the Contract Documents.

The Owner shall promptly investigate the conditions, and if it is found that such conditions do so materially differ and cause an increase or decrease in the cost of or in the time required for performance of the work, an equitable adjustment shall be made and the Contract Documents shall be modified by a change order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless the required written notice has been given, provided that the Owner may, if the Owner determines the facts so justify, consider, and adjust any such claims asserted before the date of final payment.

It is expected that groundwater control by ground freezing will be required to complete much of the Work, and it shall be the responsibility of the Contractor to provide equipment and perform the work to control groundwater as necessary to perform construction activities.

The bidders are hereby advised that they shall become familiar with and comply in all respects with the permits and easements required for construction of this Project, all conditions of which are included herewith as if written here in full.

The bidder shall be required to obtain and pay all costs for such appraisals, licenses, plumbing, drainage, mechanical, electrical, and all other permits as may be required, in addition to those already obtained by the Owner, for the execution of this Project, all costs of which shall be merged into the price bid for the items as indicated in the Proposal.

The bidder's attention is hereby directed to that portion of the Proposal, which requires that the bidder furnish information concerning his experience with work of a similar nature, equipment to be used on this Project, and general background information. Incomplete information, evasive, or of a too-general nature only, shall be considered grounds for rejection of the bid. In awarding this Contract, the Owner shall consider, in determining his best interests, both the prices offered, and the qualifications of the bidder, as indicated in the proposal.

Bidders are advised that in addition to the requirements for insurance, as outlined under the "Public Works Contract", his insurance shall provide coverage not only to the Contractor and the Owner (City of Puyallup), including its assigned offices, but shall further provide that the Engineer, Gray & Osborne, Inc., and their subconsultants, Conley Engineering, Inc., and PanGeo, Inc., will be named as additional insured.

The Contractor shall be responsible for proper notification to and coordination with all utility districts, service districts, and all other persons and services that

will be affected by this project at least one week in advance of beginning any construction that affects them.

The Owner reserves the right to make changes should unforeseen conditions necessitate such changes. Where work is on a unit-price basis, the actual quantities required by such changes shall determine the compensation.

The Contractor shall provide construction scheduling by the critical path method in accordance with Section 01320 of these Specifications. The Contractor shall update his schedule on a monthly basis, or as otherwise agreed upon by the Owner and Engineer.

The Contractor shall allow the State of Washington Department of Ecology's representatives access to the Project at all times.

It is the intent and purpose of these Contract Documents to have constructed complete wastewater treatment facilities in good working order for the least practical cost to the Owner. Suggestions, recommendations, as well as inquiries from the Contractor that will serve this purpose are welcome and will be given consideration by the Owner and the Engineer.

The Contractor's bid shall be valid for 60 days. The Owner anticipates issuing the "Notice to Proceed" to the Contractor as soon as possible after the bid opening, following approval by the Owner.

The Contractor shall take all necessary precautions required to prevent damage to existing piping, utilities, and structures above and below ground during construction. Verification of elevation and locations of existing items shall be the responsibility of the Contractor. The Contractor shall video-record the existing site and structures prior to construction and after completion of construction.

All electrical components and equipment assemblies with electrical components shall be recognized or labeled and listed by a recognized electrical testing laboratory for the application or approved by the State of Washington Department of Labor and Industries for installation on the Project per WAC 296-46B-999 requirements.

1.3 WEB-BASED PROJECT COMMUNICATION SYSTEM

The Contractor shall install and use the necessary computer hardware and software to receive and transmit project communications through the Engineer's web-based, online project communications system (G&O Construction Management System). This website will be used by the Engineer, Field Representative, Owner and Contractor to communicate online between these parties to clarify design and construction requirements, to provide information

concerning construction issues, and to post certain project documents. The intent of this communication system is to provide an efficient means of communicating between the parties to present project information and answer project-related questions while reducing the amount of paperwork typically involved with project communication and record-keeping.

The web-based project communication system will use the secure website and programming developed by the Engineer. The Engineer will provide the Contractor with the instructions and credentials for access and use of the website. Access to the website will only be available through use of system passwords assigned to each participant. There is no fee charged by the Engineer for use of this website.

The website shall be used for posting and responding to the following communications and documents:

- Submittals
- Request to Sublet
- Progress Estimates
- Requests for Information
- Construction meeting minutes
- Job photos
- Document logs
- Change order proposals
- Weekly Working Day Reports
- Weekly Quantity Reports
- Material Testing Reports

Additional items may be added to the above list at the Owner's option.

The Engineer will administer and maintain the website. The Contractor, Owner and Engineer shall use the website to communicate project information instead of using hard copies and faxes, unless the website is unable to support the desired communication.

The Contractor shall provide and maintain the following hardware and software at the Contractor's computers at the project site, and at off-site computers as desired by the Contractor, to use the web-based project communication system:

- Internet/Wireless Services
- Microsoft Office
- Email address
- PDF Read/Write Software

- Color flatbed scanner (or printer/scanner/fax) for PDF, TIFF, or GIF format scanning

1.4 CONTRACTOR USE OF SITE AND PREMISES

Construction operations shall be limited to the areas noted on the Plans and subject to the approval of the Engineer.

The Contractor shall submit a traffic control plan for all site access and egress routes for construction vehicle traffic per Section 01950 of these Specifications.

The Contractor shall plan his work to be completed within the time limits indicated in these Specifications. The hours of construction work shall be confined to the period of 7:00 a.m. to 5:00 p.m., Monday through Friday. No construction equipment shall be started, warmed up, or tested prior to 7:00 a.m., and all construction equipment promptly shut down at 5:00 p.m. No work shall be permitted on holidays without the prior approval by the Engineer. A recognized holiday shall be a day currently accepted by the trades or occupations in the locality where the Work is being performed, and shall include New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, Juneteenth, Fourth of July, Labor Day, Veterans Day, Thanksgiving Day, the day after Thanksgiving Day, and Christmas Day. Exceptions to these work hours will be allowed only for startup, testing, and commissioning, as specified, and only then with prior review and approval by the Engineer of the work and methods to be employed. In addition, no work within the right-of-way will be permitted during the Washington State Fair (April 19, 2018 through April 22, 2018 and August 31, 2018 through September 23, 2018), Meeker Days (June 15, 2018 through June 17, 2018) and the Daffodil Parade (April 7, 2018).

The Contractor shall allow representatives of the funding and regulatory agencies access to the project site at all times.

The Contractor shall be aware that the Owner's archaeologist may observe and sample excavated material for cultural artifacts during Contractor's excavation work. The Contractor shall allow this work without extra compensation.

The Contractor shall notify the Owner (or other water utility purveyor) at least 2 working days in advance of any proposed water system shut downs. The Contractor shall also be responsible for notifying all impacted water users 2 working days in advance of any water shutoff.

1.5 ORDER OF WORK

The order of work will be at the option of the Contractor, except as noted below, in keeping with good construction practice, time restrictions, requirements of the permits applicable to this project, and the order of work as outlined herein, all costs of which shall be included in the various bid amounts. The Contractor shall conduct the order of work to allow the existing facilities to remain operational during the construction of the Project and shall coordinate all of his activities through the Engineer with the Owner's operations and maintenance staff. The Contractor shall provide a written plan of activities to the Engineer and Owner each Thursday for the following week, for review and coordination with existing facility operations.

The implementation of any measure required to protect the environment shall supersede any order of work designated within these Specifications. The Contractor shall meet the conditions as outlined in any and all permits and requirements of the Federal, State, and local regulatory agencies. The Contractor shall keep the disruption of the existing wastewater treatment operations to a minimum. Bypasses of untreated sewage will not be permitted.

Access to the existing operations areas shall be maintained. Disruption of this access shall be kept to a minimum and must be prearranged and scheduled through the Engineer with the Owner's operations and maintenance staff.

The following summary used as a general guideline of the construction tasks to be performed. The tasks are generally listed in the order of completion. The tasks, however, can be completed in a different order than listed herein, including performance of two or more tasks concurrently. The Contractor shall prepare a complete project schedule, which shall be provided in accordance with the limitations specified herein.

- A. Pothole at connection of new piping to existing piping and where potential conflicts may exist to verify exact location, invert elevation, and material of existing piping.
- B. Relocate existing 13.5 kV primary feeder circuit and spare 4-inch conduit as shown on Sheet E7-1, Note 2.
- C. Replace the 8-inch storm drain in the road between the new Secondary Clarifier 3 and the existing Ultraviolet Disinfection Facilities.

- D. The remainder of the project can be constructed at any time during the duration of the project, subject to the following limitations:
1. Contractor shall provide 1 working days notice before the shutdown of any treatment processes. Shutdowns shall only occur during low-flow periods, between July 1 and September 30.
 2. Shutdowns of the WAS/WAS Pump Station shall not exceed 4 hours and shall only occur Monday through Friday.

***** END OF SECTION *****

SECTION 01150

SURVEYS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes all survey for the project. The Contractor shall provide all construction survey for the Work. The Engineer will provide primary horizontal and vertical control data and monuments, as shown on the Plans.

At the Contractor's request, the Engineer will provide the Plans in electronic format. Electronic files are provided for the Contractor's convenience and are not part of the Contract. Calculations shall be made from the Plans.

During the prosecution of the work, the Contractor shall make all necessary measurements to prevent misfitting, and shall be responsible for the accurate construction of the work.

1.1 DEFINITIONS

The meaning of words and terms used in this provision shall be as listed in "Definitions of Surveying and Associated Terms" current edition, published by the American Congress on Surveying and Mapping, and the American Society of Civil Engineers.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01720	Record Drawings

1.3 QUALIFICATIONS

The Contractor shall employ a Professional Land Surveyor (PLS) registered in the State of Washington and acceptable to the Owner. All surveying shall be completed by or under the direct supervision of the PLS.

1.4 SUBMITTALS

The Contractor shall submit the name, address, and license number of the Professional Land Surveyor before starting construction.

1.5 QUALITY ASSURANCE

The Contractor shall ensure a surveying accuracy within the following tolerances:

	<u>Vertical</u>	<u>Horizontal</u>
Slope Stakes	±0.1 feet	±0.10 feet
Subgrade Grade Stakes Set 0.04 foot Below Grade	±0.01 feet	±0.5 feet (parallel to alignment) ±0.1 feet (normal to alignment)
Stationing on Roadway	N/A	±0.1 feet
Alignment on Roadway	N/A	±0.04 feet
Surfacing Grade Stakes	±0.01 feet	±0.1 foot (parallel to alignment) ±0.1 feet (normal to alignment)
Roadway Paving Pins for Surfacing or Paving	±0.01 feet	±0.1 feet (parallel to alignment) ±0.05 feet (normal to alignment)
Alignment of sewer and storm manholes and catch basins	±.01 feet	±0.1 feet
Stationing on Structures		±.02 feet
Alignment on structures		±.02 feet
Superstructure elevations	±.01 feet variation from Plan elevation	
Substructure	±.02 feet variation from Plan grades	

When the following items are included in the project, the Contractor shall perform independent checks from different secondary control to ensure that the points staked are within the specified survey accuracy tolerances:

- Piles
- Shafts
- Footings
- Columns

The Owner may spot-check the Contractor's surveying. These spot-checks will not change the requirements for accuracy by the Contractor

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

The Contractor's PLS shall establish all secondary survey controls, horizontal and vertical, as necessary to assure proper placement of all Work based upon the primary control points provided by the Owner. The Contractor shall be responsible for setting, maintaining, and resetting all alignment stakes, clearing limit stakes, slope stakes, and grades for the Work. Except for the survey control data to be furnished by the Owner, calculations, surveying, and measuring required for setting and maintaining the lines and grades shall be the Contractor's responsibility.

Survey records shall be maintained by the Contractor's PLS, including a description of the work performed on each shift, the methods utilized, and the control points used. The record shall be adequate to allow the survey to be reproduced. A copy of each day's record shall be provided to the Engineer within three working days of Engineer's request.

All surveyed points shall be established by placing hubs and tacks with marked stakes in unpaved areas or P.K. nails with painted markings in paved areas. All surveying stakes shall be marked in accordance with WSDOT Standard Plan A-10.10-00. When stakes are needed that are not described in the Standard Plans, then those stakes shall be marked as ordered by the Engineer. The Contractor's surveyor shall maintain and replace survey hubs, stakes, nails and markings immediately if destroyed, removed, or the Engineer determines the stake or pavement markings are illegible.

For monuments to be removed or destroyed as shown on the Plans, the Contractor's PLS shall file all required permit forms with the Department of Natural Resources (DNR), as required by RCW 58.09.130 and WAC 332-120.

The form “Application for Permit to Remove or Destroy a Survey Monument” shall be signed by the PLS, and submitted directly to DNR and the Owner. No work affecting monumentation shall commence until DNR has approved the permit. The form “Completion Report for Monument Removal or Destruction” shall be signed by the PLS and submitted to DNR and the Owner upon completion of work affecting monumentation.

The Contractor shall be responsible for locating and preserving existing monuments within the right-of-way, which shall include existing property corners on the right-of-way lines. In the event the Contractor disturbs or destroys any survey marker, monument, or property corner during the course of construction, not indicated to be removed on the Plans, the Contractor shall bear all costs or survey, resetting, legal claims and filing state forms as required by RCW 58.09.130 and WAC 332-120.

***** END OF SECTION *****

SECTION 01160

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section contains information pertaining to permits and licenses and use of private property.

1.2 PERMITS AND LICENSES

The Contractor shall be responsible for obtaining and paying all fees associated with all the necessary permits, licenses, approvals, and construction permits necessary for the execution of this Contract, whether they be City, County, State, or federal permits.

1.3 OTHER PERMIT REQUIREMENTS

The Washington State Department of Ecology has prohibited bypassing of sewage to state waters. The existing wastewater treatment facilities shall remain operational during construction at all times. The Contractor shall maintain the treatment facilities in continuous operation during the entire construction period and until the project has been accepted by the Owner. The Contractor shall pay all costs of any damages and/or Regulatory Agency penalties resulting from plant bypassing or overflows caused by his actions or inactions.

1.4 USE OF PRIVATE PROPERTY

The Contractor shall be responsible for all conditions of any arrangements the Contractor makes for the use of any privately owned property.

In the event any dispute occurs and claims for damages are filed by the property owners, the Owner will request that the Contractor give evidence that he has requested his insurance company to make personal contact with the claimants. Any settlement for insurance claims shall be strictly an act restricted to the claimant, the Contractor, and his insurance company.

The Contractor is advised that in the event of any property damage, the Owner reserves the right to withhold monies to protect the property owner.

1.5 PROPERTY RELEASE FORM

The Contractor shall be held responsible for acquiring signed property release forms, in the format provided on the following page, for all properties that have been disturbed or damaged by the Contractor's operations, or utilized by the Contractor for staging, storing, or stock piling of materials or equipment.

This work shall include submitting the form(s), as further shown herein, by certified mail to each property owner effected and further including therein a self addressed stamped envelope for the property owner's use. The enclosed self addressed envelope shall be addressed to: City of Puyallup, 333 South Meridian, Puyallup, Washington 98371. Contractor shall provide evidence of all certified mailings.

***** END OF SECTION *****

PROPERTY RELEASE

(Property Address)

DATE: _____

I, _____, owner of _____
(Property Owner's Name) (Property Description or
_____, hereby release
Address)
_____, from any property
(Contractor's Name)

damage or personal injury resulting from construction adjacent

to or on my property located at _____,
(Property Address)

during construction of the Water Pollution Control Plant Third Secondary Clarifier
Installation.

My signature below is my acknowledgment and acceptance that my property, as
identified above, was returned to a satisfactory condition.

Name: _____

Signed: _____

Address: _____

Phone: _____

SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SCOPE

This Section further defines Measurement and Payment for this project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
Standard Specifications Section 1-09	Measurement and Payment
01290	Schedule of Values
01300	Submittals

1.3 MEASUREMENT

Measurement for all items shall be as indicated in these Specifications for unit price and lump sum price bid items. Bid items are outlined in detail in this Specification Section and listed in the Proposal.

Measurement shall be in accordance with Section 1-09.1 of the WSDOT Standard Specifications. Volumes of gravel materials and concrete volumes shall be measured by the Engineer in the field and quantities will be limited to the relative neat line dimensions shown on the Plans or as approved by the Engineer in the field.

Weighing equipment, scale verification checks, load tickets for quarry spalls, rock riprap, cobbles, gravel materials, hot mix asphalt, bituminous construction materials, etc., shall conform to Section 1-09.2 of the WSDOT Standard Specifications, as amended in these Specifications. Load tickets shall include all gravel materials, cast-in-place concrete, cement grout, CDF, hot mix asphalt, ATB, and reinforcing steel. The Owner will pay for no material received by weight unless they have been weighed as required in this Section or as required by another method the Engineer has approved in writing. All costs incidental to weighing shall be merged into the various unit prices bid.

1.4 INDIVIDUAL BID ITEMS

The following is a list of bid items for the project. The contract price for each item constitutes full compensation for furnishing all equipment, labor, materials, appurtenances, and incidentals and performing all operations necessary to construct and complete the various bid items in accordance with the Contract

Documents. Payment for each item shall be considered as full compensation, notwithstanding that minor features may not be mentioned herein. Work paid for under one item will not be paid for under any other item. If a particular item of work shown on the Plans or described in Specifications is not described in a specific bid item, this item of work shall be considered as incidental to the work and the costs for this work shall be merged into the various respective unit price and lump sum bid items.

1. WPCP Third Secondary Clarifier
 - a. Measurement: Will be measured by lump sum.
 - b. Payment: The lump sum contract price for the WPCP THIRD SECONDARY CLARIFIER shall include costs for the labor, materials, equipment required to provide a complete and operable Third Secondary Clarifier, as shown on the Plans and as specified herein, with the exception of all labor, materials and equipment included in the following bid items: Mobilization and Demobilization, Trench Excavation Safety Systems, Ground Freezing, Dewatering, Erosion Control, Unsuitable Excavation, and Minor Change.

2. Mobilization and Demobilization
 - a. Measurement: Will be measured by lump sum.
 - b. Payment: The lump sum contract price for MOBILIZATION AND DEMOBILIZATION shall include all costs for the labor, materials, and equipment required for mobilization and demobilization on the project as described in Section 01505.

Payment for MOBILIZATION AND DEMOBILIZATION shall be as follows:

35% Payment: When Contractor has mobilized on-site and temporary facilities are in place.

50% Payment: When 5 percent of the total pay items are completed (not including payment for materials on hand).

75% Payment: When 50 percent of the total pay items are completed (not including payment for materials on hand).

100% Payment: When Project is completed and recommended for acceptance.

3. Trench Excavation Safety Systems
 - a. Measurement: Will be measured by lump sum.
 - b. Payment: The lump sum contract price for TRENCH EXCAVATION SAFETY SYSTEMS shall include all costs for labor, materials, and equipment required to provide sheeting, shoring, and bracing of trenches and open excavations as required to meet the Washington Industrial Safety and Health Act, Chapter 49.17 RCW and Section 02250. These costs shall not be considered incidental to any other bid item.

4. Ground Freezing
 - a. Measurement: Will be measured by lump sum.
 - b. Payment: The lump sum contract price for GROUND FREEZING shall include, but not be limited to all costs for design, installation, and operation of equipment required to provide ground freezing including removal of temporary piping system and equipment, groundwater and temperature monitoring, field and laboratory investigation, and brine flow monitoring, for groundwater control of the excavation of the new third secondary clarifier as required by Section 02241 of these Specifications.

5. Dewatering
 - a. Measurement: Will be measured by lump sum.
 - b. Payment: The lump sum contract price for DEWATERING shall include, but not be limited to, all costs for design, installation, and operation of wells, pumps, and other machinery as may be required for dewatering, including permit requirements and the construction of any temporary facilities to dispose of water.

6. Erosion Control

- a. Measurement: Shall be measured by lump sum.
- b. Payment: The lump sum contract price for EROSION CONTROL shall include all costs for the labor, material, and equipment for installation and maintenance of all temporary erosion and sediment control measures and best management practices (BMPs), as shown on the Plans and as further described in Section 02370.

7. Unsuitable Excavation

- a. Measurement: Will be measured by the cubic yard, in-place and shall be to the limits as designated by the Engineer. There shall be no payment if the Engineer believes removal of materials is needed because of damage caused by the Contractor's operations.

All quantities will be measured and recorded by the Engineer in his Daily Report and the Contractor shall be responsible for reconciling his quantities with the Engineer on a daily basis.

- b. Payment: The unit price per cubic yard for UNSUITABLE EXCAVATION shall include all cost for labor, material, and equipment to excavate and wastehaul unsuitable native subgrade materials, including backfilling the resulting excavations with compacted foundation gravel materials.

8. Minor Change

- a. Measurement: Will be negotiated prior to commencing any such work under this pay item and shall be for work to remedy unforeseen conditions, utility conflicts, minor landscaping, minor drainage improvements, or special surface restoration.
- b. Payment: Payment or credits for changes amounting to \$150,000 or less may be made under the Bid Item Unexpected Site Changes. At the discretion of the Owner, this procedure for Unexpected Site Changes may be used in lieu of the more formal procedure as outlined in Section 1-04.4 of the Standard Specifications, as amended in these Specifications. The Contractor will be provided a copy of

the completed order for the Unexpected Site Change. The agreement for the Unexpected Site Change will be documented by signature of the Contractor or notation of the verbal agreement. If the Contractor is in disagreement with anything required by the order for Unexpected Site Change, the Contractor may protest the order as provided in Section 1-04.5 of the Standard Specifications, as amended in these Specifications.

Payments or credits will be determined in accordance with Section 1-09.6 of the Standard Specifications, as amended in these Specifications. For the purpose of providing a common Proposal for all Bidders, the Owner has entered an amount of \$150,000 for UNEXPECTED SITE CHANGES in the Proposal to become part of the total Bid by the Contractor.

1.5 PROJECT MATERIALS ON HAND

See Section 1-09.8 of the Standard Specifications, as amended in these Specifications.

1.6 PAYMENT

Payment for all work will be made at the contract unit price or lump sum price as indicated in the Proposal, payment of which shall constitute full compensation, for a complete installation.

For items of equipment, acceptable operating and maintenance information shall be delivered to the Engineer before the Contractor will be paid for more than 90 percent of the purchase value of that equipment. Purchase value shall be the net price for the equipment as given on the invoice.

Final operating and maintenance manuals per Section 01300 must be delivered to the Engineer prior to the Project being 90 percent complete. Progress payments for work in excess of 90 percent completion will not be made until the specified acceptable operating and maintenance information has been delivered to the Engineer.

***** END OF SECTION *****

SECTION 01290

SCHEDULE OF VALUES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section establishes the procedures for preparing the schedule of values used for preparation of the Contractor's progress pay estimates.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
Standard Specifications Section 1-09	Measurement and Payment
01200	Measurement and Payment
01300	Submittals

1.3 DESCRIPTION

Within 10 days following receipt of Notice to Proceed, the Contractor shall submit to the Engineer, for review and approval, a complete breakdown of components of all lump sum bid items showing the value assigned to each portion of the work. The schedule of values shall be prepared in such form, and supported by data that substantiates its accuracy as may be required by the Engineer. This schedule of values shall, once approved by Engineer, be used as the basis for reviewing and determining each monthly progress payment estimate and as such shall be subject to periodic review by the Engineer to assure that the schedule of values reasonably represents, in the opinion of the Engineer, the actual value of the individual items of work to be performed. No payments shall be made until the schedule of values has been approved.

***** END OF SECTION *****

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes requirements that apply to all equipment and materials supplied on the Project.

The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the requirements of the Contract Documents. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment that are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where his submittal may affect the work of another contractor or the Owner. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors and shall verify such coordination on all submittals.

Where noted in the Contract Documents, the structural, mechanical, and electrical designs associated with the indicated equipment items are specific to the manufacturer and model number specified. Any structural, mechanical, or electrical modifications required to utilize an approved substitution to the specified equipment shall be made by the Contractor at no additional cost to the Owner. Where approved substitutions of specified equipment affect other materials or equipment, mechanical, structural, or electrical work, the Contractor shall note in the equipment submittal any necessary changes to accommodate the substituted equipment. It shall also be the responsibility of the Contractor to coordinate other mechanical, structural, or electrical equipment submittals to make sure that all changes necessary to accommodate the substituted equipment are addressed in these submittals as well.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01290	Schedule of Values
01320	Progress Schedules
01400	Quality Control
01720	Record Drawings
01800	Testing, Commissioning, and Training

<u>Section</u>	<u>Item</u>
09900	Painting
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 15	Electrical

1.3 WORK INCLUDED

Submittals required for this work shall include any or all of the following as required by the particular specification section and the submittal schedule:

- A. Schedules and Plans
- B. PRODUCT SUBMITTALS
 - 1. Manufacturer's Literature
 - 2. Shop Drawings
 - 3. Color and Material Samples
 - 4. Design Calculations
 - 5. Test Reports
- C. Equipment Operation and Maintenance Manuals
- D. Post-Construction (Record) Drawings (see Section 01720)

1.4 SUBMITTAL INFORMATION

Shop, catalog, and other appropriate drawings and information shall be submitted to the Engineer for review prior to fabrication or ordering of all equipment and materials specified. The number of copies of submittal information to be submitted shall be as indicated below.

All submittal information shall be sent to the Engineer through the Contractor. The Contractor shall assign a separate submittal number to each item or group of items that relate to each specification section. Submittal numbers shall be assigned in consecutive ascending order, with the first project submittal assigned the number "1." Resubmittals shall be numbered using the same number followed by an alphabetical suffix. All submittals shall bear the Contractor's certification that he has reviewed, checked, and approved the submittal information prior to transmitting to the Engineer. The submittal number and related specification section shall be marked on each submittal.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor shall submit all submittals on the Web-Based Project Communication System. The Contractor shall submit the specified information as PDF files on the web-based project communication system, with a table of contents bookmarked to provide a navigation link to each section of the submittal. The PDF shall consist of one submittal for each submittal number and shall not be broken up into separate documents. Three CD ROM PDF version and four hard copies of all final equipment manuals shall be submitted.

2.2 PRODUCT SUBMITTALS

A. GENERAL

When indicated in the Contract Documents the contractor shall submit product data for review by the Engineer. Unless otherwise specified, within 30 calendar days after receipt of the submittal, the Engineer shall review the submittal and return three copies of the marked-up submittal. The reproducible original will be retained by the Engineer. The returned submittal shall indicate one of the following actions:

1. If the review indicates that the material, equipment, or work method complies with the project Specifications, submittal copies will be marked “NO EXCEPTIONS TAKEN.” In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
2. If the review indicates limited corrections are required, copies will be marked “MAKE CORRECTIONS NOTED.” The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in operation and maintenance data, a corrected copy shall be provided.
3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked “AMEND AND RESUBMIT.” Except at his own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted, and returned marked either “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED.”

4. If the review indicates that the material, equipment, or work method does not comply with the project Specifications, copies of the submittal will be marked "REJECTED - SEE REMARKS." Submittals with deviations that have not been identified clearly may be rejected. Except at his own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

B. MANUFACTURER'S LITERATURE

Where the contents of submitted literature include data not pertinent to the submittal, the portion(s) of the contents being submitted for the Engineer's review shall be clearly indicated.

C. SHOP DRAWINGS

Shop drawings shall be submitted in the form of blue-line or black-line prints of each sheet. Blueprint submittals will not be acceptable.

All shop drawings shall be accurately drawn to a scale sufficiently large enough to show pertinent features and method of connection or joining. On all shop drawings, figure dimensions shall be used as opposed to scaled dimensions.

D. COLOR AND MATERIAL SAMPLES

All material samples shall be of the exact article proposed to be furnished for the work and shall be submitted in the quantity required. Samples shall be returned to the Contractor, with one retained by the Engineer.

Unless the precise color is specifically described in the Contract Documents, or whenever a choice of color or pattern is available in a specified product, accurate color charts shall be submitted to the Engineer for his review and selection.

E. DESIGN CALCULATIONS

Where required in the Specifications, design calculations shall be submitted to the Engineer. Design calculations shall be complete, concise, and in an easy-to-read format. All design calculations shall be stamped by a Professional Engineer licensed in the State of Washington.

F. TEST REPORTS

Copies of all test reports shall be submitted to the Engineer.

2.3 EQUIPMENT MANUALS

A. GENERAL

For all items of equipment, preliminary manufacturer's equipment operation and maintenance manuals shall be submitted to the Engineer for review. One copy will be returned to the Contractor with comments.

The following information shall be furnished for all items of equipment installed on the project requiring operational and/or maintenance procedures, and for any additional items indicated by the Engineer.

1. Lubrication Information

This shall consist of the manufacturer's recommendations regarding the lubricants to be used and the lubrication schedule to be followed.

2. Electrical and Control Diagrams

Diagrams shall show internal and connection wiring.

3. Startup Procedures

These instructions consist of equipment manufacturer's recommendations for installation, adjustment, calibration, and troubleshooting.

4. Operating Procedures

These instructions consist of the equipment manufacturer's recommended step-by-step procedures for starting, operating, and stopping the equipment under specified modes of operation.

5. Preventive Maintenance Procedures

These instructions consist of the equipment manufacturer's recommended steps and schedules for maintaining the equipment.

6. Overhaul Instructions

These instructions consist of the manufacturer's directions for the disassembly, repair, and reassembly of the equipment and any safety precautions that must be observed while performing the work.

7. Parts List

This list consists of the generic title and identification number of each component part of the equipment.

8. Spare Parts List

This list consists of the manufacturer's recommendations of number of parts, which should be stored by the Owner and any special storage precautions, which may be required.

9. Exploded View

Exploded or cut views of equipment shall be provided if available as a standard item of the manufacturer's information. When exploded or cut views are not available, plan and section views shall be provided with detailed callouts.

10. Test Documentation

Reports, records, data and forms documenting the results of equipment factory tests, including pump and blower performance curves, shall be provided, with the operating points for the specific equipment designated. When a special factory test of the supplied equipment is not performed, the manufacturer's standard performance reports and curves, with specified operating points, shall be provided for the supplied equipment.

11. Specific Information

Where items of information not included in the above list are required, they will be provided as described in the specifications for the equipment.

12. Warranty Information.

13. Maintenance Information Summaries (see below for requirements).

In addition, the following items of equipment shall be provided with Maintenance Information Summaries in each appropriate section of the equipment manuals, prepared according to the format specified herein:

- Submersible Centrifugal Pumps
- Dry-pit Non-clog Centrifugal Pumps
- Secondary Clarifier Mechanism
- Clarifier Algae Sweep System
- Magnetic Flow Meters
- Valves (larger than 1-inch in size)
- Instrumentation, Telemetry and Control Equipment
- Electrical Equipment

Maintenance information summaries shall be prepared on 8-1/2-inch x 11-inch paper only and shall contain the following information compiled from manufacturer's recommendations in the order shown.

1. Description or name of item of equipment.
2. Manufacturer.
3. Name, address, and telephone number of local manufacturer's representative.
4. Serial number (where applicable). The Contractor shall verify that it matches the equipment installed on the project.
5. Equipment nameplate data including model number.
6. Recommended maintenance procedures:
 - a. Description of procedures.
 - b. Maintenance frequency required.
 - c. Lubricant(s) or other materials required (where applicable), including type of lubricant, lubricant manufacturer, and specific compound.
 - d. Additional information as required for proper maintenance.
7. Recommended spare parts (where applicable).

The maintenance information summary shall be placed at the beginning of the manual.

All operation and maintenance information shall be comprehensive and detailed and shall contain information adequately covering all normal operation and maintenance procedures.

For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment specification number as it appears in the project Specifications. The information shall be organized in binders. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information.

Lubricants shall be described in detail, including type, recommended manufacturer, and manufacturer's specific compound to be used.

It shall be the responsibility of the Contractor to ensure that all operation and maintenance materials are obtained. Material submitted must meet the approval of the Engineer prior to project acceptance.

B. EXTRANEOUS DATA

Where the contents of the manuals include manufacturers' standard brochures or catalog pages, the exact item(s) used in this installation shall be clearly indicated and all manufacturers' data which is extraneous shall be clearly deleted.

C. FINAL EQUIPMENT MANUALS

The Contractor shall be responsible for tracking and coordinating each separate manufacturer's equipment operation and maintenance manual submittal and shall resubmit, as necessary, until the Engineer's review indicates that the submittal is acceptable. The Contractor shall maintain equipment manual files until final approval copies are delivered to the Engineer. The Contractor shall be responsible for collating the approved operation and maintenance submittal sections into complete final manufacturers' equipment operation and maintenance manuals bound in post binders which are indexed to the Specifications. The Contractor shall deliver the complete final operation and maintenance manuals to the Engineer prior to project completion. All copies final manufacturers' equipment manuals submitted will be retained by the Engineer or Owner.

The Contractor shall also supply three CD-Rom copies of the final equipment manuals in a tabbed, searchable, .pdf format, with a table of

contents bookmarked to provide a navigation link to each section of the manual.

PART 3 EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. GENERAL

Each submittal shall be accompanied by a letter of transmittal showing the date of transmittal, specification section, or drawing number to which the submittal pertains, submittal number, and a brief description of the material submitted.

B. RESUBMITTALS

When material is resubmitted for any reason, it shall be submitted under a new letter of transmittal and referenced to the previous submittal.

3.2 REVIEW OF SUBMITTALS

The Engineer will review all submittals for general conformance with the design and other requirements of the Contract Documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract Documents. Submittals may be rejected based on inadequate information and/or not meeting the requirements of the Contract Documents. Rejection of submittals requires action on the part of the Contractor to correct the reason for the rejection. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, and for techniques of assembly and installation.

3.3 COORDINATION OF PRODUCT SUBMITTALS

A. GENERAL

Prior to submittal for review by the Engineer, all data shall be fully coordinated, including the following:

1. All field dimensions and conditions.
2. All trades and public agencies involved, including necessary approvals.
3. All deviations from the Contract Documents.

B. GROUPING OF SUBMITTALS

1. All submittals shall be grouped with associated items, unless otherwise specifically permitted by the Engineer.
2. The Engineer may reject the submittals in their entirety or any part thereof, if not in accordance with the Contract Documents.

C. CERTIFICATION

Submittals shall bear the Contractor's certification that he has reviewed, checked, and approved the shop drawings prior to forwarding them to the Engineer.

3.4 TIMING OF PRODUCT SUBMITTALS

A. GENERAL

1. All submittals shall be made far enough in advance of installation to provide all required time for reviews and securing necessary approvals.
2. In scheduling, the Contractor shall allow for the time indicated in Part 2.2A for the Engineer's review following his receipt of the submittal.

B. DELAYS

No additional or separate payment will be made for costs of delays occasioned by tardiness of submittals on the part of the Contractor.

3.5 EQUIPMENT MANUALS

The preliminary copies of the manufacturer's equipment manuals shall be delivered to the Engineer for review not later than the time of equipment delivery to the project site. The Contractor will not be paid for more than 90 percent of the purchase value of an item of equipment until the Engineer has received the preliminary equipment manual for that item of equipment.

Final copies of the manufacturer's equipment manuals shall be delivered to the Engineer at least 14 days prior to requesting payment in excess of 90 percent completion for the project. Progress payments for work in excess of 90 percent completion will not be made until the final equipment manuals have been received and accepted by the Engineer. Prior to submittal of the final equipment

manuals, the Contractor shall check the manuals for accuracy and completeness and shall verify that prior review comments have been addressed.

***** END OF SECTION *****

SECTION 01310

PROJECT MEETINGS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes information pertaining to the various meetings that will be held during the course of constructing this project.

1.2 MANDATORY PREBID CONFERENCE

A mandatory prebid conference will be held for the benefit of the prospective bidders before the bid opening. The date will be included in the published Notice to Contractors.

1.3 PRECONSTRUCTION CONFERENCE

As soon as possible following the award of the Contract, a preconstruction conference shall be scheduled for representatives of the Owner, the Contractor, the Engineer, funding agencies, regulatory agencies, and affected utilities.

1.4 PROJECT PROGRESS MEETINGS

The Owner and the Engineer will schedule and attend regular meetings with the Contractor for coordination, administrative, and procedural requirements of the project. The Contractor shall provide a meeting room with table and chairs at or near the site for project progress meetings. Meetings will occur on a weekly basis, unless otherwise agreed upon by the Owner, the Contractor, and the Engineer. The meeting frequency may be adjusted based on project status and progress.

1.5 CONSTRUCTION MEETINGS

The Contractor shall schedule and hold regular meetings during the project:

- A. Safety Meetings (Contractor's subcontractors shall attend if they are working onsite.)
- B. Project Progress Meetings
- C. Equipment Installation Meetings
- D. Coordination Meetings

E. Startup and Testing Meetings

The Contractor shall notify the Owner and Engineer in advance of all meetings. The meetings may or may not be attended by the Owner and Engineer.

***** END OF SECTION *****

SECTION 01385

VIDEO RECORDING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the video recording requirements for the project.

The Contractor shall provide the Engineer with a DVD or other computer-readable digital format of the project area prior to and upon completion of all construction. The video recording shall utilize equipment that will visually document an accurate audio-visual description of the existing and post-construction conditions.

The Contractor shall notify the Engineer prior to the recording to allow the Engineer to witness the video recording. The Contractor shall provide preconstruction video recording of the existing conditions for the entire project site.

Upon completion of the work, the Contractor shall provide video recording in the same manner and vantage point as the preconstruction video recordings. The intent of this Specification section is to provide a comparison between existing and post-construction conditions.

The rate of speed the documentation will be video recorded at, the panning rates, and the zoom-in/zoom-out rates will be controlled so that playback will produce a clear television picture of the areas video recorded.

The video recording shall be accomplished during a period of good visibility. Unless otherwise directed by the Engineer, video recording will not be allowed during times of precipitation or poor visibility.

When available light is not sufficient to produce a clear television image, additional lighting shall be supplied by the photographer to ensure good picture quality. The camera crew shall be able to work independent of any power source, utilizing battery power to operate the camera, and lighting.

A legible reader board shall be provided by the photographer to visually document the date, job title, and site identification. The audio portion of the video recording will be used for identification purposes, addresses, and any other audio required or as directed by the Engineer.

***** END OF SECTION *****

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the control tests, test sample collection, required field-testing, and special inspections as specified herein, and indicated on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02700	Gravel Materials
02740	Hot Mix Asphalt
03300	Reinforced Concrete

1.3 PAYMENT

All testing as required by this Section shall be coordinated and scheduled by the Contractor with the Owner's designated testing agency. The Owner will contract with, and pay for, a testing agency to conduct all field and laboratory tests and special inspections as designated herein.

Retesting and reinspection required because of defective work and testing performed for the convenience of the Contractor shall also be paid for by the Contractor. Costs for retesting (beyond that which is required herein) will be reimbursed to the Owner in the form of a credit on a change order at the time of project acceptance.

All costs for scheduling, sampling, coordinating, and retesting of defective work shall be considered as incidental to the work and merged into the respective unit and lump sum prices bid.

PART 2 PRODUCTS

2.1 SOILS AND GRANULAR MATERIALS

A. COMPACTION CONTROL

Optimum moisture content and maximum density tests shall be determined by the following method:

ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort

B. IN-PLACE TESTS

In-place density and moisture content tests shall be made by an independent testing laboratory according to the following methods:

ASTM D1556 – Density and Unit Weight of Soil in Place by the Sand Cone Method

ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

2.2 AGGREGATES

All aggregates shall be tested in accordance with applicable WSDOT test methods:

<u>Title</u>	<u>Test Method</u>
Sampling	AASHTO T2
Sieve Analysis of Fine and Coarse Aggregates	104A
Material Finer than No. 200 Sieve in Aggregates	102A
Percentage of Particles Smaller than 0.025 mm and 0.005 mm	603A
Organic Impurities	111A
Abrasion of Coarse Aggregates by Use of the Los Angeles Machine	101A
Sand Equivalent	109A

2.3 CAST-IN-PLACE CONCRETE

Cast-in-place concrete shall be tested in accordance with applicable parts of Chapter 16 of ACI 301. Concrete reinforcement and concrete special inspections shall be performed in accordance with local Building Official and WABO requirements.

2.4 HOT MIX ASPHALT

Paving asphalt shall be tested in accordance with the following Washington State Department of Transportation test methods:

<u>Characteristics</u>	<u>Test Method</u>
Tests on Residue from RTFC Procedure	208
Absolute Viscosity at 140 degrees F, poise	203
Kinematic Viscosity at 275 degrees F, cSt, min.	202
Penetration at 77 degrees F, 100 g/5 sec., min. ⁽¹⁾	201
Percent of Original Penetration at 77 degrees F, min.	2
Ductibility at 45 degrees F, cm, min.	
Flashpoint, (Cleveland Open Cup), degrees F min. (test on original asphalt)	206
Solubility in Trichloroethylene percent, min. (test on original asphalt)	214

(1) Original penetration, as well as penetration after RTFC loss shall be determined by AASHTO Test Method T 49.

A. COMPLETE EXTRACTIVE OF UNCOMPACTED MIX

Test methods shall be in accordance with the following:

1. AASHTO T68
2. ASTM D2172
3. AASHTO T30

B. DENSITY OF COMPACTED MIX

Test method shall be in accordance with AASHTO T166.

1. The Contractor shall coordinate and schedule an independent testing laboratory employed by the Owner to conduct complete extraction tests on the uncompacted asphalt concrete pavement mix.
2. The Contractor shall provide the Engineer with an affidavit from the asphalt supplier of the characteristics of the paving asphalt. The paving asphalt shall be tested in accordance with Washington State Department of Transportation Construction Manual and Standard Specifications, latest editions.

PART 3 EXECUTION

3.1 SAMPLING AND TESTING FREQUENCY

A. GENERAL

The Contractor shall be responsible for the coordination and scheduling of a certified independent testing laboratory employed by the Owner to provide the following quality control tests at the number and frequency described herein. The precise location of the tests shall be designated by the Engineer. The Contractor shall cooperate with laboratory personnel employed to conduct the density testing, sampling of material(s), and special inspections. The Contractor shall provide safe access within the work site for laboratory personnel such that density testing and visual inspection can be performed. The Contractor shall provide samples of materials to be tested in the quantities required and herein specified to the appropriate laboratory personnel. The Contractor shall furnish all labor, equipment, tools, and materials necessary to obtain and deliver samples as herein designated. He shall also provide and repair any test holes required in order to facilitate the testing and sampling and to provide for the testing laboratory's exclusive use for storage and curing of test samples until removed to the laboratory.

Any areas tested and further failing compliance with the Specifications shall be recompacted and retested at the Contractor's expense, until a successful density test indicating compliance with these Specifications has been achieved.

B. SOIL TESTING

The Contractor shall schedule and coordinate with the Owner-employed independent testing laboratory to conduct the following quality control tests at the given frequency:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Backfill for foundations, walls, trenches and roads ¹	Gradation	One for every 500 cy or one per day, whichever is more frequent, for each type of soil or fill material with quantities exceeding 25 cy. For trenches, one per day and one every 250 feet of trench.

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
	In-Place Density ^{2,3,4}	One every 500 cy or one per day for each type of soil or fill material with quantities exceeding 25 cy. For trenches, one per day and one every 250 feet of trench.
	Moisture-Density Relationship ³	One prior to start of backfilling operation, one every 20 densities and any time material type changes.
Pipe Bedding ¹	Gradation	One every 750 feet of trench.
Subgrade and Fills ¹	In-Place Density ^{2,3}	One every 500 cy of each type material.
	Moisture-Density Relationship	One for every 20 densities for each material.
	Gradation	One for every moisture-density.

1. All acceptance tests shall be conducted from in-place samples.
2. Additional tests shall be conducted when variations occur due to the Contractors, operations, weather conditions, site conditions, etc.
3. The nuclear densometer, if properly calibrated, may be used but only to supplement the required testing frequency and procedures. The densometer shall be calibrated and is recommended for use when the time for complete results becomes critical.
4. Depending on soil conditions, it is anticipated that compaction tests shall be required at depths of 2 feet above the pipe and at each additional 5 feet to the existing surface plus a test at the surface.

C. HOT MIX ASPHALT TESTING FREQUENCY

The Contractor shall schedule and coordinate with the Owner-employed testing laboratory to conduct the following quality control tests at the stated frequency:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Compaction		One per 80 tons asphalt concrete, with not less than one test per 400 lf of traffic lane or trench restoration, by nuclear density gauge testing, for all classes of HMA.

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Mix Design (By Contractor)	Submittal	Design Mix (include test results). Aggregate (each size) – 100 pounds. Asphalt - 1 gallon. Mineral Filler – 10 pounds.
Asphalt (including prime and tack coat)	Sample and Tests	Submit a 1-quart sample and material certification with test results for each shipment or lot of asphalt. A duplicate 1-quart sample shall be retained by the Contractor until the completion of the job.
Aggregates (from bins or source)	Gradation	One test prior to start of paving operation and one every 1,500 tons or 1,000 cy.
	Fractured Faces	Same as gradation.
	LA Abrasion	One test prior to start of paving and one test every 10,000 tons thereafter.
	Specific Gravity	Same as gradation.
Asphalt Concrete (including Asphalt Treated Base)	Marshall Method Test	One initial test during mix design and one per 3,000 tons thereafter.
	Specific Gravity	One per each Marshall test.

D. CONCRETE TESTING

All testing shall conform to applicable portions of ACI. Special inspections of concrete and concrete reinforcement shall comply with WABO requirements.

All concrete must meet the specified requirements for minimum 28-day compressive strength.

All concrete cylinders shall be molded and tested for strength by an Owner-employed testing laboratory scheduled and coordinated by the Contractor.

The Contractor shall furnish all concrete required for molding of the cylinders. In cases where cylinders are stored at the project site, the

Contractor shall provide storage and protection for the cylinders in accordance with ACI requirements.

Concrete tests and testing frequency shall be in accordance with the more stringent of the testing requirements specified in Section 03300-3.17 of these Specifications, and the following table:

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Coarse Aggregate (for each grading size) ¹	Gradation	One test every 500 cy of concrete.
	Deleterious Substances	One test initially and thereafter when appearance makes the material suspect.
	L.A. Abrasion	One every 2,000 tons of aggregate.
	Moisture specific gravity and absorption ¹	One initially and every 250 cy thereafter. One moisture to be conducted prior to any batching and more frequently if hauling and storage does not provide a consistent moisture content.
Fine Aggregate ¹	Gradation and fineness modules	One every 250 cy of concrete.
	Deleterious Substances	(same as coarse aggregate).
	Moisture, specific gravity and absorption ¹	(same as coarse aggregate).
Concrete	Slump	Conduct one test every day of placement and one additional test for every 50 cy placed and more frequently if batching appears inconsistent. Conduct in conjunction with taking concrete cylinders.
	Entrained Air	Conduct with each slump test.
	Ambient and concrete temperatures	Conduct with each slump test.

<u>Material</u>	<u>Test</u>	<u>Minimum Sampling & Testing Frequency</u>
Concrete	Compressive strength and evaluation of results per ACI 214. (includes unit weight of each cylinder)	For all concrete placement, take one set of four cylinders per day and one additional set of cylinders for every 50 cy of each class of structural concrete. Cylinders shall be 4 inch by 8 inch. Test one cylinder at 7 days and two at 28 days. Fourth cylinder shall be held in reserve. A plot and statistical evaluation shall be maintained in accordance with ACI 214 for compressive strength results. Field cure cylinders shall be made when insitu strengths are required to be known.

1. Aggregate moisture tests are to be conducted in conjunction with concrete strength tests for water/cement (w/c) calculations.

E. SPECIAL INSPECTIONS

Contractor shall coordinate and schedule all required Special Inspections per WABO requirements (Chapter 17 of the IBC) with the Owner designated testing agency. Special inspections include cast-in-place concrete, concrete reinforcement, structural welded connections, bolted connections, concrete masonry units (CMU), compaction testing for building and structure foundations, and epoxy adhesive bolting.

***** END OF SECTION *****

SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary facilities required for this project, but not necessarily limited to:

- A. Temporary utilities such as water, electricity, telephone, off-site staging, and off-site parking.
- B. Temporary piping, pumps, valves, fittings, manholes, vaults, and appurtenances necessary to keep existing facilities fully operational during construction.
- C. Sanitary facilities.
- D. Temporary enclosures such as fences, tarpaulins, barricades, and canopies.
- E. Alarms or monitoring systems for any temporary pumping facilities.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01510	Maintenance of Treatment Facility
01520	Field Offices and Storage Sheds

PART 2 PRODUCTS

2.1 UTILITIES

A. TEMPORARY ELECTRICITY

The Contractor shall provide temporary power for construction at the project site. He shall make arrangements with the electrical utility (to obtain temporary power) and shall pay all costs and fees charged by the utility associated with connection of temporary power. The Contractor shall provide all special connections, receptacles, panelboards, etc., which are required for temporary service, and are not provided by the utility.

The Contractor shall furnish and install all temporary wiring and associated equipment required to keep all portions of the existing facilities in operation at all times.

Area distribution boxes shall be furnished, installed, and so located that the individual trades may use their own construction-type extension cords to obtain proper power and artificial lighting at all points where required. The Contractor shall provide a main disconnect on all temporary wiring panels, labeled "MAIN DISCONNECT," to ensure the safety of personnel using extension cords and hand tools. Panels shall also be properly grounded and equipped with GFCI breakers in accordance with WISHA requirements.

The Contractor shall provide the Engineer single line diagrams of the temporary wiring showing all circuit breakers. These diagrams shall be provided prior to installation of this wiring. These diagrams are necessary to provide information to Owner personnel for off-hours operation.

The Contractor shall pay all demand, consumption, taxes, and fees associated with the temporary electrical service.

B. WATER

Water is available from the Owner free of charge, provided that it is used responsibly. The Contractor shall install a reduced pressure backflow prevention device prior to obtaining water from the Owner. This installation shall be inspected and approved by a Certified Backflow Assembly Tester.

C. TELEPHONE

The Contractor shall provide and pay for telephone service at his construction site office. Telephone service shall be made available for use by the Engineer in the Engineer's trailer. Two telephone lines shall be provided to the Engineer as noted above. The Contractor shall pay the costs of providing telephone service and the monthly service fees including all long-distance charges. Radio-telephone service is not acceptable as a substitute for telephone service.

2.2 TEMPORARY PIPING

The Contractor shall furnish and install all temporary piping and pumping and, upon completion of the work, remove all such temporary piping as required, except as designated on the Plans to remain as a part of the Project. Prior to installation, the Contractor shall submit drawings to the Engineer showing the

proposed installation of temporary piping and pumps, including location, type of pipe, fittings, and valves. The Contractor shall obtain the Engineer's approval for temporary piping and pumping plan prior to installation.

Temporary piping and pumping shall be provided as necessary to maintain the existing facilities in operation until the new facilities are constructed and operational. An effort has been made on the Plans and/or Specifications to note instances and locations where temporary piping and/or pumping may be required; however, this in no way limits the temporary piping and pumping to be provided by the Contractor at these locations.

2.3 SANITARY FACILITIES

The Contractor shall provide toilet and wash-up facilities for his workforce and the Engineer at the site of work. They shall comply with applicable laws, ordinances, and regulations pertaining to the public health and sanitation of dwellings and camps.

2.4 OFF-SITE STAGING AND PARKING

The Contractor shall note that space is limited throughout the construction site. Employees of the Contractor, all subcontractors, vendors, suppliers, and associated personnel shall not be allowed to park onsite during the course of construction. It shall be the responsibility of the Contractor to provide sufficient parking facilities in authorized area(s) other than the construction site for the above-mentioned personnel.

In addition, the Contractor shall not be allowed to stockpile and store equipment and materials throughout the construction site. The Contractor shall coordinate his schedule so that all equipment and materials shall be brought to the construction site only when they are to be installed / utilized.

The Contractor shall provide storage of equipment and materials at an offsite, bonded warehouse, to be approved by the Engineer. The Contractor shall pay all costs associated with off-site delivery, storage, and transfer to the construction site.

2.5 ENCLOSURES

The Contractor shall furnish, install, and maintain during the project time all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the work in compliance with all pertinent safety and other regulations.

2.6 ALARM SYSTEMS

The Contractor shall provide alarm systems for temporary pumping facilities utilized during construction. Alarms shall warn the Contractor and / or system operators of high / low level alarms and similar conditions, which, if left unattended or uncorrected, could lead to spillage or overflow of raw or treated sewage or sludge from a wet well, pumping facility, or portion of a lift station.

PART 3 EXECUTION

All temporary facilities and controls shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities and controls as rapidly as progress of the work will permit or as directed by the Owner.

***** END OF SECTION *****

SECTION 01505

MOBILIZATION AND DEMOBILIZATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of mobilization and demobilization. Mobilization consists of preconstruction activities and preparatory work for the project necessary to mobilize labor, materials, and equipment to the project site. Demobilization consists of activities to remove materials and equipment from the project site upon project completion, including final cleanup. Items which are not considered mobilization or demobilization include but are not limited to:

- A. On-going activities throughout the duration of construction.
- B. Profit, interest on borrowed money, overhead, or management costs.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
Division 1	General Technical Requirements

PART 2 PRODUCTS

Products and materials required for mobilization and demobilization are described in the various sections of Division 1 and in other parts of the Contract Documents.

PART 3 EXECUTION

Complete mobilization and demobilization as required by the various sections of Division 1 and other parts of the Contract Documents.

***** END OF SECTION *****

SECTION 01510

MAINTENANCE OF EXISTING TREATMENT FACILITY

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the steps that the Contractor shall take to ensure that the existing facilities or temporary facilities remain fully operational during all stages of construction and modifications to the various existing facilities. Discharge of untreated sewage will not be permitted.

To ensure continuous operation of any existing, temporary or permanent pumping systems, the Contractor shall inform the City of Puyallup staff of the details of operation of all temporary piping and electrical power and controls.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01110	Summary of Work
01500	Temporary Facilities

1.3 EXISTING TREATMENT PLANT

The Contractor shall schedule work so as to minimize interruption of the treatment or the transportation of sewage. Prior to starting construction, the Contractor shall confer with the Engineer and the Owner and develop a construction sequence and schedule which will provide for adequate treatment during the required modifications. The Contractor shall take all steps necessary to ensure that the existing facilities nor subject to modifications remain fully operational during all stages of construction. Discharge of untreated sewage will not be permitted.

In the event that sewage reaches the receiving water as a result of the Contractor's activities, the Contractor shall immediately notify the Owner and take corrective action. Following any such incident, the Contractor shall submit to the Owner a written report summarizing the beginning and ending times of the bypass, approximate volume bypassed, reason for bypass, and corrective measures taken.

1.4 EXISTING UTILITIES

There now exists within the site boundaries a domestic and non-potable water system and sanitary sewer system owned by the Owner, as well as privately owned and operated telephone and electric lines and poles, both underground and overhead. The utilities are vital to the continuous operation of the existing treatment facilities, as well as the community as a whole. The Contractor shall be responsible for the protection of these utilities and be responsible for notifying the utility company if their services are necessary.

All poles, piping, wiring, etc., of the various utilities shall be braced and protected from nearby excavations, at the Contractor's expense.

Whenever the Contractor is excavating in the area of these utilities, he shall make arrangements to have emergency repair equipment, materials, and manpower available within 30 minutes of the site. The Contractor shall submit his contingency plans to the Engineer for approval at least 10 days prior to performing any excavation.

If any damage is done to these lines, the Contractor shall repair the line(s) immediately so the operation of the facility is unimpaired. If the Contractor fails to repair the lines, the Owner shall repair the line(s) and deduct the costs thereof from the monies or payments due or to become due to the Contractor.

Where the Contractor is responsible for damage to an underground or overhead utility, he shall make the repair immediately, at his expense.

The Contractor shall be responsible for protecting and repairing, if damaged, all existing roadway, catch basins, culverts, fences, rockeries, retaining walls, shrubbery, and all other items that are visible and where the removal or demolition is not ordered or provided for in this Contract.

A set of "as-built" drawings of the existing Water Pollution Control Plant are available for review at the Engineer's office. Said "as-built" drawings are made available for information only and not as a warranty of existing conditions. The Contractor shall be held responsible for verifying the accuracy of the "as-built" drawings.

The Contractor shall work with the City of Puyallup Public Works by calling (253) 841-5505 and the Utilities Underground Location Center, by calling 1-800-424-5555 to advise them of the proposed construction area and the proposed schedule of work sequence so that respective participating utilities may mark their systems. The Contractor shall also check individually with those utilities not participating. The Contractor shall, by letter and copies thereof, demonstrate to the Owner his efforts to fully inform the nonparticipating utilities,

City of Puyallup Public Works, and the Utilities Underground Location Center of his activities. Furthermore, the Contractor shall demonstrate full cooperation with each utility involved in this Project.

The Contractor is hereby advised that the exact locations of the existing underground waterlines, sludge lines, sewer lines, drainage lines, chemical solution lines, and electrical conduits lines at the Water Pollution Control Plant site are not known. The Contractor shall locate and mark these lines prior to construction.

***** END OF SECTION *****

SECTION 01520

FIELD OFFICES AND STORAGE SHEDS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section describes the requirements for field offices on this project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01500	Temporary Facilities

PART 2 PRODUCTS

2.1 FIELD OFFICES

During the performance of the Contract, the Contractor shall maintain a suitable office at the site of the work, which shall be the headquarters of the Contractor's representative. Office location on the site shall be approved by the Owner and Engineer.

Contractor shall make available a separate 10-foot-wide x 14-foot-long (minimum) office trailer at the project site, approved by the Engineer, for use by the Engineer. The Contractor shall supply the office with:

1. Heat, air conditioning, and thorough ventilation system.
2. Electric lights and power.
3. Plain paper copier/scanner, which will sort copies and copy up to 11" x 17" paper. The Contractor shall provide all necessary maintenance and service for the copy machine.
4. High speed internet connection with a static IP Address and wireless capabilities.
5. Black and white printer with USB connection, toner, and paper.
6. Desk (3' x 5' minimum).

7. Layout table (4' x 6' minimum).
8. Conference Table (3' x 8')
9. Four chairs.
10. Drafting stool.
11. One four-drawer lockable metal file cabinets.
12. Cylinder door lock and three keys.
13. Sanitary facilities
14. Windows and doors shall be reasonably airtight.
15. Coffee maker with filters.
16. Potable water cooler for drinking water.
17. One microwave oven.

2.2 STORAGE SHEDS

The Contractor shall provide storage for the protection of equipment, materials, supplies, and tools and shall ensure that a building be used for the storage of materials that deteriorate when exposed to moisture. Workshops and storage buildings shall be located in the general area of the work and shall be clean and in proper order. Storage of materials at the project sites shall not obstruct access or use by the Owner's employees of existing facilities.

PART 3 EXECUTION

All storage sheds shall be maintained as long as required for the safe and proper completion of the work. The Contractor shall remove such temporary facilities as rapidly as progress of the work will permit or as directed by the Engineer. The Engineer's field office and accessories shall remain in service until the project is accepted by the Owner.

***** END OF SECTION *****

SECTION 01720

RECORD DRAWINGS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the record drawings, which shall be maintained and annotated by the Contractor during construction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals

1.3 INFORMATION PROVIDED BY THE OWNER

The Contractor will be provided with the following items to maintain record drawings for the project:

- A. One full size paper set of Plans.
- B. One set of AutoCAD drawing files for the Project.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall maintain the following record drawings for the project:

- A. A neat and legibly marked set of Contract Plans showing the final location of piping, equipment, electrical conduits, outlet boxes and cables;
- B. Additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the Contract Documents; and
- C. Contractor layout and installation drawings.

Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the Engineer during normal working hours at the Contractor's field office. At the completion of the work, prior to final payment, all record drawings shall be submitted to the Engineer.

Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:

- A. Additions - Red
- B. Deletions - Green
- C. Comments - Blue
- D. Dimensions - Graphite

Legibly mark drawings to record actual depths, horizontal and vertical location of underground raceways, cables, and appurtenances referenced to permanent surface improvements.

The Contractor's record drawings (full-size hard copy) will be reviewed monthly for completeness by the Engineer prior to preparing the progress estimate for payment. If the record drawings do not reflect the work performed, payment for that item of work will not be included in the progress estimate.

***** END OF SECTION *****

SECTION 01740

CLEANUP

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the maintenance of the building, structures, and site(s) in a standard of cleanliness throughout the construction period as described herein.

Throughout the construction period, the Contractor shall maintain the cleanliness of the site and structures as described herein. The Contractor is also to maintain access to all existing, operating equipment such that the equipment may be serviced and operated.

Dust of all kinds, including concrete dust produced by construction activities, shall be controlled to avoid damage to existing, operating equipment. Enclosures, ventilation, and air scrubbing may be required where significant potential for damage is determined by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

In addition to standards described in this Section, comply with all requirements for cleaning up when described in other sections of these Contract Documents.

1.3 QUALITY ASSURANCE

A. INSPECTION

The Contractor shall conduct daily site inspections, and more often, if necessary, to verify that requirements are being met.

B. CODES AND STANDARDS

In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

PART 3 EXECUTION

3.1 PROGRESS CLEANING

A. GENERAL

Retain all stored materials and equipment in an orderly fashion allowing maximum access, not impeding drainage or traffic, and providing protection.

Do not allow the accumulation of scrap, debris, waste material, and other items not required for this work.

At least twice each month, and more often, if necessary, completely remove all scrap, debris, and waste material from the project site.

Provide adequate storage for all materials awaiting removal from the project site, observing all requirements for fire protection and protection of the environment.

B. SITE

Daily, and more often, if necessary, inspect the site and pick up all scrap, debris, and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often, if necessary, inspect all arrangements of materials stored on the site, restack, arrange, or otherwise service all arrangements to meet the requirements above.

Maintain the site in a neat and orderly condition at all times so as to meet the approval of the Engineer.

C. STRUCTURES

Weekly, and more often, if necessary, inspect the structures and pick up all scrap, debris and waste material. Move these items into a place designated for their storage until disposal becomes available.

Weekly, and more often, if necessary, sweep clean all interior spaces. “Clean” shall be interpreted to mean free from dust and other materials that can be swept with a broom using reasonable diligence.

In preparing to install succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material. Use all equipment and materials required to achieve the required cleanliness.

D. STREETS

All paved and unpaved streets in the vicinity of the project shall be kept free of material tracked from the project site(s) or dropped from vehicles entering and leaving the site(s). The Contractor shall inspect roads in each active area daily, and all material deposited on the road from the Contractor’s activities shall be removed prior to the end of the workday. This shall include sweeping, as required, to collect any mud, dirt and dust from the surface. All catch basins and culverts in the work area shall be inspected before completion and cleaned as directed by the Engineer.

3.2 FINAL CLEANING

A. DEFINITION

Except as otherwise specifically provided, “clean” shall be interpreted as meaning the level of cleanliness generally provided by commercial building maintenance equipment and materials.

B. GENERAL

Prior to final inspection, remove from the jobsite all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final project cleaning as described below.

C. STRUCTURES

1. Exterior

Visually inspect all exterior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with

water, the Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Interior

Visually inspect all interior surfaces and remove all traces of soil, waste, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only appropriate cleaning materials and equipment.

D. TIMING

Schedule final cleaning as approved by the Engineer to enable the Owner to accept a completely clean project, ready for occupancy.

***** END OF SECTION *****

SECTION 01800

TESTING, COMMISSIONING, AND TRAINING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation, testing, commissioning, and training for all mechanical, electrical, and instrumentation systems and completed portions of the work.

See also Section 16050 for additional electrical and instrumentation system testing requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01110	Scope of Work
01300	Submittals
01400	Quality Control
01500	Temporary Facilities
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

1.3 QUALITY ASSURANCE

A. INSTALLATION

All mechanical, electrical, and instrumentation equipment provided under this Contract shall be installed in conformity with the Contract Documents, including the manufacturer's requirements. Should a manufacturer's installation recommendation conflict with specific requirements of this Contract Document, the Contractor shall bring the matter to the attention of the Engineer. Any additional costs arising out of changes authorized by the Engineer to accommodate manufacturer's installation recommendations will be considered extra work. Any costs incurred by the Contractor through failure to timely notify the Engineer of a difference between Contract Document and manufacturer's installation requirements shall be borne by the Contractor.

B. TESTING

1. General Requirements

All equipment and partially complete or fully completed portions of the work included in this Contract shall be tested and inspected to prove compliance with the Contract requirements. Unless otherwise specified, all costs of testing, including temporary facilities and connections, shall be borne by the Contractor. For the purpose of this Section, equipment shall mean any mechanical, electrical, instrumentation, or other device with one or more moving parts or devices requiring an electrical, pneumatic, or hydraulic connection. Installed leakage tests and other piping tests shall be as specified in Section 15050. Installed tests for electrical and instrumentation devices and systems shall be in accordance with Division 16.

No tests specified herein shall be applied until the item to be tested has been inspected and approval given for the application of such test.

Tests and inspection shall include:

- a. The delivery acceptance test and inspections.
- b. The installed tests and inspections. These tests may be performed with water or the process fluid, as described in the accepted test plan.
- c. The operational testing of completed sections of the facility. These tests may be performed with water or the process fluid, as described in the accepted test plan.
- d. The commissioning of completed sections of the facility by Owner's personnel. The commissioning shall be performed with the process fluid at normal flows.

Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry. The Contractor shall see that scheduling and performance of all tests are coordinated with involved subcontractors and suppliers. The Contractor shall allow for up to two additional setpoint changes during testing. No extra costs or time allowances shall be provided as long as this setpoint allowance is not exceeded.

The form of evidence of satisfactory fulfillment of delivery acceptance test and inspection requirements shall be, at the discretion of the Engineer, either by tests and inspections carried out in the Engineer's presence or by certificates or reports of tests and inspections carried out by approved persons or organizations. The Contractor shall provide and use forms that include all test information, including specified operational parameters. The content of the forms used shall be acceptable to the Engineer.

A master test log book shall be maintained by the Contractor, which shall cover all tests including piping, equipment, electrical, and instrumentation. The master test log book shall be provided with loose-leaf pages that shall be copied weekly after updating for transmittal to the Engineer. The master test log book shall be transmitted to the Engineer upon completion of the project.

2. Delivery Acceptance Tests and Inspections

The delivery acceptance tests and inspections shall be at the Contractor's expense for any equipment specified herein and shall include the following:

- a. Test of items at the place of manufacture during and/or on completion of manufacture, comprising hydraulic pressure tests, electric and instrumentation subsystems tests, performance and operating tests and inspections in accordance with the relevant standards of the industry and more particularly as detailed in individual clauses of these Specifications to satisfy the Engineer that the items tested and inspected comply with the requirements of this Contract. Tests other than those specified shall be in accordance with Section 01400.
- b. Inspection of all items delivered at the site or to any authorized place of storage so that the Engineer may be satisfied that such items are of the specified quality and workmanship and are in good order and condition at the time of delivery. The Contractor shall be prepared to remove all coverings, containers, or crates to permit the Engineer to conduct his inspection. Should the Engineer find, in his opinion, indication of damage or deficient quality of workmanship, the Contractor shall provide the necessary documentation or conduct such tests deemed necessary by the Engineer to demonstrate compliance.

3. Installed Tests and Inspections

a. General

All equipment shall be tested by the Contractor to the satisfaction of the Engineer before any facility is put into operation. Tests shall be as specified herein and shall be made to determine whether the equipment has been properly assembled, aligned, adjusted and connected. Any changes, adjustments, or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the work.

b. Procedures

i. General

The procedures shall be divided into two distinct stages: preoperation checkout and water test. Testing procedures shall be designed to duplicate, as nearly as possible, all conditions of operation and shall be carefully selected to ensure that the equipment is not damaged. Once the testing procedures have been reviewed and approved by the Engineer, the Contractor shall produce checkout, alignment, adjustment and calibration sign-off forms for each item of equipment to be used in the field by the Contractor and the Engineer jointly to ensure that each item of electrical, mechanical and instrumentation equipment has been properly installed and tested. The Contractor is advised that failure to observe these precautions may place the acceptability of the subject equipment in question.

ii. Preoperation Checkout

The installed tests and inspection procedures shall incorporate all requirements of these Specifications and shall proceed in a logical, step-wise sequence to ensure that all equipment has been properly serviced, aligned, connected, calibrated, and adjusted prior to operation. Preoperation checkout procedures shall include, but not necessarily be limited to:

- (1) Piping system pressure testing and cleaning as specified in Division 15.
- (2) Electrical system testing as specified in Division 16.
- (3) Alignment of equipment.
- (4) Preoperation lubrication.

iii. Water Test

Once all affected equipment has been subjected to the required preoperational checkout procedures and the Engineer has witnessed and has not found deficiencies in that portion of the work, individual systems may be started and operated under simulated operating conditions to determine as nearly as possible whether the equipment and systems meet the requirements of these Specifications. Test media for these systems shall either be the intended fluid or a compatible substitute. The equipment shall be operated for a sufficient period of time to determine machine operating characteristics, including temperatures and vibration, to observe performance characteristics, and to permit initial adjustment of operating controls. When testing requires the availability of auxiliary systems, such as electrical power or instrumentation, which have not yet been placed in service, the Contractor shall provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system, at no additional cost to the Owner. Disposal methods for test media shall be subject to review by the Engineer.

If under test, any portion of the work should fail to fulfill the Contract requirements and is adjusted, altered, renewed or replaced, tests on that portion when so adjusted, altered, removed or replaced, together with all other portions of the work as are affected thereby, shall, if so required by the Engineer, be repeated within reasonable time and in accordance with the specified conditions. The

Contractor shall pay to the Owner all reasonable expenses incurred by the Owner as a result of repeating such tests.

Once simulated operation has been completed, all machines shall be rechecked for proper alignment, realigned, if necessary, and doweled in place. All equipment shall be checked for loose connections, unusual movement, excessive temperature, noise, and/or vibration or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the Engineer. All machines or devices, which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. They shall then be repaired or removed from the site and replaced at no cost to the Owner.

Test results shall be within the tolerances set forth in the detailed Specification sections of the Contract Documents. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory installed test, any doubt, dispute, or difference should arise between the Engineer, and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then, the Engineer may order the test to be repeated. If the repeat test, using such modified methods or equipment as the Engineer may require, substantially confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner otherwise the costs shall be borne by the Contractor. Where the results of any installed test fail to comply with the Contract requirements for such test, then such repeat tests as may be necessary to achieve the Contract requirements shall be conducted by the Contractor at his expense.

Unless otherwise specified, the Contractor shall provide at no expense to the Owner, all water, power, fuel, compressed air supplies, labor and all other necessary items and work required to complete all tests and inspection specified herein.

The Contractor shall provide, at no expense to the Owner, temporary heating, ventilating, and air conditioning for any areas requiring it in the case where permanent facilities are not complete and operable at the time of installed tests and inspections. Temporary facilities shall be maintained until permanent systems are in service.

4. Operational Testing

After completion of all installed testing and review by the Engineer that all equipment complies with the requirements of the Specifications, the Contractor shall conduct operational testing. All domestic water, oil, fuel, and chemical systems shall be filled with the specified fluid.

The Contractor shall operate the completed facility for a period of not less than that specified in Part 3.4 of this Section during which all systems shall be operated as a complete facility at various loading conditions, as directed by the Engineer. Should the operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, or the Contractor's temporary testing systems, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, and flow.

Record drawings of facilities involved must be accepted and ready for turnover to the Owner at the time of operational testing.

All costs for water, fuel, power, and chemicals required during operational testing shall be borne by the Owner.

5. Commissioning

After completion of the operational testing and certifications by the Engineer that the systems meet all performance requirements, commissioning will begin. The commissioning period for all systems shall be 10 days. The Contractor shall remove all temporary piping that may have been in use during the operational testing and shall assist the Owner with the placement of the facility into its fully operational mode handling wastewater. The Owner's operations and maintenance personnel will be responsible for operation of the facility or portion of the facility during this period

of time. The facility or portion thereof shall be fully and continuously operational, accepting all normal flow called for in design and performing all functions as designed.

The Contractor shall be available, with all appropriate subcontractors and trades, at all times during commissioning periods to provide immediate assistance in case of failure of any portion of the system being tested. This assistance shall be available, if needed, on a 24-hour basis. The Engineer will not issue a certificate of Substantial Completion until the end of the commissioning period (including training) and then only when all corrections required to assure a reliable and completely operational facility have been complete. The Contractor shall be responsible for all costs in excess of the Owner's normal expected costs of operations during the commissioning period. The Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep the treatment facility operational.

The commissioning period will be considered completed when the facility has been continuously operated without major interruption, equipment failure, or system breakdown for the specified commissioning period. A major interruption, failure or breakdown shall be a condition or event that prevents the facility from continuously and adequately handling normal flow, cannot be repaired or corrected immediately by the Contractor, and is not caused by improper operation and maintenance of the facilities by the Owner. An interruption of the commissioning period under these circumstances will require a re-start of commissioning once required repairs and corrections are made by the Contractor. Should the commissioning period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, the commissioning shall be repeated until the specified continuous period has been accomplished without interruption.

Final O&M manuals for the facilities must be accepted and ready for turnover to the Owner before the start of commissioning.

C. TRAINING

During the phase of water testing of equipment, the Contractor shall make available experienced factory-trained representatives of the manufacturers of all the various pieces of equipment, to train the Owner's personnel in the operation and maintenance thereof. The time required for this training shall be as covered in the specifications for the specific piece of

equipment. The Contractor shall notify the Engineer of the time of the training at least 10 days prior to the start time of the training.

1.4 SUBMITTALS

A. STARTUP AND TESTING PLAN

Prior to receipt of any progress payments in excess of 60 percent of the Contractor's total bid for the work, the Contractor shall submit to the Engineer five copies of a startup and testing plan with details of the installed tests and inspection procedures he proposes to adopt for testing and startup of all equipment to be operated singly and together.

B. TRAINING OUTLINE

The Contractor shall submit five copies of a detailed outline of training activities to be performed by each manufacturer's representative 10 days prior to the start time of the training. This outline shall indicate how the manufacturer's representative is going to allocate the required specified number of training hours to fulfill these contractual obligations.

PART 2 PRODUCTS

2.1 INSTALLATION

Materials employed in the installation shall conform to the requirements of the Contract Documents and the recommendations of the equipment manufacturers.

2.2 TESTING

A. GAUGES, METERS, RECORDERS, AND MONITORS

Gauges, meters, recorders, and monitors shall be provided by the Contractor as required to supplement or augment the instrumentation system provided under this Contract to properly demonstrate that all equipment fully satisfies the requirements of the Specifications. All devices employed for the purpose of measuring the performance of the facility's equipment and systems shall be specifically selected to be consistent with the variables to be monitored. All instruments shall be recently calibrated, and the Contractor shall be prepared at all times to demonstrate, through recalibration, the accuracy of all instruments employed for testing purposes. Calibration procedures shall be in accordance with applicable standards of ASTM, ISA, and IEEE. The adequacy of all gauges, meters, recorders and monitors shall be subject to review by the Engineer.

B. RECORDS

The Contractor shall provide sign-off forms for all installed and operational testing to be accomplished under this Contract. Sign-off forms shall be provided for each item of mechanical, electrical and instrumentation equipment provided or installed under this Contract and shall contain provisions for recording relevant performance data for original testing and not less than three retests. Separate sections shall be provided to record values for the preoperation checkout, as well as signatures of representatives of the equipment manufacturers, the Contractor, and the Engineer.

C. TEMPORARY TEST FACILITIES AND MODIFICATIONS

The Contractor shall provide and install all necessary temporary piping, valves, pumps, tanks, controls, and other facilities and modifications to enable the operational testing of the permanent facility components. Operational testing requiring the recirculation of water or process fluids within the facility shall be performed by the Contractor using temporary facilities, if needed, provided and installed by the Contractor. Temporary facilities shall be removed by the Contractor once the required testing is completed.

PART 3 EXECUTION

3.1 INSTALLATION

All equipment and apparatus used in testing shall be installed by specialists properly skilled in the trades and professions required to assure first-class workmanship. Where required by detailed Specifications, the Contractor shall cause the installation of specific equipment testing items to be accomplished under the supervision of factory-trained installation specialists furnished by the equipment manufacturers. The Contractor shall be prepared to document the skills and training of all workmen engaged in the installation of all testing equipment furnished either by the Contractor or the Owner.

3.2 TESTING

Testing shall proceed on a step-by-step basis in accordance with the Contractor's written testing procedures. The Contractor's testing work shall be accomplished by a skilled team of specialists under the direction of a coordinator whose sole responsibility shall be the orderly, systematic testing of all equipment, systems, structures, and the complete facility as a unit. Each individual step in the procedures shall be witnessed by a representative of the Engineer.

During the facility operational testing period, all equipment and systems in operation shall be operated to the greatest extent practicable, at conditions, which represent the full range of operating parameters as defined by the Contract Documents.

3.3 TRAINING

Training of the Owner's personnel shall be done by experienced technical manufacturers' representatives. Training shall be provided during a scheduled, dedicated session and shall not be combined with other field services such as equipment testing, startup and check-out. When required by these specifications, the training sessions shall be video and audio-taped by the Contractor and the final DVD delivered to the Owner. These manufacturers' representatives shall follow the outline presented here:

GENERAL OUTLINE FOR MANUFACTURER PRESENTATIONS

A. FAMILIARIZATION

1. Overview explaining theory of operation.
2. Show catalog, parts lists, drawings, etc., in the shop drawings and O&M manuals. Clearly identify the model or identification number of the equipment for which training is being provided.
3. Check out the installation of the specific equipment items.
4. Demonstrate the unit and show that all parts of the Specifications are met.
5. Answer questions.

B. SAFETY

1. Point out safety references.
2. Discuss proper precautions around equipment.

C. OPERATION

1. Point out reference literature.
2. Explain all modes of operation (including emergency).

3. Check out Owner's personnel on proper use of the equipment.
(Let them do it).

D. PREVENTIVE MAINTENANCE (PM)

1. Pass out PM list including:
 - a. Reference material.
 - b. Daily, weekly, monthly, quarterly, semi-annual, and annual jobs.
2. Show how to perform PM jobs.
3. Show Owner's personnel what to look for as indicators of equipment problems.

E. CORRECTIVE MAINTENANCE

1. List possible problems.
2. Discuss repairs - point out special problems.
3. Open up equipment and demonstrate procedures, where practical.

F. PARTS

1. Show how to use parts list and order parts.
2. Check over spare parts on hand. Make recommendations.

G. LOCAL REPRESENTATIVES

1. Where to order parts: Name, address, telephone, fax, e-mail.
2. Service problems:
 - a. Who to call.
 - b. How to get emergency help.

3.4 FACILITY OPERATIONAL TESTING

The systems described below shall be tested to demonstrate the performance of mechanical, electrical, instrumentation and control subsystems together as an integrated system. Where the testing described in this Section conflicts with the testing requirements specified for individual equipment, or the manufacturer's recommended testing procedure, those requirements and procedures shall prevail.

Unless otherwise noted, a time period of 5 days shall be allowed for each facility operational test. Unless otherwise noted, each portion of the facility being operationally tested must perform through its complete design range for a period of 5 consecutive 24-hour days. Facility operational testing shall be sequenced in coordination with the work sequence specified in Section 01110. Temporary facilities necessary for operational testing are specified in Paragraph 2.2 of this Section and in Section 01500.

***** END OF SECTION *****

SECTION 01900

SALVAGE AND DEMOLITION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers the demolition of existing structures, piping, equipment, and sitework, and the salvage of existing materials and equipment as indicated on the Plans and as specified herein.

The Plans show the major items to be demolished and removed. The Contractor shall, however, remove any other incidental above-grade items which are not to be used in the completed project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01500	Temporary Facilities
01510	Maintenance of Existing Facility

1.3 SALVAGE

Salvageable equipment and material shall be removed with care so as not to impair future uses and shall include all equipment and material so indicated on the Plans. Salvaged equipment and material not reused or rejected by the Owner shall be cleaned and protected from corrosion and weather and delivered by the Contractor to the Owner at the City of Puyallup Water Pollution Control Plant

Reuse of salvageable equipment and material by the Contractor will not be permitted except where specifically indicated on the Plans and in the Specifications or where approved by the Engineer and Owner. Salvageable equipment and materials rejected in writing by the Owner shall become the property of the Contractor and shall be disposed of away from the site without additional cost to the Owner.

1.4 DEMOLITION

The Contractor shall be responsible for compliance with current City, County, State, and Federal codes and regulations related to demolition.

The Contractor shall notify all affected utilities and comply with their respective requirements for abandonment of such utilities including power, telephone, natural gas, water, sanitary sewer, and storm sewer utilities.

The Contractor shall maintain access for the Owner's employees during the demolition period and provide barricades, fences, etc., as required for job site safety.

Demolition of concrete, masonry, roofing, asphalt, and other materials shall be done so as to avoid damage to existing structures intended to remain. Demolition or cutting required to add to or modify existing structures shall be done in such a manner that the appearance and utility of the existing structure is not impaired and so that a neat transition from new to old material may occur.

All piping and appurtenances located less than 4 feet below finished grade shall be removed and hauled to an approved disposal site. All piping and appurtenances located four feet or more below finished grade may be abandoned in place, unless shown otherwise on the Plans, as long as Contractor fully seals all pipe and appurtenance openings with grout.

All waste materials from demolition or cutting shall become the property of the Contractor and shall be removed from the site and hauled to an approved waste disposal site, if declared surplus by the Owner. All materials and equipment, however, are property of the Owner unless declared surplus. Some equipment and materials scheduled for salvage and delivery to the Owner are noted on the Plans.

***** END OF SECTION *****

SECTION 01950

TRAFFIC CONTROL

PART 1 GENERAL

1.1 SCOPE

Temporary traffic control refers to the control of all types of traffic, including vehicles, bicyclists and pedestrians (including pedestrians with disabilities). The Contractor, utilizing contractor labor and contractor-provided equipment and materials (except when such labor, equipment, or materials are to be provided by the Owner as specifically identified in the Contract Documents), shall plan, manage, supervise and perform all temporary traffic control activities need to support the work of the Contract.

The Contractor shall provide flaggers, signs, and other traffic control devices not otherwise specified as being furnished by the Owner. The Contractor shall erect and maintain all construction signs, warning signs, detour signs, and other traffic control devices, necessary to warn and protect the public at all times from injury or damage as a result of the Contractor's operations which may occur on highways, roads or streets. No work shall be done on or adjacent to the roadway until all necessary signs and traffic control devices are in place.

The traffic control resources and activities shall be used for the safety of the public, the Contractor's employees, the Owner's personnel and to facilitate the movement of the traveling public. Traffic control resources and activities may be used for the separation or merging of public and construction traffic when in accordance with a specific approved traffic control plan.

Upon failure of the Contractor to immediately provide flaggers; erect, maintain, and remove signs; or provide, erect, maintain, and remove other traffic control devices when ordered to do so by the Owner, the Owner may, without further notice to the Contractor or the Surety, perform any of the above and deduct all of the costs from the Contractor's payment.

The Contractor shall be responsible for providing adequate flaggers, signs and other traffic control devices for the protection of the work and the public at all times regardless of whether or not the flaggers, signs, and other traffic control devices are ordered by the Owner, furnished by the Owner, or paid for by the Owner.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals

1.3 REFERENCES

This Section references the latest revisions to the following documents:

<u>Reference</u>	<u>Title</u>
MUTCD	<i>Manual of Uniform Traffic Control Devices Washington State Modifications to the MUTCD Quality Guidelines for Temporary Traffic Control Devices</i>
ANSI 107	<i>High Visibility Garment Standard</i>

1.4 TRAFFIC CONTROL MANAGEMENT

A. GENERAL

It is the Contractor's responsibility to plan, conduct, and safely perform the work. The Contractor shall manage temporary traffic control with his or her own staff. Traffic control management responsibilities shall be formally assigned to one or more company supervisors who are actively involved in the planning and management of field Contract activities. The Contractor shall provide the Engineer with a copy of the formal assignment. The duties of traffic control management may not be subcontracted.

The Contractor shall designate an individual or individuals to perform the duties of the primary Traffic Control Supervisor (TCS). The designation shall also identify an alternate TCS who can assume the duties of the primary TCS in the event that person's inability to perform. The TCS shall be responsible for safe implementation of approved Traffic Control Plans provided by the Contractor.

The primary and alternate TCS shall be certified as worksite traffic control supervisors by one of the organizations listed herein. Possession of a current TCS card and flagging card by the primary and alternate TCS is mandatory. A traffic control management assignment and a TCS designation are required on all projects that will utilize traffic control.

The Contractor shall maintain 24-hour telephone numbers at which the Contractor's assigned traffic control management personnel and the TCS can be contacted and be available upon the Engineer's request at other than normal working hours. These persons shall have the resources, ability and authority to expeditiously correct any deficiency in the traffic control system.

B. The duties of the Contractor's traffic control management personnel shall include:

1. Overseeing and approving the actions of the Traffic Control Supervisor (TCS) to ensure that proper safety and traffic control measures are implemented and consistent with the specific requirements created by the Contractor's work zones and the Contract. Some form of oversight shall be in place and effective even when the traffic control management personnel are not present at the jobsite.
2. Providing the Contractor's designated TCS with approved Traffic Control Plans (TCPs), which are compatible with the work operations, and traffic control for which they will be implemented.
3. Discussing proposed traffic control measures and coordinating implementation of the Contractor-adopted traffic control plan(s) with the Owner.
4. Coordinating all traffic control operations, including those of subcontractors, suppliers, and any adjacent construction or maintenance operations.
5. Coordinating the project's activities (road closures and lane closures) with appropriate police, fire control agencies, city or county engineering, medical emergency agencies, school districts, and transit companies.
6. Overseeing all requirements of the Contract, which contribute to the convenience, safety, and orderly movement of vehicular and pedestrian traffic.
7. Having the latest adopted edition of the MUTCD including the Modifications to the MUTCD for Streets and Highways for the State of Washington and applicable standards and specifications available at all times on the Project.

8. Attending all Project meetings where traffic management is discussed.
9. Being present onsite a sufficient amount of time to adequately accomplish the above-listed duties.

C. TRAFFIC CONTROL SUPERVISOR

A Traffic Control Supervisor (TCS) shall be on the Project whenever traffic control labor is required or less frequently, as approved by the Owner.

The TCS shall personally perform all the duties of the TCS. The TCS's duties shall include:

1. Inspecting traffic control devices and nighttime lighting for proper location, installation, message, cleanliness, and effect on the traveling public. Traffic control devices shall be inspected each work shift except that Class A signs and nighttime lighting need to be checked only once a week. Traffic control devices left in place for 24 hours or more should also be inspected once during the nonworking hours when they are initially set up (during daylight or darkness, whichever is opposite of the working hours).
2. Ensuring that corrections are made if traffic control devices are not functioning as required. The TCS may make minor revisions to the approved traffic control plan to accommodate site conditions as long as the original intent of the traffic control plan is maintained and the revision has concurrence of the TCM and/or Owner.
3. Attending traffic control coordinating meetings or coordination activities as authorized by the Owner.
4. Ensuring that all needed traffic control devices are available and in good working condition prior to the need to install those devices.
5. Ensuring that all pedestrian routes or access points, existing or temporary, are kept clear and free of obstructions and that all temporary pedestrian routes or access points are detectable and accessible to persons with disabilities as provided for in the approved plans.
6. Having a current set of approved TCPs and applicable contract provisions as provided by the TCM and the latest adopted edition

of the MUTCD including the *Washington State Modifications to the MUTCD* and applicable standards and specifications.

1.5 TCM AND TCS QUALIFICATIONS

The TCM and TCS shall be certified by one of the following:

The Northwest Laborers – Employers Training Trust
27055 Ohio Avenue
Kingston, Washington 98346
(360) 297-3035

Evergreen Safety Council
401 Pontius Avenue N.
Seattle, Washington 98109
(800) 521-0778 or (206) 382-4090

The TCS and all flaggers shall have a current flagging card from the State of Washington, Oregon, or Idaho.

1.6 SUBMITTALS

A. TRAFFIC CONTROL PLAN

The Contractor shall prepare and submit five copies of a Traffic Control Plan(s). All construction signs, flaggers, spotters, and other traffic control devices shall be shown on the traffic control plans. The Contractor shall designate and adopt in writing the specific traffic control plan or plans required for their method of performing the work. The traffic control plan(s) shall be in accordance with the established standards for plan development as shown in the MUTCD, Part VI.

The Traffic Control Plan shall meet the specific requirements of the franchise agreements and right-of-way permits required for this project. In addition, the Traffic Control Plan shall meet the following requirements:

- Maintain two-way traffic.

The Contractor, at the end of each day, shall leave the Work area in such condition that it can be traveled without damage to the Work, without danger to traffic, and without one-way traffic control.

PART 2 PRODUCTS

2.1 TRAFFIC CONTROL DEVICES

Flagging, signs and all other traffic control devices furnished or provided shall conform to the standards established in the latest WSDOT adopted edition of the *Manual on Uniform Traffic Control Devices (MUTCD)* published by the U.S. Department of Transportation and the *Washington State Modifications to the MUTCD*. Requirements for pedestrian traffic control devices are addressed in the MUTCD.

2.2 CONSTRUCTION SIGNS

All construction signs required by the approved traffic control plan(s) as well as any other appropriate signs prescribed by the Owner shall be furnished by the Contractor. The Contractor shall provide the posts or supports and erect and maintain the signs in a clean, neat, and presentable condition until the necessity for them has ceased. All non-applicable signs shall be removed or completely covered with either metal or plywood during periods when they are not needed. When the need for any of these signs has ceased, the Contractor, upon approval of the Owner, shall take down these signs, post, or supports.

Construction signs will be divided into two classes. Class A construction signs are those signs that remain in service throughout the construction or during a major phase of the work. They are mounted on posts, existing fixed structures, or substantial supports of a semi-permanent nature. Sign and support installation for Class A signs shall be in accordance with the WSDOT Standard Plans. Class A signs shall be designated as such on the Traffic Control Plan. Class B Construction signs are those signs that are placed and removed daily, or are used for short durations which may extend for 1 to 3 days. They are mounted on portable or temporary mountings.

Tripod-mounted signs in place more than 3 days in any one location, unless approved by the Engineer, shall be required to be post-mounted and shall be classified as Class A construction signs. Where it is necessary to add weight to the signs for stability, sandbags or other similar ballast may be used but the top of the ballast shall not be more than 4 inches above the road surface, and shall not interfere with the breakaway features of the device. The Contractor shall follow the manufacturer's recommendations for sign ballasting.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall provide all labor and equipment to execute the Traffic Control Plan. It is the Contractor's responsibility to plan, conduct, and safely perform the work.

The TCS shall be responsible for safe implementation of approved Traffic Control Plans provided by the TCM.

3.2 TRAFFIC CONTROL LABOR

The Contractor shall furnish all personnel for flagging, spotting, for the execution of all procedures related to temporary traffic control and for setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control traffic during construction operations.

Vests and other high-visibility apparel shall be in conformance with ANSI 107.

Flaggers and spotters shall be posted where shown on the approved Traffic Control Plan. Flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, or Idaho. The flagging card shall be immediately available and shown upon request by the Owner.

During hours of darkness, flagging stations shall be illuminated in a manner that insures that flaggers can easily be seen but that does not cause glare to the traveling public. Flagger station illumination shall meet the requirements of the MUTCD.

Flaggers shall be equipped with portable two-way radios, with a range suitable for the project. The radios shall be capable of having direct contact with project management (foreman, superintendents, etc.)

The Contractor shall furnish flagger Stop/Slow paddles conforming to the requirements of the MUTCD, except the minimum width shall be 24 inches.

***** END OF SECTION *****

DIVISION 2 – SITEWORK

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SECTION 02050

LOCATE EXISTING UTILITIES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the anticipated conflicts, which may exist with existing utilities. A reasonable attempt has been made to locate the existing utilities; however, the exact location, and/or depth are unknown in most instances. Locations and dimensions shown in the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring, or other verification. It shall be the responsibility of the Contractor to locate existing utilities and their depth.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
02250	Temporary Shoring and Bracing
02300	Earthwork

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall determine the difficulties to be encountered in constructing the Project and his locate effort based upon the information provided on the Plans, field investigation, and the Contractor's contacts with the existing utility companies. The Contractor shall determine the extent of exploration required to first prevent damage to those existing utilities, and secondly to determine if the proposed improvements are in conflict with existing utilities.

The Contractor shall locate existing utilities sufficiently ahead of construction so that the Engineer can modify the alignment, or grade prior to construction. Where the alignment of the proposed utility cannot be adjusted to miss the existing utility without installation of additional pipe or fittings, the Contractor may be entitled to additional compensation to reroute the proposed utility.

Where underground utilities are found to be in the way of construction, such condition shall not be deemed to be a changed or differing site condition. If necessary, pipe alignment or grade shall be modified at the Contractor's expense.

The Contractor shall call the Utility Location Request Center (One Call Center), for field location, not less than 2 nor more than 10 business days before the scheduled date for commencement of excavation that may affect underground utility facilities, unless otherwise agreed upon by the parties involved. A business day is defined as any day other than Saturday, Sunday, or a legal local, State, or Federal holiday. The telephone number for the One Call Center for this project is (800) 424-5555. If no one-number locator service is available, notice shall be provided individually to those owners known to or suspected of having underground facilities within the area of the proposed excavation.

The Contractor is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor incurred as a result of this law shall be at the Contractor's expense.

No excavation shall begin until all know facilities in the vicinity of the excavation area have been located and marked.

The following utility companies known or suspected of having facilities within the Project limits are supplied for the Contractor's convenience:

- City of Puyallup: Water, Sewer and Storm
- Puget Sound Energy: Power/Electrical and Gas

***** END OF SECTION *****

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the clearing, grubbing, and stripping of the proposed project areas in preparation of foundations, embankment construction, and pipeline installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
02305	Wet Weather Earthwork
02300	Earthwork
02370	Erosion Control

1.3 DEFINITIONS

“Clearing, grubbing, and stripping debris” as hereinafter used shall be considered as all material removed by the clearing, grubbing, and stripping operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 DISPOSAL OF CLEARING AND GRUBBING DEBRIS

Clearing and grubbing debris shall be disposed of by hauling to waste and disposal sites approved by the Owner. Any permits required for disposal shall be secured and paid by the Contractor.

3.2 CLEARING AND GRUBBING

Clearing and grubbing shall be performed as required to complete the work shown on the Plans to a minimum depth of 8 inches in order to remove the root zone of existing vegetation.

This work shall include removal and disposal of all trees, logs, brush, stumps, roots, and minor manmade structures to include but not limited to concrete,

asphalt abandoned metal and equipment, rubbish and debris to the limits indicated on the plans or as required and approved by the owner. This work shall be to a depth necessary to remove stumps, large roots and all other objectionable material. This work shall also include the protection from injury or defacement of trees, bushes, shrubs, and other objects designated to remain

***** END OF SECTION *****

SECTION 02240

DEWATERING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes dewatering excavations of any kind and location, including but not limited to groundwater, surface water, and precipitation, until backfilling has been completed to finished grade.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02241	Ground Freezing
02300	Earthwork
02370	Erosion Control

1.3 SUBMITTALS

Prior to the start of construction, the Contractor shall submit a dewatering plan in accordance with Section 01300 containing both a graphical and narrative presentation identifying proposed methods, equipment sizes and contingency plans should dewatering cause settlement of any adjacent facilities. The dewatering plan shall show specific locations, in plan and section, where dewatering is expected as well as a general discussion of methods to be employed should water be encountered in other locations. The plan shall detail the depth, diameter and anticipated flow for dewatering wells, well points or sumps.

Acceptance by the Owner of the method, installation, and operation and maintenance details submitted by the Contractor shall not in any way be considered to relieve the Contractor from full responsibility for errors therein or from the entire responsibility for complete and adequate design and performance of the system in controlling the water level in the excavated areas, and for control of the hydrostatic pressures to the depths specified herein. The Contractor shall be solely responsible for the proper design, installation, proper operation, maintenance, and any failure of any component of the dewatering system.

1.4 REFERENCES

“Rossum J.R., 1954, *Control of Sand in Water Systems*, Journal American Water Works Association, Volume 46, pp. 123-132.”

Geotechnical Report, Proposed Secondary Clarifier #3, Puyallup Wastewater Treatment Plan, Washington, PanGEO, Inc.

1.5 QUALITY CONTROL

It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering efforts to avoid all objectionable settlement and subsidence. The Contractor shall comply with local codes and ordinances of governing authorities with regard to disposal of water pumped from dewatering operations.

Proposed discharge points shall be approved by the Owner prior to implementation of dewatering. The Contractor shall be responsible for taking all reasonable precautions necessary to ensure continuous, successful operation of the system.

PART 2 PRODUCTS

Dewatering shall be in accordance with the guidance stated in the Geotechnical Report for this Project.

The Contractor shall have sufficient pumping equipment and/or other machinery available onsite before operations begin to assure that the operation of the dewatering system can be maintained. This shall include providing backup pumps of similar capacity and a standby generator of the capacity required to continuously operate the Contractor's dewatering system.

PART 3 EXECUTION

3.1 INSTALLATION AND APPLICATION

During excavation, the installation of piping, conduits and structures and during the placing of backfill, excavations shall be kept free of water, subsurface or otherwise. The Contractor shall furnish all equipment necessary to dewater the excavations and shall dispose of the water so as not to cause a nuisance or menace to the public. The dewatering system shall be installed and operated by the Contractor so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property. The release of groundwater to its static levels shall be performed so as to maintain the undisturbed state of the foundation soils, prevent disturbance of backfill and prevent movement of all structures and pipelines.

Design implementation and maintenance of any dewatering system shall be the responsibility of the Contractor.

The Contractor shall construct all dewatering wells in accordance with WAC 173-160. The dewatering system shall be sufficient to maintain the groundwater level at an elevation to protect the surface of the trench bottoms, the base of the bedding course or other foundation, and shall be accomplished prior to pipe laying and jointing or placement of reinforcing steel for concrete.

If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the excavations.

The Contractor shall design filters and screen slot sizes for all sumps, wells and well points which prevents the movement of fines during pumping. The Contractor shall develop the wells such that they produce no more than 10-ppm silica as measured with a Rossum Sand Tester (Rossum, 1954) or equivalent.

3.2 MONITORING

The Contractor shall install water level observation wells in dewatered areas sufficient to determine whether groundwater levels are maintained as per Part 3.1 of this Section.

3.3 FIELD QUALITY CONTROL

A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. The Contractor shall test all dewatering discharge using a Rossum Sand Tester or equivalent to determine the silica content of the discharge. The Contractor shall notify the Owner at least 24 hours prior to testing. Where 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 that could develop.

Should settlement be observed, the Contractor shall cease dewatering operations and implement contingency plans as outlined in the Contractor's approved dewatering plan. The responsibility for conducting the dewatering operation in a manner that protects adjacent structures and facilities rests solely on the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor. Permanent piping systems, existing or new, shall not be incorporated into the Contractor's dewatering system.

***** END OF SECTION *****

SECTION 02241

GROUND FREEZING

PART 1 GENERAL

1.1 SCOPE OF WORK

In these General Specifications ground-freezing is understood as a method of providing stable and safe temporary support and groundwater control to support excavation and construction activities. The ground freezing Contractor assumes responsibility for the implementation of the stamped drawings and design report of a qualified engineer.

The Scope of Work includes the following items, to be provided by the Contractor in the framework of a project-specific Subcontract:

- A. Implementation procedures covering all phases and aspects of the ground freezing Contractor's work.
- B. Detailed frozen-soil system design report and drawings prepared and stamped by a qualified engineer with at least 5 years of specialized soil-freezing experience and expertise.
- C. Site preparation and layout in cooperation with the General Contractor or Owner's designated representative.
- D. Equipment and all necessary piping, valves, manifolds and other materials required to implement the engineer's design.
- E. Supervision of pipe installation and formation of the frozen-soil system as called for in the engineer's design.
- F. Submittal of final layout and, if required, pipe-survey data to the design engineer to be incorporated in the As-Built Schematic which is his basis for approval of the installation.
- G. Installation and operation of the temperature-monitoring system related to freezing operations with daily reports available to the design engineer for review and analysis as the barrier-formation process moves forward.
- H. Maintenance of the system until the frozen-soil structure shown on the engineer's drawings reaches its design strength and for as long as required.

- I. Support for the General Contractor or the Owner’s designated representative in the establishment and implementation of a surveying program to measure and evaluate ground movement in the course of freeze-down, excavation and construction.
- J. Training onsite personnel for the protection of frozen-soil system during excavation and supervision of excavation and construction activities as the design engineer’s representative to assure proper interface between frozen-soil system and any activities that might produce heat, cause groundwater movement or in any way affect the thickness, strength, and stability of the frozen-soil structure.
- K. Dismantling and decommissioning of the system after freezing is no longer required. These arrangements are negotiated with the General Contractor or Owner’s designated on a project-specific basis.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02240	Dewatering
02241	Temporary Shoring and Bracing
02300	Earthwork
02305	Wet Weather Earthwork

1.3 FEDERAL, STATE AND LOCAL REGULATIONS, CODES AND STANDARDS

All work shall be performed in accordance with all applicable federal, state, and local regulations, codes, and standards.

1.4 DEFINITIONS

- A. Frozen Soil: Soil or rock in which the pore water has been frozen by the circulation of a cold liquid within a closed underground array of pipes to increase the soil’s strength and to cut off groundwater.
- B. Frozen Soil Shoring: Excavation support wall and groundwater control composed of frozen ground.
- C. TMP: Temperature Monitoring Pipe.

1.5 QUALITY ASSURANCE

A. QUALIFICATIONS

1. Ground freezing is a specialized type of excavation and construction support. The Contractor shall provide evidence of successful experience using his proposed equipment with soil-freezing to the depths required and in the soil and groundwater conditions expected.
 2. The Contractor shall employ a qualified Sub-Contractor to design, maintain and monitor the frozen earth if the Contractor cannot satisfy the specified requirements.
 3. The Contractor shall retain a Professional Engineer having a minimum of 5 years of experience designing frozen-soil structures and related systems comparable to those required on the subject project, to design all frozen-soil structures and to approve and supervise all on-site quality assurance programs during installation of the soil freezing system, and throughout the design life of the structures. Drawings shall be stamped by a licensed Professional Engineer.
 4. The contractor shall provide a manager having a minimum of 5 years experience in charge of comparable soil-freezing projects within the 5-year period immediately preceding the execution of the Subcontract for the subject installation.
- B. Contractor shall present to the General Contractor a detailed description of its standards in such critical areas as design, layout, welding, installation and system testing; the preparation and use of an As-Built Schematic; practices after the ground freezing system has been activated; and the Contractor's quality-control protocols during excavation and construction.
- C. The Contractor's qualified ground freezing manager or his designated representative shall be in attendance during installation, testing, startup of the freezing system and when excavation operations are taking place. He shall be provided access to make inspections and take soil temperature readings and collect other data for review by the design engineer.
- D. The Contractor shall report necessary monitoring results to the design engineer with 24 hours of the completion of the monitoring.

1.6 TOLERANCES

- A. Tolerances related to the installation of the soil-freezing system are established by the design engineer on a project-specific basis. All components in the underground freezing system are surveyed and documented in the As-Built, which the engineer prepares as a basis for approving the installation or calling for additional freeze-pipes and/or freezing capacity.
- B. The engineer's approval of the As-Built conveys his assurance that the system as installed, with or without additional freeze-pipes and/or freezing capacity, satisfies the standards of the original design.

1.7 DOCUMENTATION

The Contractor shall make the following available to the General Contractor:

- A. Qualifications of the soil-freezing design engineer, soil-freezing project manager and the experience of the Contractor as described above.
- B. The engineer's analysis of any field and laboratory investigations carried out beyond the scope of the geotechnical report and other components of the Project Documents.
- C. Report stamped by a licensed Professional Engineer stating that the design is satisfactory and that the necessary equipment to maintain and monitor the frozen ground under the given conditions are accounted for in the design.
- D. Shop drawings showing planned locations of all freeze pipes, heads and manifolds relative to the excavation and lay-by area(s) provided by the General Contractor and showing information provided by the Owner regarding the location of underground obstructions, utilities and structures and the footings of nearby buildings and other above-ground structures.
- E. Procedures for the documentation of freeze-pipe installation and the framework for the As-Built assuring that proofs of achieved tolerances, as established by the design engineer, will be met before the engineer approves the activation of soil-freezing operations.
- F. Product data for refrigerant, brine, chillers, pumps, and temperature-monitoring instrumentation.
- G. Procedures for determining freeze-wall thickness, strength, and stability.

- H. Design, installation procedures and monitoring protocols for pressure relief wells if such are called for in the stamped design.
- I. Quality assurance/quality control plan for installation, operation and maintenance of the freeze system including frequency and reporting format of monitoring.
- J. Emergency notification procedures including identification of the chain of command of those responsible for making emergency-response decisions.

PART 2 PRODUCTS

2.1 GENERAL

- A. All materials shall conform to the requirements spelled out by the General Contractor or the Owner's designated representative consistent with any applicable federal, state, or local regulatory regime.
- B. Inside and outside diameters of pipe shall be as called for in the Engineer's stamped design, consistent with the most efficient and cost-effective operation of the soil-freezing system as a whole.
- C. All pipe connections for subsurface installation shall be welded and pressure-tested before installation. Threaded couplings are not permitted.
- D. Surface piping shall be insulated to minimize energy losses.

2.2 GROUNDWATER LEVEL MONITORING

If the Engineer's stamped design calls for groundwater monitoring, then adequate systems shall be designed and implemented as necessary to provide the ability for constant monitoring by the Engineer.

2.3 GROUNDWATER MONITORING SYSTEM

Groundwater monitoring system shall be as proposed by the Engineer.

2.4 TEMPERATURE MONITORING THERMOCOUPLES

Temperature-monitoring thermocouples shall conform to the specifications called for by the Engineer and shall be installed and monitored consistent with protocols that provide the Engineer with required soil- and brine-temperature data as the soil-freezing system is formed and maintained.

2.5 INSULATION

Type and thickness as applied in place shall be in accordance with the Engineer's stamped design.

PART 3 EXECUTION

3.1 FIELD AND LABORATORY INVESTIGATION

The Engineer's design is based on soils data and geotechnical analysis provided by the Owner. Additional field and laboratory investigation may be planned, implemented, and managed by the Contractor to provide supplemental information deemed necessary by the Contractor for the soil-freezing design. Except as negotiated otherwise, additional field and/or laboratory investigation is undertaken at the General Contractor's expense.

3.2 DESIGN REQUIREMENTS

The design is based on the Engineer's analysis of all available data from field and laboratory investigation, including all available data concerning the location of underground obstructions, utilities and structures and the footings of nearby buildings and other above-ground structures.

3.3 GENERAL REQUIREMENTS FOR INSTALLATION OF FREEZING SYSTEM

- A. The Contractor shall prepare and submit shop drawings showing the locations of all freeze pipes, heads, and manifolds relative to the excavation and to all known underground and nearby above-ground structures
- B. Number, diameter, and spacing of freeze pipes shall be determined by the Contractor on the basis of the design requirements specified in Article 3.2 of this Specification Section.
- C. The Contractor (or his Subcontractor) shall provide reliable equipment to successfully install freeze pipes through or around obstructions and the soil profile as detailed in the geotechnical information provided by the Owner. Records of each drill hole shall be maintained and shall include location, depth and thickness of any known obstructions encountered.
- D. Freeze pipes shall penetrate, displace, or be installed to avoid obstructions. Additional freeze pipes shall be installed as necessary to obtain a consistent frozen mass of the minimum dimension as determined by the analysis of the Engineer.

- E. If called for in the Engineer's design report, freeze pipes shall be surveyed to determine variation from planned position with depth, using inclinometers or other approved methods. Detailed As-Built drawings shall be produced as the basis for the Engineer's judgment that the ground freezing system has been installed to his standards and specifications.
- F. The Contractor (or his Subcontractor) shall dispose of any drill cuttings and drilling fluids unless the Subcontract assigns this responsibility to another party. All brine and refrigeration fluids shall be considered the property of the Contractor for management, spill control, collection, and disposal.
- G. All work shall be performed within the limits and to the standards specified in the Subcontract consistent with the Project Documents.

3.4 FREEZING SYSTEM PERFORMANCE REQUIREMENTS

- A. All subsurface pipe connections must be welded and tested. Threaded couplings are unacceptable.
- B. Prior to charging the system with brine, all components shall be tested, including the freezing elements, to standards acceptable to the Engineer to ensure that no leakage can occur.
- C. Install additional piping if the gap between adjacent pipes at any depth becomes excessive based on the results of the Engineer's analyses of as-built conditions.
- D. Maintain the integrity of frozen ground by whatever means required. This is the sole responsibility of the Contractor, including placement of protective covering and insulation on exposed surfaces in conformance with submittals.
- E. Install subsurface refrigeration pipes by procedures that will minimize adjacent soil disturbance.
- F. Fluids shall be removed from all piping systems prior to removal. The Contractor shall demonstrate that all fluids have been managed and disposed in accordance with all federal, state, and local environmental regulations.
- G. All elements of the distribution system shall be removed.

- H. The Contractor shall be responsible for repair of any damage to existing and adjacent facilities resulting from the ground freezing operations.
- I. Management of the interface between the frozen soil system, grouting activities and permanent structures, e.g., concrete, is the responsibility of the General Contractor or the Owner's designated representative and requires careful attention to Quality Control standards and cooperation between all parties involved in the project.

3.5 GENERAL REQUIREMENTS FOR MONITORING

- A. The Contractor shall provide a monitoring system capable of thermo-profiling freezing operations to verify that the system is providing the design thickness, strength and stability called for by the design engineer.
- B. All temperature monitoring shall be planned by the Contractor, and the Contractor shall install and operate the system and record the data required by the design engineer.
- C. As a minimum the monitoring system shall include:
 - 1. Temperature monitoring pipes (TMP's) as called for in the Engineer's stamped design.
 - 2. Thermocouple probes for each wall as reviewed and approved by the Engineer.
 - 3. Temperature monitoring of brine supply and return and of soils at increments of depth as called for by the Engineer.
 - 4. Brine flow monitoring including loss of circulation and/or loss of coolant.
 - 5. Monitoring of active freeze units including temperature, flow rate and on/off status.
 - 6. The Contractor shall provide reports to the Engineer in a format approved by the Engineer.
- D. MONITORING FREQUENCY
 - 1. Obtain at least two initial readings for each instrument prior to the activation of the soil-freezing system.

2. Monitor each instrument daily or on a nearly daily basis from the start of freezing operations through freeze-down and as long as excavation and construction activities are on-going.
3. Report all monitoring results to the design engineer within 24 hours of completion of the monitoring.

E. REPORT ON SOIL AND BRINE TEMPERATURES

1. Provide weekly report on data provided by thermocouples in TMP's.
2. Report shall consist of a plot of temperature versus elevation for each TMP.

F. DISPOSAL OF INSTRUMENTATION

All instrumentation shall be disposed of by the Contractor.

***** END OF SECTION *****

SECTION 02250

TEMPORARY SHORING AND BRACING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary shoring and bracing for excavations including the trench excavation safety systems as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02240	Dewatering
02241	Ground Freezing
02300	Earthwork
02305	Wet Weather Earthwork

1.3 GEOTECHNICAL REPORT

Geotechnical Report, Proposed Secondary Clarifier #3, Puyallup Wastewater Treatment Plan, Washington, PanGEO, Inc.

1.4 WORK INCLUDED

The extent of temporary shoring and bracing work includes, but is not limited to:

- A. Temporary shoring and bracing necessary to protect the following against loss of ground or caving embankments: existing structures, buildings, roads, walkways, utilities, electrical transmission towers and support wiring, other facilities and improvements where required to comply with codes and authorities having jurisdiction.
- B. Trench excavation safety systems, pursuant to RCW Chapter 49.17 and WAC 296-155-655.
- C. Maintenance of shoring and bracing.

1.5 QUALITY ASSURANCE

A. SHORING CONSULTANT

The Contractor shall engage the services of a qualified geotechnical engineer and qualified structural engineer registered in the State of Washington to design temporary shoring and bracing when required by applicable regulations.

B. SHORING DESIGN

The Contractor shall provide layout and design drawings and specifications for shoring and bracing when a trench box is inadequate for the purpose or will not be used and trench depth exceeds 4 feet and back sloping will not be used. Temporary shoring and bracing system design and calculations shall be prepared, stamped, and signed by a Professional Engineer registered in the State of Washington.

C. REGULATIONS

The Contractor shall design sheeting, shoring and bracing in accordance with the Washington State Safety Code and any local codes and ordinances of governing authorities having jurisdiction.

1.6 SUBMITTALS

The Contractor shall submit shoring and bracing layout and design drawings, calculations and other backup data to the Owner for review in accordance with Section 01300 prior to the start of construction.

1.7 PROJECT CONDITIONS

A. SOILS INFORMATION

A Geotechnical investigation has been conducted for this project and a copy of the report is included in Appendix 1.

B. SITE SURVEY

The background survey information provided on the Plans is shown for clarity only. The Contractor shall determine, before commencing work, the exact location of all existing features that may be disrupted by new construction, including existing underground utilities. The Contractor shall be fully responsible for any and all damages, which might be caused by the Contractor's failure to exactly locate and/or preserve existing site

features. Prior to commencing work, the Contractor shall check and verify governing dimensions and elevations.

The Contractor shall survey adjacent structures and facilities, establishing exact elevations at fixed points to act as temporary bench marks to monitor potential settlement from the contractor's ongoing operations. Clearly identify temporary bench marks and record existing elevations from the control points shown on the Plans.

During excavation, the Contractor shall resurvey bench marks weekly. The Contractor shall maintain and make available at the job site an accurate log of surveyed elevations for comparison with original elevations, and promptly notify the Owner if changes in elevations occur or if cracks, sags or other damage is evident.

1.8 EXISTING UTILITIES

The Contractor shall protect existing active sewer, water, gas, electrical, and other utility services and structures that may be present. This shall also include all pipelines, services, and structures that are the property of the Owner.

PART 2 PRODUCTS

The Contractor shall provide suitable shoring and bracing materials, which shall support loads imposed. Materials for shoring systems need not be new, but shall be in serviceable conditions.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

The Contractor shall notify the Owner immediately if, during construction, subsurface conditions are different from those encountered in the exploratory holes or as described in the Geotechnical Report.

3.2 INSTALLATION AND APPLICATION

The Contractor shall provide shoring systems adequately anchored and braced to resist earth and hydrostatic pressures at locations as needed to support excavations during construction. The Contractor shall locate required bracing to clear all permanent work. Bracing which must be relocated shall be installed prior to the removal of original bracing. The Contractor shall not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to the Owner. The Contractor shall maintain bracing until structural

elements are rebraced by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.3 REMOVAL

The Contractor shall remove shoring and bracing in stages to avoid disturbances to adjacent and underlying soils and damage to structures, pavements, facilities and utilities. The Contractor shall repair or replace, as acceptable to the Owner, adjacent work damaged or displaced through the installation or removal of shoring and bracing work.

3.4 EXCAVATION SAFETY SYSTEMS

All work shall be carried out with due regard for public safety. Open trenches shall have proper barricades and at night they shall be distinctly indicated by adequately placed lights, as provided for elsewhere in the Specifications.

The Contractor is reminded that the Owner has not so delegated, and the Owner's Representative does not purport to be a trench or excavation system safety expert, is not so engaged in that capacity under this Contract, and has neither the authority nor the responsibility to enforce construction, safety laws, rules, regulations, or procedures or to order the stoppage of work for claimed violations of trench or excavation safety.

The furnishing by the Owner of resident representation and inspection personnel shall not make the Owner responsible for the enforcement of such laws, rules, regulations, or procedures, nor shall such make the Owner responsible for construction means, methods, techniques, sequences, procedures, or for the Contractor's failure to properly perform the work necessary for proper trench and excavation safety.

The Contractor is advised that shoring or excavation, in addition to the use of a trench box, may be required for trenches deeper than 4 feet. The Contractor shall be solely responsible for any measures required for the stabilization of trench walls in addition to trench boxes.

***** END OF SECTION *****

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the earthwork, including trench excavation and backfill for piping, excavation and backfill for structures, and finish grading.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01500	Temporary Facilities
02230	Clearing and Grubbing
02240	Dewatering
02250	Temporary Shoring and Bracing
02305	Wet Weather Earthwork
02370	Erosion Control
02700	Gravel Materials
02900	Landscaping

PART 2 PRODUCTS

2.1 GRAVEL MATERIALS

All gravel materials shall conform to Section 02700.

PART 3 EXECUTION

3.1 PREPARATION

Excavation may commence once all erosion control measures are in place in accordance with the Plans and Section 02370 and to the satisfaction of the Owner.

3.2 GENERAL REQUIREMENTS

Excavation, compaction and backfill for structures, pipelines and the final site contours shall be formed by either excavating or compacting fill, as required, to provide the cross-sections as shown on the Plans.

All excavation performed on this Project shall be considered unclassified. Excavation shall consist of the removal of any and all material encountered, including debris, rubble, concrete, metal, topsoil, cutting and removal of existing surfacing, tree stumps, trees, logs, abandoned rail ties, abandoned piping, piling, riprap, etc.

In the event the Contractor chooses to back slope excavations in lieu of sheeting and shoring, the Contractor shall be solely responsible for the cost of excavation and backfill. The Contractor is advised that maximum allowable slopes must be re-evaluated in the field during construction based on actual conditions.

Excavations shall be kept free of water, both surface water and groundwater, during the excavation, installation of pipelines and structures, and the placement of backfill. For additional requirements see Section 02240.

The Contractor's attention is also called to the depth of the structures and piping; for this reason, special shoring and bracing may be required. All shoring and bracing or sheeting required to perform and protect the excavation and to safeguard the employees, shall be furnished by the Contractor. For additional requirements see Section 02250.

No timber bracing, lagging, sheathing or other lumber shall be left in any excavation except with permission of the Engineer and in the event such permission is granted, no separate payment shall be allowed for burying such material.

General fill required to bring grade to the final site contours shall be structural fill, as specified in Section 02700. Structural fill placed as general fill shall be moisture conditioned to within 3 percent optimum moisture content and shall be placed in loose horizontal layers. The thickness of the layers placed before compaction shall not exceed 8 inches for heavy equipment compactors and shall not exceed 4 inches for hand operated mechanical compactors. Layers shall be compacted to a dense state equaling at least 95 percent of the maximum dry density, using the modified Proctor per ASTM D1557.

All stockpiles shall be covered with plastic and no stockpile shall be higher than 6 feet above existing grade.

3.3 EXCAVATION AND BACKFILL FOR STRUCTURES

Excavation and backfill for structures shall be in conformance with Section 2-09 of the WSDOT Standard Specifications, and as further described herein. All excavation for structures shall be done to the dimensions and levels indicated on the Plans or specified herein. Excavation shall be made to such width outside the

lines of the structures to be constructed as may be required for proper working methods, the erection of forms and the protection of the work.

Excavation shall consist of the removal of any and all material encountered to the elevations shown on the Plans. Excavations for structures shall be continued down to the subgrade which is defined as 12 inches below concrete mat foundations, concrete footings, and slab on grade floors for the installation of crushed surfacing base course, unless otherwise noted on the Plans.

When stone columns are encountered, they shall be excavated to the bottom of the concrete mat. The structure shall rest directly on the stone columns.

Fill material placed under structures, including footings and floor slabs, shall be foundation gravel free from debris and organics, as specified in Section 02700.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will be under the unit price bid item entitled "UNSUITABLE EXCAVATION," as described in Section 01200. The Contractor shall then replace the material with compacted foundation gravel, as specified in Section 02700. Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

The Contractor shall notify the Engineer when excavation for compacted fill or structures is complete. No forms, reinforcing steel, or concrete shall be placed until the excavation has been inspected by the Engineer.

Backfill material shall conform to the Specifications gravel backfill for walls as set forth in Section 02700.

No excavated native material shall be allowed to be used as structural backfill on this project. All excavated native material shall be hauled to an approved waste site(s), as selected by the Contractor.

3.4 PROTECTION OF FOUNDATION SURFACES

Care shall be taken to preserve the foundation surfaces shown on the Plans in an undisturbed condition. If the Contractor unnecessarily over excavates or disturbs the foundation surfaces shown on the Plans or specified herein without written authorization of the Engineer the Contractor shall replace such foundations with concrete fill or other suitable material approved by the Owner in a manner which will show by test an equal bearing capacity with the undisturbed foundation material. No additional payment shall be made for the added quantity of concrete

fill or other suitable material used because of unnecessary over excavation caused by the Contractor or his operations.

3.5 EXCAVATION AND BACKFILL FOR TRENCHES

Excavation and backfill for trenches shall be in conformance with Sections 7-08 and 7-09 of the WSDOT Standard Specifications, and as further described herein. The following pipe materials shall be considered flexible:

- PVC
- Polyethylene Tubing
- FRP
- HDPE
- Polyethylene
- Corrugated Polyethylene

All other pipe materials shall be considered rigid.

Upon completion of work each day, all pipeline open trenches shall be completely backfilled, leveled, and temporarily patched or graveled, as herein specified. Under certain conditions, the trench may be left open at the last length of pipe laid during the day to avoid re-excavation the following morning, provided that the opening is adequately plated or covered for vehicle traffic. Special attention shall be given to barricading to keep vehicular traffic away from newly-backfilled trench areas until restored for traffic.

The Engineer reserves the right to restrict the Contractor in the amount of trench for pipeline that can be opened during the working day. Should the Contractor, in the Engineer's opinion, fail to diligently pursue backfilling, an allowable limit of open trench shall be 100 lineal feet and shall be strictly enforced.

The width of the trench at or below a point 12 inches above the top of the outside diameter of the pipe shall be carefully controlled and maintained to ensure the strength of the pipe and prevent pipe failures. Backfilling shall proceed as follows:

A. SUBGRADE PREPARATION

The subgrade for piping is defined as the elevation of the bottom of the pipe bedding material as shown on the Plans.

In the event unsuitable material is encountered below the subgrade shown on the Plans and described herein, the Contractor, as required by the Engineer, shall over-excavate until a suitable foundation is reached. If over-excavation of unsuitable material is required by the Engineer, it will

be paid for under the unit price bid item entitled “UNSUITABLE EXCAVATION,” as found in the Proposal. The Contractor shall then replace the material with compacted foundation gravel, as specified in Section 02700.

Quantities, if any, shall be calculated by neat line measurement to the depth agreed to in the field by the Engineer.

B. BEDDING FOR RIGID PIPE

Above the foundation material, if any, the bedding material shall be suitable native or Gravel Backfill for Pipe Bedding, as specified in Section 02700. This material shall be placed in lifts of approximately 8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

C. BEDDING FOR FLEXIBLE PIPE

Above the foundation material, if any, Gravel Backfill for pipe bedding, as specified in Section 02700, shall be placed in lifts of approximately 8 inches up to a point 12 inches above the pipe. This material shall be hand shoveled in place and carefully worked under and around the pipe.

D. BACKFILL FOR TRENCHES

Partial backfill to protect the pipe will be permitted immediately after the pipe has been properly laid in accordance with the Plans and these Specifications. Complete backfilling of trenches will not be permitted until the section of pipe installed has been inspected by the Engineer.

From the point 12 inches above the top of the pipe barrel, the backfill material to be used in the trench section shall be structural fill, as specified in Section 02700, except where required or shown on the Plans to use other material. The Contractor shall place backfill in horizontal lifts not to exceed 8 inches in thickness. All backfill shall be free of large rocks, organic matter, stumps, trees, pieces of pavement, broken concrete and other deleterious substances. No excavated material shall be allowed to be used as backfill for trenches on this project.

The Contractor shall remedy, at his expense, any defects that appear in the backfill prior to final acceptance of the work. Cleanup operations shall progress immediately behind backfilling to accommodate the return to normal use of the trench area.

During placement of the initial lifts, the backfill material shall not be bulldozed into the trench or dropped directly over the pipe with less than 3 feet of backfill material above the top of the pipe.

3.6 ROCK EXCAVATION

It is not anticipated that solid rock will be encountered. Should such material be encountered, however, it will be paid for change order as directed by the Engineer and approved by the Owner. Boulders or broken rock less than 2 cubic yards in volume as measured in the field by the Engineer, will not be classified as rock, nor will so-called "hard-pan" or cemented gravel, even though it may be advantageous to use explosives in its removal if blasting were allowed. For the purpose of this contract, rock excavation shall be defined as mineral matter in place and of such hardness and texture that, when it is encountered, cannot be loosened by three passes of a ripper tooth mounted on the larger of a tracked backhoe of at least 25,000 pounds operating weight and 75 horsepower or the largest backhoe being utilized on the job by the Contractor. Where rocks occur as boulders that are smaller than the larger of: (1) 2 cubic yards in volume, or (2) the volume that can be readily handled by the largest backhoe being utilized on the job by the Contractor, they shall be considered incidental to excavation.

Where removal of a boulder results in a void below the desired elevation of the intended excavation, backfilling of the void shall be handled in the same manner as the replacement of unsuitable excavated material.

3.7 REUSE AND DISPOSAL OF EXCAVATED MATERIAL

No excavated native materials shall be allowed to be used as backfill on this project. All excavated materials shall be hauled to an approved waste site(s), as selected by the Contractor. The Contractor shall submit a list of approved waste haul site(s) to the Owner prior to the commencement of hauling of waste materials. Any permits required for waste haul and disposal shall be the responsibility of the Contractor.

3.8 FINAL SITE GRADING

The site shall be graded consistent with the elevations shown on the Plans. The slopes between elevations shall be uniform or as shown on the Plans. Excavations and backfill shall be to the elevations required for the placement of all surface restorations, such as asphalt, concrete, gravel surfacing, or landscaping. All areas shall be graded to provide proper drainage. The final ground surface shall be smooth, raked free of debris and stones, and prepared for restoration as specified in Section 02900.

3.9 STRUCTURE COMPACTION

The foundation gravel material placed underneath all structures shall be moisture conditioned to within 3 percent of optimum moisture content and shall be placed in loose, horizontal layers. The thickness of layers placed before compaction shall not exceed 8 inches for heavy equipment compactors and shall not exceed 4 inches for hand-operated mechanical compactors. Water settlement is not allowed for compaction.

Layers shall be compacted to a dense state equaling at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557. Prior to the placement of fill below structures, any and all groundwater and surface water shall be drained or pumped from areas to be filled.

Wall backfill material shall be compacted to at least 90 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557 within 5 feet of all walls and shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557 beyond 5 feet of all walls. Any and all compaction within 5 feet of all walls shall be accomplished by means of hand-operated mechanical equipment rather than heavy equipment compactors.

3.10 TRENCH COMPACTION

Trench backfill materials shall be moisture conditions to within three percent of optimum moisture content. Water settlement is not allowed for compaction.

Pipe bedding materials, for both rigid and flexible pipes, shall be compacted to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in non-structural and non-paved areas shall be performed by using mechanical equipment to at least 90 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

Compaction of the backfill above the bedding material in all trenches in structural or paved areas shall be performed by using mechanical equipment to at least 95 percent of the maximum dry density, using the Modified Proctor, per ASTM D1557.

***** END OF SECTION *****

SECTION 02305

WET WEATHER EARTHWORK

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the procedures to be followed if earthwork is to be accomplished in wet weather or in wet conditions where control of soil moisture is difficult.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02250	Temporary Shoring and Bracing
02300	Earthwork
02370	Erosion Control
02700	Gravel Materials

PART 2 PRODUCTS

The size or type of construction equipment shall be selected as required to prevent soil disturbance. In some instances, it may be necessary to limit equipment size or to excavate soils with a backhoe, Gradall, or equivalent type of equipment to minimize subgrade disturbance caused by construction traffic.

Material used as structural fill during wet weather earthwork shall generally consist of clean granular material containing less than 5 percent fines (material passing the U.S. Standard No. 200 sieve), based on wet sieving the fraction passing the 3/4-inch sieve. The fines shall be non-plastic.

PART 3 EXECUTION

3.1 WET WEATHER EXCAVATION AND FILL PLACEMENT QUALITY CONTROL

Excavation and placement of fill or backfill material will be observed on a full-time basis by the Owner, to determine that all work is being accomplished in accordance with these Specifications.

3.2 WET WEATHER EARTHWORK PROTECTION

The ground surface shall be sloped away from construction areas to promote the rapid runoff of precipitation and prevent ponding of water.

Earthwork shall be accomplished in small sections to minimize exposure to wet weather. Excavation or the removal of unsuitable soil shall be followed immediately by the placement and compaction of a suitable thickness (generally 8 inches or more if approved by the Owner) of clean foundation gravel.

No soil shall be left uncompacted and exposed to moisture. A smooth drum vibratory roller, or equivalent, shall be used to seal the ground surface after placement of fill or backfill materials.

All wet weather work shall meet local, state, and federal codes as specified herein and as indicated on the Plans.

***** END OF SECTION *****

SECTION 02370

EROSION CONTROL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the temporary erosion and sedimentation control (TESC) in and around the site caused by the actions of the Contractor as shown on the Plans and as specified herein.

Work under this Section shall be directed towards site areas disturbed during construction as well as all off-site storage and parking areas maintained by the Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01160	Regulatory Requirements
01200	Measurement and Payment
01300	Submittals
02240	Dewatering
02300	Earthwork

1.3 SUBMITTALS

A. STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A SWPPP shall be prepared by the CESCL for the project and submittal in accordance with Section 01300 and paragraph 1.5 of this specification section. **The SWPPP shall be submitted to the Owner for approval at the preconstruction conference.**

1.4 CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL)

The Contractor shall designate a Certified Erosion and Sediment Control Lead (CESCL) for this project. The CESCL shall have, for the life of this Contract, a current Certificate of Training in Construction Site Erosion and Spill Control signed by the WSDOT Water Quality Program Manager.

Duties of the CESCL shall include, but are not limited to:

A. Inspecting temporary erosion and spill control Best Management Practice (BMPs) for proper location, installation, maintenance, and repair.

Inspections shall be made as noted on the Plans and after each significant precipitation event, including those that occur during weekends and after working hours. A Temporary Erosion and Spill Control Inspection Report shall be prepared for each inspection and shall be included in the Temporary Erosion and Spill Control file. The inspection report shall include, but not be limited to:

1. When BMPs are installed, removed or changed;
 2. Repairs needed or made;
 3. Turbidity monitoring results;
 4. Observations of BMP effectiveness and proper placement;
 5. Recommendations for improving performance of BMPs.
- B. Prepare and maintain a Temporary Erosion and Spill Control file on site that includes but is not limited to:
1. Temporary Erosion and Spill Control Inspection Reports;
 2. Contractor's Stormwater Pollution Prevention Plan (SWPPP);
 3. Spill Prevention, Control, and Countermeasures (SPCC) Plan;
 4. All project permits, including but not limited to grading permits and Hydraulics Project Approval;
 5. Manufacturer instructions for all products used for TESC BMPs;
 6. Washington State Department of Ecology's Stormwater Management Manual for Western Washington, Chapter 4, Volume II, current edition.

1.5 STORMWATER POLLUTION PREVENTION PLAN

The CESCL Contractor shall be responsible for preparing a Stormwater Pollution Prevention Plan (SWPPP). The intent of the SWPPP is to reflect the Contractor's operations by supplementing the TESC Drawings, details, and notes shown on the Plans to provide comprehensive pollution control at the construction site, staging areas, stockpiles, and borrow sites. The SWPPP shall be prepared by the CESCL for the project and submittal in accordance with Section 01300. The SWPPP shall be submitted to the Owner for approval at the preconstruction conference. **No**

work shall begin until the Contractor's SWPPP, as approved by the Owner, is implemented. The SWPPP shall address, at least, the following items:

- Identification of construction haul routes and location of BMPs (e.g., stabilized construction entrance, silt fences, storm drain inlet protection).
- Waste disposal methods and locations.
- Detailed construction sequence and schedule, including identifying dates scheduled for BMP installation, removal, clearing, grading, seeding, and landscaping.
- Details for any temporary flow diversions, dewatering systems, and BMPs (in accordance with the current edition of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington) proposed by the Contractor.
- Calculations for temporary sedimentation ponds, if used
- A list of products to be used, including Material Safety Data Sheets.
- Identification of stockpile and staging areas, and BMPs to be implemented at these locations.

The SWPPP shall be prepared in accordance with details shown on the Plans, these Specifications, and Chapter 4, Volume II – BMPs from the current edition of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington, which are hereby referenced and made a part of the Contract Documents. Only those sections of the Stormwater Management Manual for Western Washington that address preparation, implementation, and maintenance of permanent and temporary erosion and sedimentation control BMPs are applicable.

The SWPP shall include best management practices to control windblown dust.

PART 2 PRODUCTS

2.1 SILT FENCES

Silt fences shall conform to the details shown on the Plans and the fabric shall conform meet the requirements of Geotextile for Temporary Silt Fence of Section 9-33 of the WSDOT Standard Specifications.

2.2 STRAW BALES

Straw bale dams shall conform to the details shown on the Plans.

2.3 STORM DRAIN INLET (CATCH BASIN) PROTECTION

Storm drain inlet protection shall be with a “silt sack,” as manufactured by ACF Environmental or equal.

2.4 EROSION CONTROL BLANKET

On all disturbed slopes steeper than 2H:1V, an erosion control blanket shall be placed and secured per manufacturer’s recommendation with a biodegradable means.

The erosion control blanket shall be temporary, biodegradable and is to remain in place.

The erosion control blanket shall be “Biomac C” as manufactured by MacCafferri, Inc. or “Curlex II,” as manufactured by American Excelsior Co., or Equal.

PART 3 EXECUTION

3.1 PREPARATION

Site preparation work shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped.

3.2 BEST MANAGEMENT PRACTICES (BMPS)

Silt fences and straw bale dams shall be constructed to control erosion and migration of soils disturbed during construction. The fences and dams shall provide temporary protection and shall be removed only upon approval of the Owner.

All areas or drainage ways downstream of the construction site shall have Best Management Practices (BMPs) installed prior to the beginning of any clearing activities. Runoff from cleared or disturbed area shall be directed through the BMPs. Disturbed ground shall be stabilized at the end of each work day. Permanent soil stabilization and erosion and sedimentation control shall be implemented upon reaching finish grade. Slope protection shall be immediately implemented upon any soils showing signs of erosion. This shall be done in a manner approved by the Owner.

All BMPs shall be inspected, maintained and kept in a condition sufficient to provide effective erosion and sedimentation control at all times. The site shall be inspected to ensure the BMPs are properly located, constructed and operating as designed during the first storm. Any necessary adjustments or repairs shall be made immediately and be approved by the Owner. The BMPs shall be inspected thereafter after all significant storm events. Turbidity monitoring will be held on a weekly basis at a minimum, or more frequently if necessary as determined by the CESCL.

All BMPs shall be removed no later than 30 consecutive calendar days after final site stabilization has been achieved as determined by the Owner. BMPs such as storm drain inlet protection, straw bales, silt fences and supports and plastic coverings shall be removed and properly disposed of offsite by the Contractor. Areas disturbed by removal of these BMPs shall be immediately stabilized in a manner approved by the Owner.

***** END OF SECTION *****

SECTION 02530

UTILITY STRUCTURES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes precast concrete vaults, manholes, catch basins, castings, and steps for a complete installation as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
08310	Access Hatches

PART 2 PRODUCTS

2.1 GENERAL

The exterior finish of all precast concrete utility structures shall be smooth with no imperfections larger than 1/8 inch in diameter. The interior finish of all precast concrete utility structures shall be smooth and sacked with non-shrink cementitious materials and epoxy bonding agent. No bug holes, fins, projections, or other defects are acceptable.

2.2 PRECAST CONCRETE MANHOLES

Precast components shall conform to the requirements of ASTM C478. All Portland cement used in the manufacture of the precast sections shall conform to the requirements of ASTM C150 and shall be Type II or Type V.

Standard precast riser sections shall consist of circular sections in standard nominal inside diameter as shown on the Plans. Reinforcement shall be in accordance with ASTM C478. Minimum height of a riser section shall be 1 foot. The height of riser and base sections shall be arranged so no pipes pass through the joining surfaces.

The taper section (cone) shall be eccentric, tapering to 24-inches inside diameter and shall be between 18-inches and 36-inches high. Joining to the riser sections

shall be similar to joining between riser sections, but the top surface shall be flat and at least 5-inches wide, radially, to receive grade rings.

Grade rings above the taper section shall be 24-inches inside diameter and 4-inches high. Grade ring height shall be a minimum of 8 inches, with a maximum of 20 inches. Otherwise another section of manhole rings shall be installed.

Access hatches shall be as specified in Section 08310.

2.3 GASKETS AND MANHOLE ADAPTERS

Rubber gaskets shall conform to Section 9-04.4 of the WSDOT Standard Specifications. Pipe connections to existing manholes shall be made using a heavy duty sand collar with gasket, head, or equal. Pipe connections to new manholes or vaults shall utilize an adaptor coupling with gasket or watertight flexible rubber boot, Kor-n-Seal or equal. The Contractor shall provide Kor-n-Seal cavity O-rings to fill the annular spaces between the pipe and the manhole wall.

PART 3 EXECUTION

3.1 MANHOLES

Manhole installation shall be as shown on the Plans. Precast sections with damaged joint surfaces or with cracks or damage that would permit infiltration shall not be installed.

Precast riser sections and cones shall be set using the specified joint sealant or gasket. Priming and preparation of surfaces and installation of jointing material shall be in strict conformance with the manufacturer's instructions. Only one 12-inch-high riser section shall be used per manhole and it shall be placed immediately below the cone. Grade rings shall be set in a full bed of cement grout.

All pipe connections to manholes shall be made with manhole adaptors.

Manhole frames shall be set carefully to the established surface grade in a full bed of cement grout. The manhole rim elevation shall be set flush with the existing pavement or grade in paved and improved areas. In unimproved areas, manhole rim elevations shall be set 2 inches above grade unless otherwise shown on the Plans to be set higher. Patch all lifters after removed picking eyes. Patch all joints inside and outside flush with walls.

Pipe connections to existing manholes or vaults shall be in accordance with Section 7-05.3(3) of the WSDOT Standard Specifications and as further shown on the Plans.

3.2 FINAL ADJUSTMENT AND CLEANUP

After installation is complete, the Contractor shall cleanout all precast structures prior to placing the new facilities into service. The adjustment of castings shall be done in a manner satisfactory to the Owner. Adjustment shall be done only with precast grade rings. Bricks are unacceptable. Grouting and final adjustment of castings shall be done with non-shrink grout.

***** END OF SECTION *****

SECTION 02700

GRAVEL MATERIALS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the various types of granular materials that are to be used in trenches and other excavations as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02305	Wet Weather Earthwork
02710	Gravel Surfacing

1.3 SUBMITTALS

The Contractor shall provide certificates of laboratory tests in accordance with Section 01300, indicating particle size distribution for review for each type of granular material furnished and proctor test reports for all material to be placed as pipe bedding material, trench backfill, backfill under and around structures and underneath crushed surfacing and asphalt concrete pavements.

The certificates and proctor test reports shall be provided to the Owner at least 5 calendar days prior to placement.

PART 2 PRODUCTS

2.1 FOUNDATION GRAVEL

Foundation gravel shall be Class A Gravel Backfill for Foundations in conformance with Section 9-03.12(1)A of the WSDOT Standard Specifications.

2.2 GRAVEL BACKFILL FOR PIPE BEDDING

Gravel backfill for pipe bedding shall meet the requirements of Section 9-03.12(3) of the WSDOT Standard Specifications except that no more than 5 percent passing shall pass the No. 200 Sieve.

Native granular material shall not be utilized for gravel backfill for pipe bedding.

2.3 STRUCTURAL FILL

Structural fill shall consist of clean, non-plastic, free-draining sand and gravel free from organic matter or other deleterious materials, in conformance with Section 9-03.14(1) of the WSDOT Standard Specifications. The material shall contain particles less than 4-inches maximum dimension with less than 7-percent passing the U.S. No. 200 size sieve.

During period of wet weather the allowable fines content of the structural fill materials shall be no more than 5 percent passing the U.S. Standard No. 200 size sieve. Alternatively, crushed surfacing base course, in conformance with Section 9-03.9 (3) of the WSDOT Standard Specifications may be used.

2.4 GRAVEL BASE

Provide gravel base in paved areas as backfill material as indicated on the Plans. Gravel base shall be in conformance with Section 9-03.10. The material shall contain particles of less than 4 inches maximum dimension, with less than 7 percent passing the U.S. No. 200 size sieve.

During period of wet weather the allowable fines content of the gravel base materials shall be no more than 5 percent passing the U.S. No. 200 size sieve.

2.5 GRAVEL BACKFILL FOR WALLS

Gravel backfill for walls shall conform to Section 9-03.12(2) of the WSDOT Standard Specifications.

2.6 CRUSHED SURFACING

Crushed surfacing base course and top course shall conform to Section 9-03.9(3) of the WSDOT Standard Specifications.

2.7 MISCELLANEOUS GRAVEL

If the Plans call for a gravel that is not herein specified than the gravel shall conform to the type of gravel called for as per the WSDOT Specifications.

PART 3 EXECUTION

3.1 FOUNDATION GRAVEL

Foundation gravel shall be placed and compacted to replace unsuitable excavated materials.

In the event the Contractor unnecessarily overexcavates the pipe trench or structure foundation, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.2 GRAVEL BACKFILL FOR PIPE BEDDING

Bedding material shall be placed simultaneously on both sides of the pipe for the full width of the trench in lifts not exceeding 6 inches. To assure uniform support, the material shall be carefully worked underneath the pipe haunches with a tool capable of preventing the formation of void spaces around the pipe. In the event the Contractor overexcavates the pipe trench, or if the width of the pipe trench becomes wider than the pay limit shown on the Plans, all material so placed shall be at the Contractor's sole expense.

3.3 STRUCTURAL FILL

Provide structural fill as shown on the Plans or where excavated material is unsuitable as directed by the Engineer. Structural fill shall be installed in lifts not to exceed 8 to 10 inches maximum thickness. Structural fill placed under structures shall be compacted to at least 95 percent of the maximum dry density as determined by the modified Proctor, per ASTM D1557.

3.4 GRAVEL BASE

Gravel base shall be used where excavated material is unsuitable or unavailable for the backfill of trenches, around manholes, vaults and structures, as approved by the Engineer, as shown on the Plans and as specified herein.

3.5 GRAVEL BACKFILL FOR WALLS

Gravel backfill for walls shall be used where excavated materials are unsuitable for backfilling around the walls of structures, as approved by the Owner, as shown on the Plans and specified in these specifications.

3.6 CRUSHED SURFACING

Crushed surfacing base course and/or top course shall be placed underneath asphalt paving, to the lines and grades shown on the Plans or as required by the Plans and shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

3.7 MISCELLANEOUS GRAVEL

Miscellaneous gravel shall be installed per the Plans.

***** END OF SECTION *****

SECTION 02710

GRAVEL SURFACING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation of crushed surfacing materials.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02300	Earthwork
02700	Gravel Materials

1.3 SUBMITTALS

The Contractor shall provide the Owner with a certificate of laboratory test indicating gradation of each material provided in accordance with Section 01300. The certificate shall be provided to the Owner 5 days prior to placement of any materials.

PART 2 PRODUCTS

2.1 GRAVEL MATERIALS

All gravel materials shall conform to the requirement of Section 02700.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be prepared as per Section 2-06.3 of the WSDOT Standard Specifications. As the rolling of the subgrade proceeds, all soft or spongy areas shall be removed and the resulting holes filled with gravel base. The Contractor shall dispose of excess materials resulting from the preparation of the subgrade. Rollers shall not be operated adjacent to structures where such use may cause damage. Where the subgrade abuts structures and compaction with a roller is not possible for practical reasons, the area shall be compacted with mechanical tampers or other approved equipment.

3.2 GRAVEL MATERIAL

Gravel materials shall be placed in the layers and thickness as shown on the Plans. Gravel materials shall be placed in accordance with Section 4-04.3 of the WSDOT Standard Specifications.

The Contractor shall place gravel materials in a uniform layer over the entire area to receive gravel materials without segregation of sizes, to such depth that when compacted with the power roller, the course shall have the required thickness. The maximum layer thickness for compaction with a roller shall be 6 inches for ballast or base course and 4 inches for crushed surfacing. The gravel material shall be bladed with a grader and rolled while damp with a power roller until the course is thoroughly and uniformly compacted and until its surface is smooth and conforms to grade and crown requirements shown on the Plans. The cross-section of the finished surface shall be subject to reasonable variations as approved by the Owner to meet the varying conditions encountered. The surface shall be maintained in its finished condition until the succeeding layer is placed.

The roller shall not be operated adjacent to structures where such use may cause damage. Where the gravel materials abut structures and compaction with a roller is not possible for practical reasons, the area shall be compacted with mechanical tampers or other approved equipment.

3.3 COMPACTION

All materials shall be compacted to a dense, unyielding state of at least 95 percent of the maximum dry density, using the modified Proctor, per ASTM D1557.

*****END OF SECTION*****

SECTION 02740

HOT MIX ASPHALT PAVING

PART 1 GENERAL

1.1 SCOPE

The work in this section shall be accomplished in accordance with the Standard Specifications for Road, Bridge and Municipal Construction, 2021 edition, as issued by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), Washington State Chapter (hereafter “Standard Specifications”). Delete section 5-04 of the Standard Specifications, with the exception of 5-04.2(1), and replace it with the following:

The work specified in this Section includes providing and placing one or more layers of plant-mixed hot mix asphalt (HMA) on a prepared foundation or base in accordance with these Specifications and the lines, grades, thicknesses, and typical cross-sections shown in the Plans. The manufacture of HMA may include warm mix asphalt (WMA) processes in accordance with these Specifications. WMA processes include organic additives, chemical additives, and foaming.

This work also consists of adjusting castings to grade per the details in the Contract Plans.

HMA shall be composed of asphalt binder and mineral materials as may be required, mixed in the proportions specified to provide a homogeneous, stable, and workable mixture.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01400	Quality Control
02300	Earthwork
02530	Utility Structures
02700	Gravel Materials
02710	Gravel Surfacing

1.3 SUBMITTALS

A. MIX DESIGN – OBTAINING PROJECT APPROVAL

1. ESALs

The number of ESALs for the design and acceptance of the HMA shall be <0.3 million.

Commercial HMA shall be an HMA Cl. 1/2" PG 58H-22 design mix.

No paving shall begin prior to the approval of the mix design by the Engineer.

Commercial evaluation will be used for Commercial HMA and for other classes of HMA in the following applications: sidewalks, road approaches, ditches, slopes, paths, trails, gores, prelevel, and pavement repair. Other nonstructural applications of HMA accepted by commercial evaluation shall be as approved by the Project Engineer. Sampling and testing of HMA mixture accepted by commercial evaluation will be at the option of the Project Engineer.

Commercial Evaluation Mix Design Approval of a mix design for "Commercial Evaluation" will be based on a review of a Mix Design from the current WSDOT QPL. At the discretion of the Engineer, agencies may accept verified mix designs older than 12 months from the original verification date with a certification from the Contractor that the materials and sources are the same as those shown on the original mix design. Testing of the HMA by the Contracting Agency for mix design approval is not required.

Using Warm Mix Asphalt Processes. The Contractor may elect to use additives that reduce the optimum mixing temperature or serve as a compaction aid for producing HMA. Additives include organic additives, chemical additives and foaming processes. The use of Additives is subject to the following:

- Do not use additives that reduce the mixing temperature more than allowed in subsection 3.3 F. in the production of mixtures.
- Before using additives, obtain the Engineer's approval using WSDOT Form 350-076 to describe the proposed additive and process.

PART 2 PRODUCTS

2.1 ATB PAVEMENT

Materials shall meet the requirements of the following sections of the Standard Specifications:

Asphalt	9-02.1
Anti-Stripping Additive	9-02.4

The grade of paving asphalt shall be as required in the Contract.

2.2 HMA PAVEMENT

HMA pavement, Commercial HMA, HMA Cl. 1/2" PG 58H-22.

A. MATERIALS

Materials shall meet the requirements of the following sections of the Standard Specifications:

Asphalt Binder	9-02.1(4)
Cationic Emulsified Asphalt	9-02.1(6)
Anti-Stripping Additive	9-02.4
HMA Additive	9-02.5
Aggregates	9-03.8
Recycled Asphalt Pavement	9-03.8(3)B
Mineral Filler	9-03.8(5)
Recycled Material	9-03.21
Portland Cement	9-01
Sand	9-03.1(2).
(As noted in subsection 3.3D.1. for crack sealing)	
Joint Sealant	9-04.2
Foam Backer Rod	9-04.2(3)A

The Contract documents may establish that the various mineral materials required for the manufacture of HMA will be furnished in whole or in part by the Contracting Agency. If the documents do not establish the furnishing of any of these mineral materials by the Contracting Agency, the Contractor shall be required to furnish such materials in the amounts required for the designated mix. Mineral materials include coarse and fine aggregates, and mineral filler.

The Contractor may choose to utilize recycled asphalt pavement (RAP) in the production of HMA. The RAP may be from pavements removed

under the Contract, if any, or pavement material from an existing stockpile.

The Contractor may use up to 20 percent RAP by total weight of HMA. The asphalt content and gradation test data shall be reported to the Contracting Agency when submitting the mix design for approval on the QPL. The Contractor shall include the RAP as part of the mix design as defined in these Specifications.

The grade of asphalt binder shall be as required by the Contract. Blending of asphalt binder from different sources is not permitted.

The Contractor may only use warm mix asphalt (WMA) processes in the production of HMA with 20 percent or less RAP by total weight of HMA. The Contractor shall submit to the Engineer for approval the process that is proposed and how it will be used in the manufacture of HMA.

Production of aggregates shall comply with the requirements of Section 3-01 of the Standard Specifications.

Preparation of stockpile site, the stockpiling of aggregates, and the removal of aggregates from stockpiles shall comply with the requirements of Section 3-02 of the Standard Specifications.

B. HMA TOLERANCES AND ADJUSTMENTS

1. Job Mix Formula (JFM) Tolerances

After the JMF is determined as required in subsection 3.6A. The constituents of the mixture at the time of acceptance shall conform to the following tolerances:

Aggregate, percent passing	<i>Nonstatistical Evaluation</i>	<i>Commercial Evaluation</i>
1", 3/4", 1/2", and 3/8" sieves	$\pm 6\%$	$\pm 8\%$
U.S. No. 4 sieve	$\pm 6\%$	$\pm 8\%$
U.S. No. 8 sieve	$\pm 6\%$	$\pm 8\%$
U.S. No. 200 sieve	$\pm 2.0\%$	$\pm 3.0\%$
Asphalt Binder	$\pm 0.5\%$	$\pm 0.7\%$

These tolerance limits constitute the allowable limits as described in Standard Specification Section 1-06.2. The tolerance limit for aggregate shall not exceed the limits of the control points section, except the tolerance limits for sieves designated as 100 percent

passing will be 99-100. The tolerance limits on sieves shall only apply to sieves with control points.

2.3 TEMPORARY HMA AND TEMPORARY COLD MIX

Cold-mix material shall be MC-2 asphaltic concrete commonly referred to as “cold-mix,” (EZ Street or Contracting Agency approved equal).

Temporary HMA material shall meet the requirements for Commercial HMA.

PART 3 EXECUTION

3.1 GENERAL

Where paving occurs on a facility, the Contractor shall maintain access to the facility at all times. The Contractor shall provide 1-week notification to the Contracting Agency prior to paving and shall coordinate all work with the Contracting Agency to ensure their paving plan does not interfere with the Contracting Agency’s on-going operations.

When paving occurs on a roadway open to traffic, the requirements of subsection 3.3B. apply.

The Contractor shall provide, place and maintain all temporary markings and signage as required to warn and direct facility traffic as necessary during their paving operations.

3.2 ATB PLACEMENT

(Not used)

3.3 HMA PLACEMENT

A. WEATHER LIMITATIONS

Do not place HMA for wearing course on any Traveled Way beginning October 1st through March 31st of the following year without written concurrence from the Engineer.

Do not place HMA on any wet surface, or when the average surface temperatures are less than those specified below, or when weather conditions otherwise prevent the proper handling or finishing of the HMA.

Minimum Surface Temperature for Paving

Compacted Thickness (Feet)	Wearing Course	Other Courses
Less than 0.10	55 degrees F	45 degrees F
0.10 to .20	45 degrees F	35 degrees F
More than 0.20	35 degrees F	35 degrees F

B. PAVING UNDER TRAFFIC

When the Roadway being paved is open to traffic, the requirements of this Section shall apply.

The Contractor shall keep intersections open to traffic at all times except when paving the intersection or paving across the intersection. During such time, and provided that there has been an advance warning to the public, the intersection may be closed for the minimum time required to place and compact the mixture. In hot weather, the Engineer may require the application of water to the pavement to accelerate the finish rolling of the pavement and to shorten the time required before reopening to traffic.

Before closing an intersection, advance warning signs shall be placed and signs placed marking the detour or alternate route.

During paving operations, temporary pavement markings shall be maintained throughout the project. Temporary pavement markings shall be installed on the Roadway prior to opening to traffic. Temporary pavement markings shall be in accordance with Standard Specifications Section 8-23.

All costs in connection with performing the Work in accordance with these requirements shall be included in the unit Contract prices for the various Bid items involved in the Contract.

C. EQUIPMENT

1. Mixing Plant

Plants used for the preparation of HMA shall conform to the following requirements:

a. Equipment for Preparation of Asphalt Binder

Tanks for the storage of asphalt binder shall be equipped to heat and hold the material at the required temperatures.

The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the storage tank. The circulating system for the asphalt binder shall be designed to ensure proper and continuous circulation during the operating period. A valve for the purpose of sampling the asphalt binder shall be placed in either the storage tank or in the supply line to the mixer.

b. Thermometric Equipment

An armored thermometer, capable of detecting temperature ranges expected in the HMA mix, shall be fixed in the asphalt binder feed line at a location near the charging valve at the mixer unit. The thermometer location shall be convenient and safe for access by Inspectors. The plant shall also be equipped with an approved dial-scale thermometer, a mercury actuated thermometer, an electric pyrometer, or another approved thermometric instrument placed at the discharge chute of the drier to automatically register or indicate the temperature of the heated aggregates. This device shall be in full view of the plant operator.

c. Heating of Asphalt Binder

The temperature of the asphalt binder shall not exceed the maximum recommended by the asphalt binder manufacturer nor shall it be below the minimum temperature required to maintain the asphalt binder in a homogeneous state. The asphalt binder shall be heated in a manner that will avoid local variations in heating. The heating method shall provide a continuous supply of asphalt binder to the mixer at a uniform average temperature with no individual variations exceeding 25 degrees F. Also, when a WMA additive is included in the asphalt binder, the temperature of the asphalt binder shall not exceed the maximum recommended by the manufacturer of the WMA additive.

2. Hauling Equipment

Trucks used for hauling HMA shall have tight, clean, smooth metal beds and shall have a cover of canvas or other suitable material of sufficient size to protect the mixture from adverse weather.

Whenever the weather conditions during the work shift include, or are forecast to include, precipitation or an air temperature less than 45 degrees F or when time from loading to unloading exceeds 30 minutes, the cover shall be securely attached to protect the HMA.

The Contractor shall provide an environmentally benign means to prevent the HMA mixture from adhering to the hauling equipment. Excess release agent shall be drained prior to filling hauling equipment with HMA. Petroleum derivatives or other coating material that contaminate or alter the characteristics of the HMA shall not be used. For live bed trucks, the conveyer shall be in operation during the process of applying the release agent.

3. Pavers

HMA pavers shall be self-contained, power-propelled units, provided with an internally heated vibratory screed and shall be capable of spreading and finishing courses of HMA plant mix material in lane widths required by the paving section shown in the Plans.

The HMA paver shall be in good condition and shall have the most current equipment available from the manufacturer for the prevention of segregation of the HMA mixture installed, in good condition, and in working order. The equipment certification shall list the make, model, and year of the paver and any equipment that has been retrofitted.

The screed shall be operated in accordance with the manufacturer's recommendations and shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, segregating, or gouging the mixture. A copy of the manufacturer's recommendations shall be provided upon request by the Contracting Agency. Extensions will be allowed provided they produce the same results, including ride, density, and surface texture as obtained by the primary screed. Extensions without augers and an internally heated vibratory screed shall not be used in the Traveled Way.

When specified in the Contract, reference lines for vertical control will be required. Lines shall be placed on both outer edges of the Traveled Way of each Roadway. Horizontal control utilizing the reference line will be permitted. The grade and slope for intermediate lanes shall be controlled automatically from reference

lines or by means of a mat referencing device and a slope control device. When the finish of the grade prepared for paving is superior to the established tolerances and when, in the opinion of the Engineer, further improvement to the line, grade, cross-section, and smoothness can best be achieved without the use of the reference line, a mat referencing device may be substituted for the reference line. Substitution of the device will be subject to the continued approval of the Engineer. A joint matcher may be used subject to the approval of the Engineer. The reference line may be removed after the completion of the first course of HMA when approved by the Engineer. Whenever the Engineer determines that any of these methods are failing to provide the necessary vertical control, the reference lines will be reinstalled by the Contractor.

The Contractor shall furnish and install all pins, brackets, tensioning devices, wire, and accessories necessary for satisfactory operation of the automatic control equipment.

If the paving machine in use is not providing the required finish, the Engineer may suspend Work as allowed by Standard Specification Section 1-08.6. Any cleaning or solvent type liquids spilled on the pavement shall be thoroughly removed before paving proceeds.

4. Rollers

Rollers shall be of the steel wheel, vibratory, oscillatory, or pneumatic tire type, in good condition and capable of reversing without backlash. Operation of the roller shall be in accordance with the manufacturer's recommendations. When ordered by the Engineer for any roller planned for use on the project, the Contractor shall provide a copy of the manufacturer's recommendation for the use of that roller for compaction of HMA. The number and weight of rollers shall be sufficient to compact the mixture in compliance with the requirements of subsection 3.3J. The use of equipment that results in crushing of the aggregate will not be permitted. Rollers producing pickup, washboard, uneven compaction of the surface, displacement of the mixture or other undesirable results shall not be used.

D. PREPARATION OF TREATED SURFACES FOR HMA

A treated surface includes cement concrete, asphalt concrete, brick, seal coat, bituminous surface treatment and cement treated base. When the treated surface or old base is irregular, the Contractor shall bring it to a

uniform grade and cross-section as shown on the Plans or approved by the Engineer.

Preleveling of uneven or broken treated surfaces over which HMA is to be placed may be accomplished by using an asphalt paver, a motor patrol grader, or by hand raking, as approved by the Engineer.

Compaction of preleveling HMA shall be to the satisfaction of the Engineer and may require the use of small steel wheel rollers, plate compactors, or pneumatic rollers to avoid bridging across preleveled areas by the compaction equipment. Equipment used for the compaction of preleveling HMA shall be approved by the Engineer.

Before construction of HMA on an existing paved surface, the entire surface of the pavement shall be clean. All fatty asphalt patches, grease drippings, and other objectionable matter shall be entirely removed from the existing pavement.

All treated surfaces over which HMA is to be placed shall be thoroughly cleaned of dust, soil, pavement grindings, and other foreign matter. All holes and small depressions shall be filled with an appropriate class of HMA. The surface of the patched area shall be leveled and compacted thoroughly. Prior to the application of tack coat, or paving, the condition of the surface shall be approved by the Engineer.

A tack coat of asphalt shall be applied to all treated surfaces on which any course of HMA is to be placed or abutted. Tack coat shall be uniformly applied to cover the treated surface with a thin film of residual asphalt free of streaks and bare spots at a rate between 0.02 and 0.10 gallons per square yard of retained asphalt. The rate of application shall be approved by the Engineer. A heavy application of tack coat shall be applied to all joints. For Roadways open to traffic, the application of tack coat shall be limited to surfaces that will be paved during the same working shift. The spreading equipment shall be equipped with a thermometer to indicate the temperature of the tack coat material.

Equipment shall not operate on tacked surfaces until the tack has broken and cured. If the Contractor's operation damages the tack coat it shall be repaired prior to placement of the HMA.

The tack coat shall be CSS-1, or CSS-1h emulsified asphalt. The CSS-1 and CSS-1h emulsified asphalt may be diluted once with water at a rate not to exceed one part water to one part emulsified asphalt. The tack coat shall have sufficient temperature such that it may be applied uniformly at

the specified rate of application and shall not exceed the maximum temperature recommended by the emulsified asphalt manufacturer.

E. PRODUCING/STOCKPILING AGGREGATES AND RAP

Aggregates and RAP shall be stockpiled according to the requirements of Standard Specifications Section 3-02. Sufficient storage space shall be provided for each size of aggregate and RAP. Materials shall be removed from stockpile(s) in a manner to ensure minimal segregation when being moved to the HMA plant for processing into the final mixture. Different aggregate sizes shall be kept separated until they have been delivered to the HMA plant.

F. MIXING

After the required amount of mineral materials, asphalt binder, recycling agent and anti-stripping additives have been introduced into the mixer the HMA shall be mixed until complete and uniform coating of the particles and thorough distribution of the asphalt binder throughout the mineral materials is ensured.

When discharged, the temperature of the HMA shall not exceed the optimum mixing temperature by more than 25 degrees F as shown on the reference mix design report or as approved by the Engineer. Also, when a WMA additive is included in the manufacture of HMA, the discharge temperature of the HMA shall not exceed the maximum recommended by the manufacturer of the WMA additive. A maximum water content of 2 percent in the mix, at discharge, will be allowed providing the water causes no problems with handling, stripping, or flushing. If the water in the HMA causes any of these problems, the moisture content shall be reduced as directed by the Engineer.

Storing or holding of the HMA in approved storage facilities will be permitted with approval of the Engineer, but in no event shall the HMA be held for more than 24 hours. HMA held for more than 24 hours after mixing shall be rejected. Rejected HMA shall be disposed of by the Contractor at no expense to the Contracting Agency. The storage facility shall have an accessible device located at the top of the cone or about the third point. The device shall indicate the amount of material in storage. No HMA shall be accepted from the storage facility when the HMA in storage is below the top of the cone of the storage facility, except as the storage facility is being emptied at the end of the working shift.

Recycled asphalt pavement (RAP) utilized in the production of HMA shall be sized prior to entering the mixer so that a uniform and thoroughly mixed HMA is produced. If there is evidence of the RAP not breaking down during the heating and mixing of the HMA, the Contractor shall immediately suspend the use of the RAP until changes have been approved by the Engineer. After the required amount of mineral materials, RAP, new asphalt binder and asphalt rejuvenator have been introduced into the mixer the HMA shall be mixed until complete and uniform coating of the particles and thorough distribution of the asphalt binder throughout the mineral materials, and RAP is ensured.

G. SPREADING AND FINISHING

The mixture shall be laid upon an approved surface, spread, and struck off to the grade and elevation established. HMA pavers complying with subsection 3.3C. shall be used to distribute the mixture. Unless otherwise directed by the Engineer, the nominal compacted depth of any layer of any course shall not exceed the following:

HMA Class 1"	0.35 feet
HMA Class 3/4" and HMA Class 1/2" wearing course	0.30 feet
HMA Class 3/4" and HMA Class 1/2" other courses	0.35 feet
HMA Class 3/8" wearing course	0.25 feet
HMA Class 3/8" other courses	0.30 feet

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the paving may be done with other equipment or by hand.

When more than one job mix formula (JMF) is being utilized to produce HMA, the material produced for each JMF shall be placed by separate spreading and compacting equipment. The intermingling of HMA produced from more than one JMF is prohibited. Each strip of HMA placed during a work shift shall conform to a single JMF established for the class of HMA specified unless there is a need to make an adjustment in the JMF.

H. AGGREGATE ACCEPTANCE PRIOR TO INCORPORATION IN HMA

Sampling and testing of aggregates for HMA accepted by commercial evaluation will be at the option of the Engineer.

I. SURFACE SMOOTHNESS

The completed surface of all courses shall be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds. The completed surface of the wearing course of the following sections of Roadway shall not vary more than 1/4 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to centerline on all Sections of roadway within the project limits that are posted less than 45 mph.

The completed surface of the wearing course of all other sections of Roadway shall not vary more than 1/8 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to centerline.

The transverse slope of the completed surface of the wearing course shall vary not more than 1/4 inch in 10 feet from the rate of transverse slope shown in the Plans.

When deviations in excess of the above tolerances are found that result from a high place in the HMA, the pavement surface shall be corrected by one of the following methods:

1. Removal of material from high places by grinding with an approved grinding machine; or
2. Removal and replacement of the wearing course of HMA; or
3. By other method approved by the Engineer.

Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.

Deviations in excess of the above tolerances that result from a low place in the HMA and deviations resulting from a high place where corrective action, in the opinion of the Engineer, will not produce satisfactory results will be accepted with a price adjustment. The Engineer shall deduct from monies due or that may become due to the Contractor the sum of \$500.00 for each and every section of single traffic lane 100 feet in length in which any excessive deviations described above are found.

J. SEALING PAVEMENT SURFACES

Apply a fog seal where shown in the plans. Construct the fog seal in accordance with Standard Specifications Section 5-02.3. Unless otherwise approved by the Engineer, apply the fog seal prior to opening to traffic.

3.4 TEMPORARY PAVEMENT REPAIR

During the course of construction, it may be necessary to provide improved temporary vehicle and/or pedestrian access within the project limits. Such temporary access shall be provided by temporarily patching trench crossings or other areas with temporary HMA and temporary cold mix until such time as the permanent surface restoration is installed. Locations shall include those areas specifically indicated on the Plans, directed by the Engineer or as further specified herein. This material will be furnished, placed, compacted, and removed and wastehauled at various locations throughout the project. The trenches and/or subgrade shall be thoroughly compacted and brought to a smooth grade prior to placing the material. It shall be placed, maintained (daily), and removed and wastehauled by the Contractor. Typical compacted depth will be 4 inches. Temporary HMA and temporary cold mix shall also be used around castings, after grinding, to provide a transition until final lift of HMA paving is installed.

3.5 HMA JOINTS

A. TRANSVERSE JOINTS

The Contractor shall conduct operations such that the placing of the top or wearing course is a continuous operation or as close to continuous as possible. Unscheduled transverse joints will be allowed and the roller may pass over the unprotected end of the freshly laid mixture only when the placement of the course must be discontinued for such a length of time that the mixture will cool below compaction temperature. When the Work is resumed, the previously compacted mixture shall be cut back to produce a slightly beveled edge for the full thickness of the course.

A temporary wedge of HMA constructed on a 20H:1V shall be constructed where a transverse joint as a result of paving or planing is open to traffic. The HMA in the temporary wedge shall be separated from the permanent HMA by strips of heavy wrapping paper or other methods approved by the Engineer. The wrapping paper shall be removed and the joint trimmed to a slightly beveled edge for the full thickness of the course prior to resumption of paving.

The material that is cut away shall be wasted and new mix shall be laid against the cut. Rollers or tamping irons shall be used to seal the joint.

B. LONGITUDINAL JOINTS

The longitudinal joint in any one course shall be offset from the course immediately below by not more than 6 inches nor less than 2 inches. All longitudinal joints constructed in the wearing course shall be located at a lane line or an edge line of the Traveled Way. A notched wedge joint shall be constructed along all longitudinal joints in the wearing surface of new HMA unless otherwise approved by the Engineer. The notched wedge joint shall have a vertical edge of not less than the maximum aggregate size or more than 1/2 of the compacted lift thickness and then taper down on a slope not steeper than 4H:1V. The sloped portion of the HMA notched wedge joint shall be uniformly compacted.

3.6 QUALITY CONTROL

A. HMA MIXTURE ACCEPTANCE

Acceptance of HMA shall be as provided under nonstatistical, or commercial evaluation.

Commercial evaluation will be used for Commercial HMA and for other classes of HMA in the following applications: sidewalks, road approaches, ditches, slopes, paths, trails, gores, prelevel, temporary pavement, and pavement repair. Other nonstructural applications of HMA accepted by commercial evaluation shall be as approved by the Engineer. Sampling and testing of HMA mix accepted by commercial evaluation will be at the option of the Engineer.

The mix design will be the initial JMF for the class of HMA. The Contractor may request a change in the JMF. Any adjustments to the JMF will require the approval of the Engineer and may be made in accordance with this section.

1. HMA Tolerances and Adjustments

See Section 2.2 for Job Mix Formula Tolerances.

- a. Job Mix Formula Adjustments – An adjustment to the aggregate gradation or asphalt binder content of the JMF requires approval of the Engineer. Adjustments to the JMF will only be considered if the change produces material of equal or better quality and may require the development of a new mix design if the adjustment exceeds the amounts listed below.

- i. Aggregates – 2 percent for the aggregate passing the 1-1/2", 1", 3/4", 1/2", 3/8", and the No. 4 sieves, 1 percent for aggregate passing the No. 8 sieve, and 0.5 percent for the aggregate passing the No. 200 sieve. The adjusted JMF shall be within the range of the control points in Standard Specifications Section 9-03.8(6).
 - ii. Asphalt Binder Content – The Engineer may order or approve changes to asphalt binder content. The maximum adjustment from the approved mix design for the asphalt binder content shall be 0.3 percent.
2. Mixture Acceptance – Commercial Evaluation

If sampled and tested, HMA mix produced under Commercial Evaluation and having all constituents falling within the tolerance limits of the job mix formula shall be accepted at the unit Contract price with no further evaluation. When one or more constituents fall outside the commercial tolerance limits in the Job Mix Formula shown in Section 2.2, the lot may be subject to rejection. When less than three sublots exist, backup samples of the existing sublots or samples from the street shall be tested to provide a minimum of three sets of results for evaluation.

B. HMA COMPACTION ACCEPTANCE

HMA mixture accepted by commercial evaluation and HMA constructed under conditions other than those listed above shall be compacted on the basis of a test point evaluation of the compaction train or by testing of roadway cores. Compaction of the HMA mixture to a minimum of 92 percent of the reference maximum density is required for acceptance.

1. HMA Compaction – General Compaction Requirements

Compaction shall take place when the mixture is in the proper condition so that no undue displacement, cracking, or shoving occurs. Areas inaccessible to large compaction equipment shall be compacted by other mechanical means. Any HMA that becomes loose, broken, contaminated, shows an excess or deficiency of asphalt, or is in any way defective, shall be removed and replaced with new hot mix that shall be immediately compacted to conform to the surrounding area.

The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided the specified densities are attained. Unless the Engineer has approved otherwise, rollers shall only be operated in the static mode when the internal temperature of the mix is less than 175 degrees F. Regardless of mix temperature, a roller shall not be operated in a mode that results in checking or cracking of the mat. Rollers shall only be operated in static mode on bridge decks.

2. HMA Commercial Evaluation Compaction

The location of the HMA compaction tests will be randomly selected by the Engineer.

Tests for the determination of the pavement density will be taken by the Contractor, in accordance with the required procedures for measurement by a nuclear density gauge or roadway cores, after completion of the finish rolling.

HMA mixture accepted by commercial evaluation shall be compacted on the basis of a test point evaluation of the compaction train. The Contractor shall provide the RICE density test results for the HMA mixture, identifying the reference maximum density of the mix, prior to the first day of paving. The test point evaluation shall be performed by the Contractor, in accordance with instructions from the Engineer. The number of passes with an approved compaction train, required to attain a minimum of 92 percent of the reference maximum density, shall be used on all subsequent paving.

If the Contracting Agency uses a nuclear density gauge to determine density the test procedures FOP for WAQTC TM 8 and WSDOT SOP T 729 will be used on the day the mix is placed and prior to opening to traffic.

Alternatively, the HMA mixture accepted by commercial evaluation may be evaluated by testing of roadway cores taken after completion of the finish rolling, resulting in a minimum of 92 percent of the reference maximum density. Roadway cores for density shall be obtained by the Contractor in accordance with WSDOT SOP 734. The core diameter shall be 4-inches minimum, unless otherwise approved by the Engineer. Roadway cores will be tested by the Contractor in accordance with WSDOT FOP for AASHTO T 166. Core locations shall be outside of wheel paths and as determined by the Engineer

If the Contract includes the Bid item “Roadway Core” the cores shall be obtained by the Contractor in the presence of the Engineer on the same day the mix is placed and at locations designated by the Engineer.

C. REJECT WORK

1. Reject Work General

Work that is defective or does not conform to Contract requirements shall be rejected. The Contractor may propose, in writing, alternatives to removal and replacement of rejected material. Acceptability of such alternative proposals will be determined at the sole discretion of the Engineer.

2. Rejection by Contractor

The Contractor may, prior to sampling, elect to remove any defective material and replace it with new material. Any such new material will be sampled, tested, and evaluated for acceptance.

3. Rejection Without Testing (Mixture or Compaction)

The Engineer may, without sampling, reject any batch, load, or section of Roadway that appears defective. Material rejected before placement shall not be incorporated into the pavement. Any rejected section of Roadway shall be removed.

No payment will be made for the rejected materials or the removal of the materials unless the Contractor requests that the rejected material be tested.

Commercial Evaluation: If the Contractor elects to have the rejected material tested, a minimum of three representative samples shall be obtained and tested by the Contractor. Acceptance of rejected material will be based on conformance with the commercial evaluation tolerances in Section 2.2. If one or more of the mixture components are out of tolerance then, no payment will be made for the rejected material; in addition, the cost of sampling and testing shall be borne by the Contractor. If the material is rejected before placement and all of the mixture components are within the commercial evaluation tolerances, then compensation for the rejected material will be at the unit Contract price, with an

addition of 25 percent of the unit Contract price added for the cost of testing, removal and disposal.

3.7 SAWCUTTING

Where shown on the Plans or where directed in the field by the Contracting Agency, the Contractor shall make a neat vertical sawcut at the boundaries of the area to be removed. Care shall be taken during sawcutting so as to prevent damage to the existing HMA or cement concrete pavement, to remain in place. Any pavement or cement concrete surface that is damaged by the Contractor outside the area scheduled for removal due to the Contractor's operations or negligence shall be repaired or replaced to the Contracting Agency's satisfaction by the Contractor at no additional cost to the Contracting Agency.

All cuts shall be continuous, full depth, and shall be made with saws specifically equipped for this purpose. No skip cutting, wheel cutting or jack hammering will be allowed unless specifically approved otherwise in writing by the Contracting Agency. However, even if preapproved as a method of cutting, no payment will be made for this type of work, and it shall be considered incidental and included in the various unit contract and lump sum prices listed in the Proposal.

The location of all pavement cuts shall be preapproved by the Contracting Agency in the field before cutting commences.

All water and slurry material resulting from sawcutting operations shall not be allowed to enter the storm drainage or sanitary sewer system and shall be removed from the site and disposed of in accordance with the Washington State Department of Ecology regulations.

All existing pavement edges shall be saw cut back to sound material, in uniform lines immediately prior to paving operations. Any edges broken between the time of cutting and placement of new paving shall be recut to the satisfaction of the Contracting Agency at no additional cost to the Contracting Agency. All excess excavated materials shall be hauled to waste.

3.8 ADJUSTING STRUCTURES TO GRADE

All utility castings and monuments within the existing and/or new pavement area shall be referenced by the Contractor prior to any pavement removal or planing. The Contractor shall keep a record of such references and submit a copy to the Contracting Agency.

Existing structures and new structures shall be adjusted to the finished grade as shown on the Plans and as further specified herein. Existing boxes, rings, grates,

covers, and lids shall be reset in a careful and workmanlike manner to conform to the required grades.

The new and existing utility castings and monuments shall be adjusted to grade in the following manner:

As soon as the street has been paved past each structure or casting, the HMA mat shall be scored around the location of the structure or casting. After rolling has been completed and the mat has cooled, it shall be cut along the scored lines. The structure or casting shall then be raised to finished pavement grade and the annular spaces filled as indicated on the Plans. The Contractor shall install the pavement to give a smooth finished appearance. All covers, lids, frames, and grates shall be thoroughly cleaned.

After pavement is in place, all new pavement joints shall be sealed with a 6-inch-wide strip of hot asphalt sealer. A sand blanket shall be applied to the surface of the hot asphalt sealer immediately after the placement of the sealer to help alleviate the tracking of the asphalt. The sealer shall meet the requirements of the Standard Specifications Section 9-04.2(1).

***** END OF SECTION *****

SECTION 02900

LANDSCAPING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the installation of all landscaping work as shown on the Plans and as specified herein. Landscaping activities shall include work both at the project location as well as any residential properties that are affected by construction activities.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement & Payment
01300	Submittals
02230	Clearing & Grubbing
02300	Earthwork
02950	Site Restoration and Rehabilitation

1.3 SUBMITTALS

A. WATERING SCHEDULE

Prior to Final Acceptance of the Landscaping, the Contractor shall submit a written "watering schedule" to the Owner to ensure adequate watering (summer, fall, winter, and spring) of all plant materials during the Guarantee Period of this Contract. Watering shall be by hand and watering truck, unless otherwise directed by the Owner.

B. PLANT PROCUREMENT

The Contractor shall provide all plants of the size, species, variety and quality noted and specified. Submit written documentation to the Owner that all specified plant materials have been ordered. If unavailable, the Contractor shall notify the Owner in writing immediately and provide the names, addresses, and telephone numbers of five nursery suppliers that have been contacted. If substitution should be permitted, it can be made only with the prior written acceptance of the Owner.

C. SOIL ANALYSIS REPORTS

See Section 2.1 and 2.2 of this Specification.

D. SUBGRADE PERCOLATION TEST RESULTS

See Section 3.1 of this Specification.

E. SEED MIX

See Section 2.4 of this Specification.

F. WEED AND PEST CONTROL PLAN

See Section 1.5 of this Specification.

1.4 QUALITY ASSURANCE

A. CONTRACTOR QUALIFICATIONS

All landscaping work shall be performed by a licensed Landscape Contractor registered in the State of Washington and shall be qualified for landscaping work through certification by the Washington Association of Landscape Professionals (WALP).

B. PLANT MATERIAL

Quality, size, and conditions as determined by standards set forth in the American Association of Nurserymen Standard ANSI Z60.1.

C. FERTILIZER

Conform to Washington State Department of Agriculture Laws and Federal Specification O-F-241D pertaining to commercial fertilizers.

1.5 WEED AND PEST CONTROL PLAN

The Weed and Pest Control Plan (WPCP) shall be submitted and approved by the Owner prior to starting any landscape work.

The WPCP shall include scheduling and methods of all control measures described in this Section, including soil preparation methods to meet the required soil surface conditions in the planting areas. The weed control plan shall show general weed control including:

- Hand, mechanical, and chemical methods;
- Timing and frequency;
- Application of herbicides including type, rate, use, and timing; and
- Noxious weed control.

Target weeds and unwanted vegetation to be removed shall be identified and listed in the weed control plan.

The plan shall be prepared and signed by a licensed commercial operator with a Washington State Department of Agriculture (WSDA) Commercial Applicator pesticide license. The plan shall include methods of weed control, dates of weed control operations, and the name, application rate, and Material Safety Data Sheets (MSDS) of all proposed herbicides. In addition, the Contractor shall furnish the Owner with a copy of the current product label for each herbicide/pesticide and spray adjuvant to be used. These product labels shall be submitted with the weed control plan for approval.

All herbicides and/or pesticides must be carefully selected and applied in accordance with U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), WSDA, and local sensitive area ordinances and regulations.

1.6 GUARANTEE

A. GUARANTEE PERIOD

Guarantee work within this Specification for 2 years against all defects of materials and workmanship. The guarantee period begins after the date of Final Acceptance. Replace plants not in normal healthy growing condition at the end of guarantee period. Replace with plants with identical species and size. Final Acceptance will be certified in writing by the Owner.

B. DEAD AND DISFIGURED PLANT MATERIAL

Any plant material that is 25 percent or more dead or disfigured shall be considered dead and must be replaced at no charge. A tree shall be considered dead when the main leader has died back or there is 25 percent of the crown dead. Plants shall be considered disfigured when excessive dead wood has been removed or when the symmetry, typical habit of growth, or sculptured form has been impaired by the removal of dead wood.

During the 2-year guarantee period, should any seed areas showing signs of failure such as dead or dying areas of grass or bare spots larger than 6" square, the Contractor shall repair or replace all deficient areas to the satisfaction of the Owner.

C. PLANT REPLACEMENT

All plants are subject to one replacement only per item, and the Contractor shall submit, after each replacement period, a marked planting plan showing the exact location of each item replaced at that time. The owner may require the contractor to replace dead plants prior to the end of the guarantee period at no additional cost. This applies only after Final Acceptance.

Replacements made by the Contractor shall be made in the same manner as specified for the original planting and shall be done at no extra cost to the Owner.

Replace all trees, shrubs, and groundcovers when plants are no longer in a satisfactory growing condition as determined by the Owner for the duration of the guarantee period. Make replacements within 10 working days of notification from the Owner.

D. ACCESS TO PROJECT SITE

Contractor has the right to enter upon the property for inspection and curative treatment of any materials needing such which are still under warranty during the entire guarantee period. The Owner must be notified at least 48 hours in advance of any corrective or curative treatment measures to arrange for convenient access to the area.

E. APPLICABLE CONDITIONS

The guarantee shall be applicable to any growing conditions through which plants of like kind could be expected to survive, and any deformity or cause of death which could be attributed to, or affected by, the physiological condition of the plant shall be deemed replaceable cause; however, this would not apply to plant losses due to abnormal weather conditions such as floods, excessive wind damage, drought, severe freezing or abnormal rains, as determined by the National Weather Service.

F. MAINTENANCE DURING GUARANTEE

It is expressly understood that the Contractor will be responsible, during the Guarantee Period, for normal landscape maintenance of the project. Maintenance of the landscape shall include, but not be limited to hand watering, mowing, weeding, monitoring and treating any disease and/or pest-problems, cultivating and any other maintenance requirements, per standard trade practices, to keep the plant materials in a normal healthy growing condition.

PART 2 MATERIALS

2.1 TOPSOIL

The topsoil shall consist of 67 percent sandy loam and 33 percent composted organic material by volume.

The soil shall meet the following requirements:

Soil shall be sandy loam or loamy sand consisting largely of sand, but with enough silt and clay present to give it a small amount of stability. Individual sand grains can be seen and felt readily. On squeezing in the hand when dry, it shall fall apart when the pressure is released; on squeezing when moist, it shall form a cast that does not only hold its shape when the pressure is released, but shall withstand careful handling without breaking.

The mixed soil shall meet the following gradation:

<u>Screen Size</u>	<u>Percent Passing</u>
1/2 inch	100
1/4 inch	95 – 100
#10	85 – 95
#30	60 – 75
#60	50 – 60
#100	20 – 30
#200	5 – 15

Shall have a pH range of 5.5 to 7.5. Soils indicated having a pH below 5.5 shall be treated with dolomitic limestone as necessary to attain this pH range. Soils having a pH greater than 7.5 shall be treated with sulfur as necessary to attain this pH range. The pH shall be determined by soil test.

Organic material shall consist of composted yard debris or organic waste material composted for a minimum of 3 months. Compost shall consist of 100 percent recycled content. In addition, the organic material shall have the following physical characteristics:

1. Shall pass a standard cress test for seed germination (90 percent germination compared to standard).
2. Shall have a pH from 5.5 to 7.5.
3. Shall have a maximum electrical conductivity of 3.0 ohms/cm.
4. Shall have a maximum carbon to nitrogen ratio of 40:1.

5. Shall be certified by the “Process to Further Reduce Pathogens” (PFRP) guideline for hot composting as established by the United States Environmental Protection Agency.

Submit a certified laboratory analysis from an accredited soils testing laboratory indicating the Material source and compliance with all planting soil Specifications to the Engineer for approval before delivery to the Project Site. The analysis shall be with a sample size of no less than 1 pound.

2.2 COMPOST

Composted material shall be derived from a Type 1 feedstock and produced by a facility in compliance with WAC 173-350-220. The compost shall meet Grade AA Compost as defined by Ecology’s Interim Guidelines for Compost Quality (Publication #94-38, Revised November 1994). Compost material shall have 100 percent passing a 1/2-inch screen. The carbon to nitrogen ratio (C:N) of the compost shall be in the range of 20:1 to 35:1. Organic matter of the composted material shall be between 4 percent and 10 percent, and the moisture content shall be between 35 percent to 50 percent as determined by ASTM D 2974. The pH of the compost shall be within the range of 5.5 to 7.0 as determined by ASTM D 2976. The maximum electrical conductivity of composted material shall be 6 ohms/cm. Decomposed Organic Compost shall be mature as determined by US Composting Council stability test ratings referred to in the Ch 173-350 WAC. The product shall be tested within 6 months of proposed use.

2.3 LANDSCAPING BARK

All areas that have been cleared and grubbed, graded, and where restoration is required, shall be covered with landscaping bark. Bark shall be a high quality mix of medium/fine fir and/or hemlock species no greater than 2 inches in length. Bark shall be applied at a rate of 1 cubic yard per 100 square feet to an even depth of 2-3 inches. The bark shall not contain resin, tannin or compounds in quantities that would be hazardous plant life.

2.4 PLANT MATERIALS

A. QUALITY

Genera, species, and variety; quantity, size, and conditions as shown on the Plans.

B. TREES, SHRUBS, AND GROUND COVER

All plants shall be nursery grown, or normal habit of growth, healthy, vigorous, and free of disease, insect eggs, and larvae. Plants shall not be

pruned prior to delivery. Plants shall have all leaders and buds intact. Grading of plant material and root ball/container sizes shall be in accordance with the code of standards of the American Landscape and Nursery Association. Names shall conform to accepted nomenclature in the nursery trade.

Trees with multiple leaders, unless specified, will be rejected. Trees with a damaged or crooked leader, bark abrasions, sunscald, disfiguring knots, insect damage, or cuts of limbs over 3/4 inch in diameter that are not completely closed will be rejected.

No less than 10 percent of each variety and/or species of plant delivered to the project shall be accurately labeled. Whether or not labeled, any plants, which do not conform to the Plant Schedule and/or the Plans shall be replaced immediately with appropriate plant type. Plant material labels shall be durable, legible labels stating the correct plant name.

Provide the number of plants shown on the Plans. Collected plant material is not acceptable. Plant material with weeds in the top of the rootballs or containers will be rejected.

Trees grown in fabric bags shall have a well-established root system reaching the sides of the fabric bag to maintain a firm ball when the fabric is removed, but shall not have excessive root growth encircling the fabric bag. Fabric bags shall be entirely removed prior to planting.

PART 3 EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. DELIVERY

Deliver fertilizer and soil additives to the site in original unopened containers bearing manufacturer's guaranteed chemical analysis, weight, manufacturer's name, trademark, and conformance with state law.

Protect plant material during delivery to prevent damage to root ball, trunks, stems, or desiccation of leaves.

Transport plants in enclosed trucks. Large trees shall be totally wrapped to prevent damage and windburn. Provide adequate protection so that trunks are not scarred in transport and branches are not broken. Tree trunks shall be wrapped with protective covering prior to handling and loading. Covering shall be removed at the time of plant materials inspection at the job site.

B. HANDLING

Exercise care in handling, loading, unloading, and storing of plant materials. Plant materials damaged in any way shall be discarded and replaced with undamaged materials.

C. STORAGE

Protect plant materials from mechanical damage, wind, excessive sun, and drying out. If planting is delayed more than 4 hours after delivery, set plants in shade and keep roots moist by covering with mulch, soil or other acceptable means of retaining moisture.

Protect packaged materials from deterioration during storage.

3.2 LANDSCAPE AREA SOIL PREPARATION

Verify that planting bed grades are in accordance with those indicated on the Plans before proceeding with work. Verify that soil conditions are satisfactory for soil preparation work.

Prepare soil no closer than 3 feet from existing tree trunks up to 6 inches in diameter; no closer than 4 feet from existing tree trunks up to 12 inches in diameter; no closer than 6 feet from existing tree trunks larger than 12 inches in diameter.

Loosen compacted soils to a depth of 12 inches. Rake and remove all material larger than 1-1/2 inches in diameter.

Place 2 inches of compost over existing soil, mix and till to a depth of 6 inches. Place additional 6 inches of topsoil on top of this throughout all buffer planting areas.

3.3 INSTALLATION OF PLANTS

Planting should occur in spring or fall of the year and when weather conditions are consistent with good horticultural practice. If container stock looks to be rootbound, slash roots vertically with a sharp knife along outside of ball in three places minimum before planting. Finish grade at plants, after planting and settling, shall afford positive drainage away from crown.

Set all trees, shrubs, and groundcovers according to the Plans. Plant trees upright and face to give best appearance or relationship to adjacent public right-of-way or properties.

Excavate all planting holes twice the spread of the tree, shrub, or groundcover root ball or root system. Place 3 inches minimum lightly compacted layer of prepared topsoil under root system of each tree and shrub. Loosen planting hole subsurface to a depth of 4 to 6 inches prior to placement.

Loosen and remove from container as shown on the Plans. Pulling burlap from under balls will not be permitted on large and loose root balls. Cut off cleanly all broken or frayed roots.

Place and compact backfill soil consisting of topsoil carefully to avoid injury to roots, then fill all voids. When hole is nearly filled, completely fill with water and allow water to soak away. Fill holes to finish grade and prepare for other work indicated.

Provide all planting areas with uniform 2-inch layer of mulch over a properly cleaned and graded surface unless otherwise noted on the Plans.

All groundcover plant materials shall be installed continuous under all trees and shrubs as indicated on the Plans.

Fertilize all trees, shrubs and groundcover with Triple 14 slow-release fertilizer. Place fertilizer on surface of mulch around plant. Apply in quantities per manufacturer's specifications.

3.4 PROTECTION

All planting materials shall be properly protected against harm from normal weather conditions and the public by the Contractor until Final Acceptance. Maintenance of all the planted areas until Final Acceptance, shall include, but not be limited to, watering, mowing, weeding, and pruning as well as replacement of any plants that appear to be in distress. Tree stakes shall be kept secure at all times. Although planting should occur in spring or fall and when weather conditions are favorable, special planting techniques, defoliating, wilt proofing or spray misting may be required should unseasonable planting conditions occur. No work shall be performed in, over or adjacent to planting areas without approved protection and safeguards.

Plant losses due to abnormal weather conditions such as, floods, excessive wind, drought, severe freezing or abnormal rain, as determined by the National Weather Service shall not be the responsibility of the Contractor.

3.5 WEED CONTROL

The Contractor shall use extreme care to ensure chemicals remain within the designated areas. The use of chemical herbicides shall require the use of anti-drift

and activating agents and a spray pattern indicator, unless otherwise allowed by the Owner.

All applications of post-emergent herbicides shall be made while green and growing tissue is present. Should unwanted vegetation reach the seed stage in violation of these Specifications, the Contractor shall physically remove and bag the seed heads. All physically removed vegetation and seed heads shall be disposed of offsite at no cost to the Owner.

The Contractor shall assume all responsibility for rendering any area unsatisfactory for planting by reason of chemical application. The Contractor shall replace, repair, and pay for all damages caused by his/her negligence to the satisfaction of the Owner prior to final payment.

3.6 PEST CONTROL

The Contractor shall use extreme care to ensure chemicals remain within the designated areas. The use of spray chemical pesticides shall require the use of anti-drift and activating agents and a spray pattern indicator, unless otherwise allowed by the Owner.

The Contractor shall assume all responsibility for rendering any area unsatisfactory for planting by reason of chemical application. The Contractor shall replace, repair, and pay for all damages caused by his/her negligence to the satisfaction of the Owner prior to final payment.

3.7 CONSTRUCTION ACCEPTANCE

Construction acceptance shall be subject to well-established trees, shrubs, groundcover, and seeded areas that fulfill the requirement of the approved Plans. The Contractor shall protect and care for all plantings until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient and continuous watering of all seeded areas until final acceptance.

Final Acceptance of all landscaping work described in this Specification, with the exclusion of possible replacements of plant materials under the Guarantee, shall be made by the Owner to determine 100 percent completion of the Contract work. This review shall be made upon written request to the Owner no less than 48 hours prior to the anticipated date of inspection.

***** END OF SECTION *****

SECTION 02950

SITE RESTORATION AND REHABILITATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes areas requiring restoration or rehabilitation as shown on the Plans or specified herein, including those areas that shall be graded, restored with hydroseeding or sod, areas restored with concrete sidewalk and driveway, and areas containing certain improvements and landscaping on and along the right-of-way including the adjacent private properties. The work also includes repair and replacement of fencing and other property features impacted construction.

Particular care shall be taken to minimize damage to landscaped areas within and adjacent to construction areas. In the event that construction is to be carried out in landscaped areas, appropriate measures shall be taken to restore such areas to conditions existing prior to construction.

Surface restoration type and location are shown on the Plans.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
02230	Clearing and Grubbing
02300	Earthwork
02710	Gravel Surfacing
02740	Hot Mix Asphalt Paving
02900	Landscaping
03300	Cast-In-Place Concrete

1.3 QUALITY ASSURANCE

Quality assurance shall be in accordance with Section 02900, Landscaping

PART 2 PRODUCTS

2.1 TOPSOIL

Topsoil shall be in accordance with Section 02900, Landscaping.

2.2 PLANT MATERIALS

Plants that have been disturbed but not marked for removal in the Plans shall be replaced in kind with quality, size, and conditions as determined by standards set forth in the American Association of Nurserymen Standard ANSI Z60.1.

2.3 CONCRETE

Concrete for concrete curb and gutter shall meet the requirements of Section 8-04 of the WSDOT Standard Specifications. Concrete for driveway entrances shall meet the requirement of Section 8-06 of the WSDOT Standard Specification. Concrete for sidewalks shall be the requirements of section 8-14 of the WSDOT standard Specification.

PART 3 EXECUTION

3.1 SOIL PREPARATION

Restoration of areas requiring soil preparation shall be in accordance with Section 02900, Landscaping.

3.2 TREE PLANTING

Restoration of trees shall be in accordance with Section 02900, Landscaping

3.3 TOPSOIL

Restoration of topsoil shall be in accordance with Section 02900, Landscaping. The Contractor may elect to utilize and stockpile existing and excavated topsoil material; however, no separate payment will be made for its use.

3.4 CONCRETE

Concrete Curbs and Gutters shall be constructed per WSDOT Standard Specifications section 8-04. Sidewalks shall be constructed per WSDOT Standard Specifications 8-14. Driveway entrances shall be constructed per WSDOT Standard Specification 8-06.

Any curb, gutter, sidewalk or driveway entrance damaged, defaced, cracked, chipped, or determined to be of poor workmanship, in the opinion of the Owner, shall be removed, wastehauled and replaced by the Contractor, at the Contractor's expense. Sacking and grinding shall not be considered an acceptable means for repairing unacceptable sections. The Contractor shall further provide verbal and written notice (door hanger) to property owners identifying restricted use of their driveways, sidewalks, etc. This notice must be provided twice: at 1 week prior and again 1 day prior to the work being performed.

At locations where the new sidewalk is to abut existing concrete, saw concrete for a depth of 2 inches and chip the old concrete back to sound material on a straight line, clean the surface, and apply a neat cement paste just prior to pouring the new sidewalk.

Place preformed asphalt expansion joints in the adjacent curb, where the sidewalk ends at a curb, and around posts, poles, or other objects protruding through the sidewalk.

Provide contraction joints transversely to the walks at locations opposite the contraction joints in the curb. These joints shall be 3/16-inch by 1-inch weakened plane joints. They shall be straight and at right angles to the surface of the walk. Walk areas wider than 20 feet shall have longitudinal contraction joints at spacings not to exceed 15 feet.

Place, process, finish, and cure concrete in conformance with the applicable requirements of ACI 614 and this Specification. Where the requirements differ, the higher requirement shall govern.

Broom the surface with a fine-hair broom at right angles to the length of the walk and tool at all edges, joints, and markings. Mark the walks transversely at 5-foot intervals with a joining tool. Upon completion of the finishing, apply an approved curing compound to exposed surfaces. Protect the sidewalk from damage for a period of 7 days.

Driveway access shall be maintained at all times. The Contractor shall use steel plates to bridge entrances or construct entrances in sections in order to protect new driveway entrances and allow access during the curing period.

The driveway entrance, curb and gutter and sidewalk shall be protected against damage or defacement of any kind until acceptance by the Owner. Any driveway entrance not acceptable, in the opinion of the Engineer, because of damage or defacement shall be removed, wastehauled, and replaced by the Contractor at the Contractor's expense. Sacking, grinding, or spot repair shall not be considered an acceptable means for repairing unacceptable sections.

3.5 LANDSCAPE FABRIC AND BARK

Landscape fabric shall be spread smoothly across the final grade and the fabric shall be overlapped by 1 foot. The fabric shall be pinned by jute net pins on a approximate 10-foot grid and along the edge of the fabric.

The bark shall be placed to a depth of 4 inches.

3.6 LANDSCAPED AND IMPROVED AREAS

Certain improvements and landscaping have been placed on and along the rights-of-way including the adjacent private properties. Wherever such property is damaged, destroyed, or the use thereof is interfered with due to the operation of the Contractor, it shall be immediately restored to its former condition by the Contractor. Notice should be given to the property owner along the route of construction by the Contractor advising them of the methods he will use to preserve and restore the improvements.

3.7 WATERING MAINTENANCE AND PROTECTION

The Contractor shall water, protect and care for all seeded areas until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient watering of all planted areas until final acceptance.

Watering of landscaped areas shall be at the Contractor's expense until new plantings are fully established.

The Contractor shall guarantee landscaping materials and workmanship for a period of 2 years following the date of project acceptance. During the 2-year guarantee period, should any planted areas show signs of failure, such as dead or dying areas of grass or bare spots, or any shrubs or trees planted as part of the site restoration fail, the Contractor shall repair or replace all deficient seeded areas and replace all dead shrubs and trees to the satisfaction of the Owner. If any seeded areas or plants require replacement, the Contractor's maintenance and guarantee period applicable to the replaced plants shall extend for an additional 1-year period after the time of the replacement.

3.8 FINISHING AND CLEANUP

Before acceptance of the Project, all pipes, manholes, catch basins, and other appurtenances shall be cleaned of all debris and foreign material. After all other work on the Project is completed and before final acceptance, the entire roadway, including the roadbed, planting, sidewalk areas, shoulders, driveways, alley and side street approaches, slopes, ditches, utility trenches, and construction areas shall be neatly finished to the lines, grades and cross-sections shown on the Drawings and as hereinafter specified.

In undeveloped areas, the entire area which has been disturbed by the construction shall be shaped so that, upon completion, the area will present a uniform appearance, blending into the contour of the adjacent properties. All other requirements outlined previously shall be met. Slopes, sidewalk areas, planting areas and roadway shall be smoothed and finished to the required cross-section and grade.

Upon completion of the cleaning and dressing, the Project shall appear uniform in all respects. All graded areas shall be true to line and grade as shown on the typical sections and as required by the Owner.

All rocks in excess of 1-inch diameter shall be removed from the entire construction area and shall be disposed of the same as required for other waste material. In no instance, shall the rock be thrown onto private property. Overhang on slopes shall be removed and slopes dressed neatly so as to present a uniform, well sloped surface.

All excess excavated material within the limits of the Project shall be removed entirely. All debris resulting from clearing and grubbing or grading operations shall be removed and disposed.

Drainage facilities, such as inlets, catch basins, culverts, and open ditches, shall be cleaned of all debris resulting from the Contractor's operations.

All pavements and oil mat surfaces, whether new or old, shall be thoroughly cleaned. Existing improvements, such as Portland cement concrete curbs, curb and gutters, walls, sidewalks, and other facilities which have been sprayed by the asphalt cement shall be cleaned to the satisfaction of the Owner.

Castings for manholes, monuments, water valves, lamp poles, vaults, and other similar installations which have been covered with the asphalt material shall be cleaned to the satisfaction of the Owner.

3.9 CONSTRUCTION ACCEPTANCE

The Contractor shall protect and care for all seeded and sodded areas until fully established and healthy. Care shall include equipment and labor necessary to provide sufficient and continuous watering of all seeded areas until final acceptance.

The Contractor shall guarantee landscaping materials and workmanship for a period of 2 years following the date of project acceptance. During the 2-year guarantee period, should any seed areas show signs of failure such as dead or dying areas of grass or bare spots, the Contractor shall repair or replace all deficient areas to the satisfaction of the Owner.

3.10 PERMANENT SIGNING AND APPURTENANCES

During the life of the Contract all existing signs, mailboxes and other appurtenances that are damaged or removed shall be replaced by the Contractor at no additional expense to the Owner.

Existing signs may be temporarily relocated to portable sign stands for convenience of construction, subject to the approval of the Owner. When temporarily installed on posts, the signs shall be located as near as practical to their permanent locations and shall have a minimum vertical clearance above the pavement in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). Private signs and appurtenances shall be removed and provided to the Owner.

All portable sign stands shall be designed to rigidly support the sign in position without creating a hazard to the motorist. Portable sign stands shall be furnished by the Contractor and upon completion of the work shall remain the property of the Contractor and shall be removed from the Project.

All signs, unless specified herein, shall be mounted at a height of 7 feet as measured vertically from the ground (finished grade) to the bottom of the sign.

3.11 ADJUSTMENT OF NEW AND EXISTING STRUCTURES TO GRADE

This work consists of constructing and/or adjusting all new and existing utility structures encountered on the Project to finished grade.

Prior to commencing manhole adjustments, a plywood and visqueen cover, as approved by the Owner, shall be placed over the manhole base and channel to protect them from debris.

The castings shall not be adjusted until the contractor has completed his paving operations. The asphalt concrete pavement around the casting shall be cut and removed to a neat circle, the diameter of which shall not exceed 6 inches from the outside diameter of the casting frame. The casting frame shall be brought up to the desired grade. Adjustment of manholes, catch basins and precast concrete vaults shall be made with the use of concrete adjustment rings or bricks. No iron adjustment rings will be allowed. An approved class of mortar (one part cement to two parts of plaster sand) shall be placed between adjustment rings or bricks and casting frame to completely fill all voids and to provide a watertight seal. No rough or uneven surfaces will be permitted inside or out. Adjustment rings or brick shall be placed and aligned so as to provide vertical sides and vertical alignment of ladder steps (if steps are necessary).

***** END OF SECTION *****

DIVISION 3 – CONCRETE

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes reinforcement and associated items for all concrete, including, but not necessarily limited to: reinforcing steel bars, wire fabric, and accessories for cast-in-place concrete.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Cast-in-Place Concrete

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ACI 301	Structural Concrete for Buildings
ACI 318	Building Code Requirements for Structural Concrete
ACI SP-66	American Concrete Institute - Detailing Manual
ANSI/ASTM A82	Cold Drawn Steel Wire for Concrete Reinforcement
ANSI/ASTM A185	Welded Steel Wire Fabric for Concrete Reinforcement
ANSI/AWS D1.4	Structural Welding Code for Reinforcing Steel
ASTM A615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement

1.4 SUBMITTALS

Submit in accordance with provisions of Section 01300.

A. SHOP DRAWINGS

Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

B. MANUFACTURER'S CERTIFICATE

Certify that reinforcing bar and welded wire fabric meet or exceed specified requirements.

Submit certified copies of mill test reports of reinforcement materials analysis.

1.5 QUALITY ASSURANCE

Perform Work in accordance with ACI 301.

1.6 COORDINATION

Coordinate with placement of formwork, formed openings, and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. REINFORCING STEEL

ASTM A615, deformed bars: Grade 40 for #3 bars and smaller, Grade 60 for #4 bars and larger, unless noted otherwise on the Plans.

B. WELDED STEEL WIRE FABRIC

ASTM A185 Plain Type; in flat sheets; plain.

2.2 ACCESSORY MATERIALS

A. TIE WIRE

Minimum 16-gauge annealed type.

B. CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS

Sized and shaped for strength and support of reinforcement during concrete placement conditions including load-bearing pad on bottom where required to prevent vapor barrier puncture.

**C. SPECIAL CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS
ADJACENT TO WEATHER EXPOSED CONCRETE SURFACES**

Plastic-coated steel type; size and shape as required.

D. MECHANICAL BAR SPLICES

Comply with ACI 318 requirement of minimum tensile strength of 125 percent of specified yield for reinforcement.

Subject to compliance with the requirements and approval of the Engineer, products, which may be incorporated into the work include, but are not limited to, the following:

BAR-LOCK (MBT) Coupler Systems
“ERICO” REBAR SPLICING

E. ADHESIVE ANCHORS

Injection adhesive system shall consist of a dual-cylinder adhesive refill pack, a mixing nozzle, and dispenser. The adhesive shall be formulated to include resin and hardeners.

1. Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.
 - b. SET-XP, Simpson Strong Tie, Inc.
 - c. PE1000+, Powers Fasteners, Inc.

2.3 FABRICATION

Fabricate concrete reinforcing in accordance with ACI SP-66. Obtain written approval from the Engineer prior to welding reinforcing steel. Weld reinforcement in accordance with ANSI/AWS D1.4.

PART 3 EXECUTION

3.1 PLACEMENT

Comply with Concrete Reinforcing Steel Institute’s recommended practice for “Placing Reinforcing Bars” for details and methods of reinforcement placement and supports, and as herein specified. Avoiding cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete. Accurately position, support, and

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

Install reinforcing bars with clearance indicated on the Plans. Provide laps as shown and stagger locations to minimize the concentration of multiple reinforcing at joints. Bar lap splicing shall have full contact. Where full contact cannot be achieved, the maximum space between the spliced bars shall not exceed 2 inches. Unless noted otherwise on the Plans, provide two #5 minimum trim bars around all openings and penetrations. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with tie wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

***** END OF SECTION *****

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes schedules, notes, and details for the construction of cast-in-place concrete structures, landings, equipment piers, housekeeping pads and slabs on grade.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01310	Project Meetings
01400	Quality Control
03200	Concrete Reinforcement
08310	Metal Access Hatches

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ACI 117	Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 212.3	Chemical Admixtures for Concrete
ACI 301	Specifications for Structural Concrete
ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 309	Guide for Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete and Commentary
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 347	Guide to Formwork for Concrete
ACI 350.1	Tightness Testing of Reinforced Engineering Concrete Structures and Commentary
ASTM C31	Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Compressive Strength of Cylindrical Concrete Specimens

ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready-Mixed Concrete
ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C143	Slump of Hydraulic Cement Concrete
ASTM C150	Portland Cement
ASTM C172	Sampling Freshly Mixed Concrete
ASTM C173	Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C535	Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C881	Epoxy-Resin-Base Bonding Systems for Concrete

1.4 SUBMITTALS

Submittals shall be in accordance with Section 01300.

A. GENERAL

The submittal for each included concrete mix shall include, as a complete package, the following as defined below:

1. Concrete Mix Design
2. Certified Test Results
3. Sieve Analysis
4. Product Data

An incomplete concrete mix submittal package may render a rejection of the mix or could delay the review process.

B. CONCRETE MIX DESIGN

Submit mix design for the proposed mix to be used on the Project, indicating components, and proportions by weight, including any admixtures. Mix design shall state chloride content. Mix designs to be provided are:

1. Unspecified Concrete for Liquid Containment Structures
2. Unspecified Concrete
3. Lean Concrete
4. Cement Grout

C. CERTIFIED TEST RESULTS

Submit laboratory test results indicating compressive strength of concrete in compliance with requirements specified herein and in accordance with ACI 301.

D. SIEVE ANALYSIS

Submit sieve analysis for proposed coarse and fine aggregates indicating components, source, gradation, and WSDOT aggregate source approval report, including WSDOT Aggregate Source ID.

E. PRODUCT DATA

Provide product data on all proposed admixtures, accessories, and embedded items to be used on the Project, including, but not limited to:

1. Cement; source and type
2. Air Entraining Agent
3. Water Reducing Admixtures
4. Pozzolans
5. Bonding Agents
6. Curing Compounds/Floor Hardeners
7. Non-Shrink Grout; Non-metallic and Metallic

8. Plastic Joint Formers

9. Waterstops

For admixtures other than those proposed for air entrainment, submit a letter from the manufacturer describing the benefits of its use for the project and effect of its use on the properties of the concrete. Product data shall expressly state admixtures are chloride free, or the manufacturer shall submit a letter certification stating the same.

F. MATERIAL DELIVERY TICKETS

Provide copies of all concrete and grout material delivery tickets for the Project to the Engineer.

1.5 QUALITY ASSURANCE

Perform work in accordance with ACI 301. Acquire cement and aggregates from same source for all work performed on the Project. Conform to ACI 305 when concreting during hot weather. Conform to ACI 306 when concreting during cold weather. Provide or coordinate field and laboratory testing as described later in this Section and under provisions of Section 01400.

1.6 COORDINATION

Coordinate work in accordance with provisions of Section 01310. Coordinate the placement of embedded items with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. FORMS FOR EXPOSED FINISH CONCRETE

Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the Plans.

B. FORMS FOR UNEXPOSED FINISH CONCRETE

Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. FORMS FOR CYLINDRICAL COLUMNS AND SUPPORTS

Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

D. FORM COATINGS

Provide commercial formulation form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

E. FORM TIES

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units, which will leave no metal closer than 1-1/2 inches to surface. Unless noted otherwise on Plans, provide ties with plastic cone devices which, when removed, will leave holes not larger than 1-inch diameter in concrete surface.

2.2 CONCRETE MATERIALS

A. CEMENT

ASTM C150, Type II – Moderate or Type I - II. Use one brand of cement throughout the project, unless otherwise approved by the Engineer. Provide low alkali cement where Alkali-Silica Reaction (ASR) mitigation measures are required by WSDOT Aggregate Source Approval.

B. FINE AND COARSE AGGREGATES

Comply with ASTM C33. Provide aggregates from a single source. Coarse aggregate shall be size designation 467 (Nominal size 1-1/2 inch to No. 4 sieve) for all liquid containing structures, and size designation 67 (Nominal size 3/4-inch to No. 4 sieve) for all other concrete. Aggregates shall show a loss of weight not exceeding 35 percent after 500 revolutions in a Los Angeles wear machine, when tested in accordance with ASTM

C131 or ASTM C535. Aggregates shall be from a WSDOT approved source.

C. WATER

Clean, potable, and not detrimental to concrete, in compliance with ASTM C94.

2.3 ADMIXTURES

Except for air entrainment, use of all other admixtures used shall be subject to approval of the Engineer and at no additional cost to the Owner. Only admixtures expressly stated by the manufacturer as being chloride-free shall be used. Subject to compliance with requirements, products, which may be incorporated into the work include, but are not limited to, the following:

A. AIR ENTRAINMENT

ASTM C260 certified by manufacturer to be compatible with other proposed admixtures.

BASF MasterAir AE 90 or AE200
Sika AER
W.R. Grace Daravair or Darex Series

B. WATER REDUCING ADMIXTURE

ASTM C494 Type A.

BASF PolyHeed 997
Sika Plastocrete 161
W.R. Grace WRDA Series

C. ACCELERATING ADMIXTURE

ASTM C494 Type C.

BASF Masterset AC 534
Sika Plastocrete 161 FL
W.R. Grace Polarset or DCI

D. WATER REDUCING, RETARDING ADMIXTURE

ASTM C494, Type D.

BASF Masterset R 100
Sika Plastiment
W.R. Grace Daratard Series

E. WATER REDUCING, ACCELERATING ADMIXTURE

ASTM C494, Type E.

Euclid Chemical Co. Accelguard 80
Master Builders Pozzutec 20
W.R. Grace Daracel

F. HIGH RANGE WATER REDUCER (HRWR)

ASTM C494, Type F.

BASF MasterRheobuild 1000
Sika Sikament 10 ESL
W.R. Grace ADVA 100

G. HIGH RANGE WATER REDUCER AND RETARDER

ASTM C494, Type G.

BASF MasterPozzolith 200
W.R. Grace Daracem-100

H. POZZOLAN

ASTM C618 - CLASS F, with a CaO maximum content of 10 percent.

2.4 ACCESSORIES

A. BONDING AGENT

ASTM C881, Type I and II, Grade 2, Class C, Epoxy Resin. Subject to Contract requirements, provide one of the following or equal:

Sika Armatec 110
Conspec SpecBond 100
W.R. Meadows Sealtight Rezi Weld 1000

B. CURING COMPOUND/CHEMICAL FLOOR HARDENER

ASTM C309, Type I, Class A and B. Subject to Contract requirements, provide one of the following or equal:

W.R. Meadows Sealtight 1100-Clear
Conspec RX cure
Chemrex, Inc. Masterkure
Burke Spartan-Cote WB

C. CHEMICAL FLOOR HARDENER

Apply per manufacturer's recommendations. Subject to contract requirements, provide the following or equal:

W.R. Meadows Liqui-Hard

D. GENERAL PURPOSE NON-SHRINK NON-METALLIC GROUT

Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi (17 Mpa) in 48 hours and 7,000 psi (48 Mpa) in 28 days. Subject to Contract requirements, provide one of the following or equal:

Sika SikaGrout 212
Conspec 100 Non Metallic
Chemrex, Inc. Masterflow 928 Grout
W.R. Meadows Sealtight 588

E. PLASTIC JOINT FORMER

Provide and install, per manufacturer's recommendations, where shown on the Plans or at locations approved by the Engineer. Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak
Vinylex Corporation
W.R. Meadows

F. WATERSTOPS

Provide waterstop of type and size at construction joints and other joints as indicated on the Plans.

1. PVC (Polyvinyl Chloride)

Serrated (ribbed), 3/8 of an inch minimum thickness for 6 inches and larger and 3/16 of an inch minimum thickness for 4 inches. Comply with Corps of Engineers CRD-C-572. No reclaimed PVC will be allowed in waterstop.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Greenstreak
Vinylex Corporation
W.R. Meadows

2. Cold Joint Waterstop

Install where shown on the Plans or at locations approved by the Engineer. Cold joint waterstop shall be certified by the manufacturer to be compatible for use in wastewater (sewage) containment structures. Unless otherwise shown in the Plans, size shall be 1-inch thick and 1-inch wide.

Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:

Hydrotite, Greenstreak

2.5 CONCRETE MIX

A. GENERAL

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to the Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as that used for field quality control testing.

The maximum water soluble chloride ion content, expressed as a percent of the cement, contributed from all ingredients of the concrete mix, including water, aggregates, cementitious materials, and admixtures, shall not exceed 0.10 percent. Pozzolans may be counted as part of the total cementitious material in the concrete mix design. The cementitious material is the “minimum cement content” specified in the mix design for each type of concrete. When pozzolans are used as part of this “cement content,” the minimum content shall be 15 percent by weight of the total cementitious materials (Portland cement and pozzolans) and not more than 20 percent.

Where ASR mitigation measures are required by WSDOT, provide a minimum of 15 percent pozzolan included in the cementitious material in the design mix.

B. MIX DESIGNS

Provide normal weight concrete with the following properties, unless noted otherwise on the Plans.

1. Unspecified Concrete for Liquid Containment Structures

Structural concrete of general use in liquid containment structures.

Minimum compressive strength @ 28 days:	4,000 psi
Minimum cement content:	6 sacks per cubic yard
Maximum water cement ratio by weight:	0.45
Nominal coarse aggregate size:	1-1/2" to No. 4 (size designation 467)

2. Unspecified Concrete

Structural concrete of general use in structures, sidewalks, and where no specific class of concrete is designated.

Minimum compressive strength @ 28 days:	4,000 psi
Minimum cement content:	5.5 sacks per cubic yard
Maximum water cement ratio by weight:	0.45
Nominal coarse aggregate size:	3/4" to No. 4 (size designation 67)

3. Lean Concrete

Concrete for pipe thrust blocks or for use as noted as "Concrete Fill" on the Plans.

Minimum compressive strength @ 28 days: 2,500 psi
Minimum cement content: 5 sacks per cubic yard

4. Cement Grout

Material for filling guard posts, grouting of clarifier bottoms or for other uses as shown on the Plans. Cement grout shall be sand and cement only and shall not contain coarse aggregate.

Minimum compressive strength @ 28 days: 2,500 psi
Minimum cement content: 6.5 sacks per cubic yard
Maximum water cement ratio by weight: 0.54

C. ADMIXTURES

1. Air Entrainment

Use air-entraining admixture in all exterior exposed concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement in accordance with ASTM C173 or C231 having total air content with a tolerance of plus or minus 1 percent within the following limits:

5.5 percent for 1.5 inch max. coarse aggregate size
6.0 percent for 1.0 inch max. coarse aggregate size
7.0 percent 0.50 inch or less max. coarse aggregate size

2. Other Admixtures

Use of all other admixtures shall be subject to the approval of the Engineer, and shall be in accordance with ACI 212.3 and Manufacturer's recommendations. Only admixtures stated by the manufacturer to be chloride free shall be used.

D. SLUMP LIMITS

Proportion and design mixes to result in concrete slump (1 inch \pm of the maximum) at the point of placement in accordance with ASTM C143 as follows:

Ramps, slabs, and sloping surfaces: 3 inches.

Reinforced foundation systems: 3 inches.

Other concrete: 4 inches.

Concrete containing HRWR admixture (super-plasticizer): Not more than 8 inches after addition of HRWR to site-verified 2- to 3-inch slump concrete.

E. CONCRETE MIXING

Comply with requirements of ASTM C94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than that specified in ASTM C94 may be required.

PART 3 EXECUTION

3.1 GENERAL

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

3.2 FORMS

Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

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

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

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

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

Chamfer all exposed corners and edges and other areas shown on the Plans, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

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

3.3 JOINTS

A. CONSTRUCTION JOINTS

Locate and install construction joints where indicated, or locate so as not to impair strength and appearance of the structure, as acceptable to the Engineer. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise shown on the Plans.

B. ISOLATION JOINTS IN SLABS-ON-GRADE

Unless otherwise noted, construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as shown on the Plans.

Joint filler and sealant materials are specified in Division 7.

C. SLAB (CONTROL) JOINTS

Construct joints in slabs-on-grade as shown on the Plans. Use saw cuts 1/8 of an inch wide x 1/4 of the slab depth or inserts 1/4-inch wide x 1/4 of the slab depth.

D. PREMOLDED (CONTROL) JOINTS

Insert premolded plastic, hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

E. EDGE FORMS AND SCREED STRIPS FOR SLABS

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

3.4 INSTALLATION OF EMBEDDED ITEMS:

A. GENERAL

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

B. CLEANING AND TIGHTENING

Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

C. REGLETS

Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashing as shown at lintels, relieving angles, and other conditions.

3.5 PLACING REINFORCEMENT

See Section 03200.

3.6 PREPARATION OF FORM SURFACES

Clean reused forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.7 PREPARATION OF EXISTING CONCRETE SURFACES

The Contractor shall bush hammer all existing concrete surfaces that are to have new concrete cast against them. Apply epoxy bonding agent prior to placing concrete.

3.8 CONCRETE PLACEMENT

A. GENERAL

Comply with ACI 304 and as herein specified.

Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during concrete placement.

B. PLACING CONCRETE IN FORMS

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

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

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

C. PLACING CONCRETE SLABS

Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Maintain reinforcing in proper position during concrete placement operations.

D. COLD WEATHER PLACING

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

When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27 degrees C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

E. HOT WEATHER PLACING

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

Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is at Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed. Upon approval, water-reducing retarding admixture (Type D) may be used when required by high temperatures, low humidity, or other adverse placing conditions.

3.9 FINISH OF FORMED SURFACES

Provide smooth form finish for all formed concrete surfaces exposed-to-view including all surfaces exposed to water or wastewater, or that are to be covered with a coating material applied directly to the concrete, or a covering material applied directly to concrete, such as veneer plaster, painting, or other similar type of system.

Provide smooth form finish for surfaces to be waterproofed or dampproofed. Surfaces must comply with recommendations of the manufacturer of the product being utilized.

Provide rough form finish for formed concrete surfaces not exposed-to-view in the finished work or by other construction, unless otherwise indicated.

A. SMOOTH FORM FINISH

This is to be the as-cast concrete surface obtained utilizing selected form facing material, arranged orderly and symmetrically with a minimum of seams, and as specified herein.

Repair and patch tie holes and defective areas, with all fins or other projections completely removed and smoothed, by one of the following methods:

1. Provide smooth rubbed finish to concrete surfaces after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

2. Provide grout “sacked” cleaned finish. The sacking grout shall be one part Portland cement to 1-1/2 parts fine sand by volume, and mixed with water to consistency of thick paint. Proprietary additives such as epoxy bonding agents or adhesives may be used at Contractor’s option. Blend standard Portland cement and white Portland cement, amounts to be determined by trial patches, so that final color of dry grout matches adjacent surfaces. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep sacked surfaces damp by fog spray or other acceptable method so surfaces do not dry out.

B. ROUGH FORM FINISH

This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/8 of an inch in height rubbed down or chipped off. All “bug holes” exceeding 1/2 inch in diameter and exceeding 1/4-inch depth shall be repaired or filled in.

C. RELATED UNFORMED SURFACES

At tops of walls, horizontal offsets, and similar unformed surfaces occurring at adjacent formed surfaces, continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

D. TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:

- | | |
|---|--|
| a. In the lines and surfaces of columns, pier, walls and in arises | In any 10 feet of length –
1/4 inch. Maximum for entire length – 1 inch |
| b. For exposed corner columns, control-joint grooves, and other conspicuous lines | In any 20 feet of length –
1/4 inch. Maximum for entire length – 1/2 inch |

2. Variations from level or from the grades indicated on the Plans:
 - a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores

In any 10 feet of length – 1/4 inch. In any bay or opening, or in any 20 feet of length – 3/8 of an inch. Maximum for entire length – 3/4 inch
 - b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

In any bay or opening, or in any 20 feet of length – 1/4 inch. Maximum for entire length – 1/2 inch
3. Variations in the linear building lines from the established position in plan view

In 20 feet of length – 1/2 inch. Maximum for entire length – 1 inch
4. Variations in distance between walls, columns and partitions

In any 10 feet of distance – 1/4 inch. In any bay or opening – 1/2 inch. Maximum total variation – 1-inch.
5. Variations in the sizes and locations of sleeves, floor openings and wall openings

Minus – 1/4 inch
Plus – 1/2 inch
6. Variations in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls

Minus – 1/4 inch
Plus – 1/2 inch
7. Variations in footings:
 - a. Variation from dimensions on Plans when formed or plus 3-inches when placed against unformed excavations

Minus – 1/2 inch
Plus – 2 inches

- | | | |
|----|---|---|
| b. | Misplacement of eccentricity | 2 percent of the footing width in the direction of the misplacement, but not more than 2 inches |
| c. | Reduction in thickness of specified thickness | Minus – 5 percent |
| 8. | Variations in steps: | |
| a. | In a flight of stairs | Riser – 1/8 of an inch
Tread – 1/4 inch |
| b. | In consecutive steps | Riser – 1/16 of an inch
Tread – 1/8 of an inch |

3.10 MONOLITHIC SLAB FINISHES:

A. SCRATCH FINISH

Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping, including grout finishes where indicated on plans, or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated. Slope surfaces uniformly to floor drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

B. FLOAT FINISH

Apply float finish to monolithic slab surfaces 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 indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. TROWEL FINISH

Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks and uniform in texture and appearance. Grind smooth surface defects that would telegraph up through applied floor covering system.

D. TROWEL AND FINE BROOM FINISH

Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

E. NON-SLIP BROOM FINISH

Apply non-slip broom finish to exterior concrete platforms, landings, steps, and ramps, sidewalks and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Owner before application.

F. CHEMICAL-HARDENER FINISH

Apply chemical-hardener finish to interior exposed concrete floors and steps, unless noted otherwise. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Evenly apply each coat, and allow 24 hours for drying between coats. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

G. TOLERANCES FOR MONOLITHIC SLAB FINISHES

The flatness of the concrete shall be carefully controlled and the tolerances shall be measured by the straight edge system as specified in paragraph 4.5.7 of ACI 117, using a 10-foot straight edge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straight edge can be placed.

Bullfloated 1/2 inch
Float Finish 3/16 inch
Trowel Finish 1/8 inch
Straightedges 5/16 inch

3.11 CONCRETE CURING AND PROTECTION

A. GENERAL

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep concrete continuously wet for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried out. Continue final curing for at least 7 days in accordance with ACI 301 curing methods. Avoid rapid drying of concrete at the end of final curing period.

B. CURING METHODS

Perform curing of concrete by use of curing and sealing compound, by moist curing, by moisture-retaining cover curing, or by combinations thereof, as herein specified.

Provide moisture curing by the following methods. Keep concrete surface continuously wet by covering with water or provide continuous water-fog spray.

Covering concrete surface with absorptive cover, thoroughly saturating cover with water and keeping continuously thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

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

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walls, sidewalks, and curbs, as follows:

Apply curing and sealing compound to concrete slabs and walls as soon as initial curing operations are complete or immediately after the forms have

been stripped (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Completely cover the concrete surfaces with curing and sealing compound. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair any damage during curing period.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

C. CURING FORMED SURFACES

Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period and until forms are removed. When forms are removed, continue curing by methods specified above, as applicable.

D. CURING UNFORMED SURFACES

Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of an appropriate curing method.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture retaining cover.

3.12 SHORES AND SUPPORTS

A. GENERAL

Comply with ACI 347 for shoring, and as herein specified. Extend shoring from ground to roof for structures four stories or less, unless otherwise permitted. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

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

B. REMOVAL OF FORMS

Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

Formwork supporting weight of concrete, such as beam soffits, joints, suspended slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained 70 percent of the design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens, representative of concrete location or members.

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

3.13 REUSE OF FORMS

Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Provide new form facing material. Apply new form coating compound as specified for new formwork prior to reuse of forms.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, unless approved by the Engineer and acceptable to the Owner

3.14 MISCELLANEOUS CONCRETE ITEMS

A. FILLING-IN

Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work. Fill-in all form tie holes and other forming system holes with non-shrink grout.

B. CURBS

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

C. BASE PLATE, EQUIPMENT BASES AND FOUNDATIONS

Provide machine and equipment bases (housekeeping pad/pier) and foundations, as shown on the Plans. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturers furnishing machines and equipment.

Provide 4-inch-high, square or rectangular concrete pad around all conduits and small diameter pipes that penetrate through floor slabs.

Provide leveling grout under base plates and equipment frames using non-metallic, non-shrink grout. Minimum thickness for leveling grout shall be 1/2 inches unless noted otherwise on the Plans or specified by equipment manufacturer.

3.15 CONCRETE SURFACE REPAIRS

A. PATCHING DEFECTIVE AREAS

Repair and patch defective areas immediately after removal of forms. Cut out honeycomb, rock pockets, voids or bugholes over 1/4 inch in any dimension, 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. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. For water and wastewater containment structures, utilize an epoxy resin bonding agent. Place patching mortar after bonding compound has dried.

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

B. REPAIR OF FORMED SURFACES

Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Engineer. Surface defects, as such,

include color and texture irregularities, cracks, spalls, air bubbles, bug holes, honeycomb, rock pockets; fins and other discolorations that cannot be removed by cleaning. Flush out form tie holes and form bolt holes, fill with non-shrink grout, or precast concrete cone plugs or rubber plugs secured in place with bonding agent or epoxy adhesive.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. All repairs shall be approved by the Engineer. If defects cannot be repaired, the Contractor shall remove and replace the concrete.

C. REPAIR OF UNFORMED SURFACES

Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

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

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out 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.

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 inches of clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned

concrete surfaces and apply bonding agent. 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. Place dry pack after bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of the Engineer for method and procedure, using specified epoxy adhesive and mortar. Repair methods not specified above may be used, subject to approval of the Engineer. If acceptable repairs cannot be made, the Contractor shall remove and replace the concrete at no cost to the Owner.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. GENERAL

Sampling and testing for quality control during placement of concrete shall include the following:

1. Sampling Fresh Concrete

ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump

ASTM C143: one test at point of discharge for each day's placement of each type of concrete; additional tests when concrete consistency seems to have changed.

3. Air Content

ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231 pressure method for normal weight concrete; one for each day's placement of each type of air-entrained concrete.

4. Concrete Temperature

Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above; and each time a set of compression test specimens is made.

5. Compression Test Specimen

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

6. Compressive Strength Tests

ASTM C39; one set for each day's placement exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any 1 day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

Test results will be reported in writing to Engineer and Contractor within 24 hours after testing. FAX of test results is acceptable; however, mailing hard copies of test results is also required. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, and compressive breaking strength and type of break for both 7 day tests and 28-day tests.

7. Nondestructive Testing

Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection of concrete.

8. Additional Tests

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

the Owner. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for cost of such tests when unacceptable concrete is verified.

***** END OF SECTION *****

DIVISION 5 – METALS

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SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes structural steel work as shown on the Plans, including schedules, notes, and details to show size and location of members, typical connections, and type of steel required. Miscellaneous metal fabrications are specified elsewhere in Division 5.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Cast-In-Place Concrete
09900	Painting

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ASTM A36	Structural Steel
ASTM A53	Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe
ASTM A123	Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A276	Stainless Steel Bars and Shapes
ASTM A307	Carbon Steel Externally Threaded Standard Fasteners
ASTM A325	High Strength Bolts for Structural Steel Joints
ASTM A490	Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
ASTM A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A572	High-Strength Structural Steel
ASTM A992	High-Strength Structural Steel
AWS A2.4	Standard Welding Symbols
AWS D1.1	Structural Welding Code
AISC	Specification for Structural Steel Buildings
SSPC	Steel Structures Painting Council

1.4 SUBMITTALS

Submit under provisions of Section 01300.

A. SHOP DRAWINGS

Indicate profiles, sizes, spacing, locations, and complete details of structural members, to include openings, cuts, camber, fasteners, connections, and other pertinent data. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.

B. MANUFACTURER'S MILL CERTIFICATE

Submit under provisions of Section 01300 certifying that products meet or exceed specified requirements.

C. MILL TEST REPORTS

Submit under provisions of Section 01300 Manufacturer's Certificates, indicating structural strength, destructive and non-destructive test analysis.

D. WELDERS' CERTIFICATES

Submit under provisions of Section 01300 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months.

1.5 QUALITY ASSURANCE

Codes and Standards: Comply with the provisions of the following, except otherwise indicated:

<u>Standard</u>	<u>Title</u>
AISC	"Code of Standard Practice for Steel Buildings and Bridges"
AISC	"Specifications for Structural Steel Buildings," including "Commentary" and Supplements thereto as issued
AISC	"Specifications for Structural Joints using ASTM A325 or A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

American Welding Society (AWS) D1.1 “Structural Welding Code – Steel”

ASTM A6 “General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use”

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver material to site at such intervals to ensure uninterrupted progress of work.

Deliver anchor bolts and anchorage devices that are to be embedded in cast-in-place concrete or masonry in ample time as to not delay work.

Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 MATERIALS

A. STRUCTURAL STEEL SHAPES

ASTM A992, High-Strength Structural Steel.

B. STRUCTURAL STEEL PLATES AND BARS

ASTM A36, unless noted otherwise.

C. STRUCTURAL TUBING

Cold-Formed: ASTM A500, Grade B, $F_y=46\text{KSI}$
Hot-Formed: ASTM A501, $F_y=36\text{KSI}$

D. STEEL PIPE

ASTM A53, Type E or S Grade B.

E. HEADED STUD-TYPE CONNECTORS

ASTM A108, Grade 1015, forged steel, uncoated.

F. HIGH-STRENGTH THREADED FASTENERS

Heavy hexagon structural bolts, as follows:

Quenched and tempered medium carbon steel bolts, nuts and washers complying with ASTM A325.

Quenched and tempered alloy steel bolts, nuts and washers complying with ASTM A490 where indicated.

Heavy hexagon nuts complying with ASTM A563.

Hardened washers complying with ASTM F436.

Provide and install bolts with load indicator devices (load indicator washers or snap-off heads).

G. ANCHOR BOLTS AND THREADED RODS

ASTM F1554, Grade 36, unless noted otherwise. Heavy hexagon nuts complying with ASTM A563 and hardened washers complying with ASTM F436.

ASTM A193 Grade B8, where stainless steel is noted in the plans. Heavy hexagon nuts complying with ASTM A194 Grade 8 and type 304 stainless steel washers.

H. UNFINISHED THREADED FASTENERS

ASTM A307, Grade A, regular low-carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.

I. EXPANSION ANCHORS

Provide size and type indicated. Expansion anchors shall be one piece stud type, wedge-style anchor.

Carbon steel expansion anchors shall meet the following:

- Stud: ASTM A108 and zinc plated in accordance with ASTM B633

- Wedge: AISI 1010 carbon steel
- Nut: ASTM A563 Grade A
- Washer: SAE 1005-1020

Stainless steel expansion anchors shall meet the following:

- Stud: ASTM F593, AISI 304 or 316
- Wedge: AISI 304 or 316
- Nut: ASTM F594
- Washer: AISI 304 or 316 conforming to ASTM A240

Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to, the following:

KWIK Bolt 3, Hilti, Inc.
 Strong-Bolt 2, Simpson Strong Tie, Inc.
 Power-Stud+ SD1, Powers Fasteners, Inc.

J. FLUSH TYPE EXPANSION ANCHORS

Provide size to match fastener indicated, conforming to AISI 12L14, meeting ASTM A108, and zinc plated in accordance with ASTM B633, SC1, Type III.

Subject to compliance with the requirements products, which may be incorporated in the work include, but are not limited to, the following:

HDI Anchor, Hilti, Inc.
 Drop-In Anchor, Powers Fasteners, Inc.

K. ADHESIVE ANCHORS

1. Adhesive capsules shall be self-contained two-part component consisting of a vinyl urethane resin with a Dibenzoyl Peroxide Hardener.

Subject to compliance with the requirements products, which may be incorporated in the work include, but are not limited to the following:

HVU Adhesive capsule, Hilti, Inc.
 Chem-Stud Capsule, Powers Fasteners, Inc.

2. Injection adhesive system shall consist of a dual-cylinder adhesive refill pack, a mixing nozzle, and dispenser. The adhesive shall be formulated to include resin and hardeners.

Subject to compliance with the requirements products, which may be incorporated in the work include, but are not limited to, the following:

HIT RE 500 V3 Injection Adhesive Anchor, Hilti, Inc.
SET-XP, Simpson Strong Tie, Inc.
PE1000+, Powers Fasteners, Inc.

3. For hollow-base materials such as concrete masonry units (CMU), provide galvanized screen tubes as required by the manufacturer.

Subject to compliance with the requirements products, which may be incorporated in the work include, but are not limited to, the following:

HIT HY 70 Adhesive Anchor System for Unreinforced Masonry, Hilti, Inc.
Pure 110+, Powers Fasteners, Inc.

L. WELDING MATERIALS

AWS A5.1 or A5.5, E70XX; AWS A5.17, E70S-X; AWS A5.20, E70XT-X. Comply with AWS code.

M. GROUTING MATERIALS

Shall comply with Section 03300 "Cast-in-Place Concrete."

N. STRUCTURAL STEEL PRIMER PAINT

Epoxy Primer per Section 09900, SSPC SP-10.

2.2 FABRICATION

A. SHOP FABRICATION AND ASSEMBLY

Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.

Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence, which will expedite erection and minimize field handling of materials.

Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. CONNECTIONS

Weld or bolt shop connections, as indicated on the Plans or as specified.

Bolt field connections, except where welded connections or other connections are indicated.

Provide high-strength threaded fasteners for all bolted connections, except where unfinished bolts are indicated.

C. HIGH-STRENGTH BOLTED CONSTRUCTION

Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts."

D. WELDED CONSTRUCTION

Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Assemble and weld built-up sections where indicated by methods which will produce true alignment of axes without warp.

E. SHEAR CONNECTORS

Prepare steel surfaces as recommended by manufacturer of shear connectors. Shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

2.3 SHOP PAINTING

A. GENERAL

Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is

partially exposed, or the exposed portions and initial two inches of embedded areas only. Do not paint surfaces that are to be welded or are high-strength bolted with friction-type connections. Apply two coats of paint complying with Section 09900 to surfaces that are inaccessible after assembly or erection.

B. SURFACE PREPARATION

After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows: SP-10 “Near-White Blast Cleaning.”

C. PAINTING

Immediately after surface preparation, apply structural steel primer paint in accordance with Section 09900 and manufacturer’s instructions and at a rate to provide dry film thickness of not less than 1.5 mils DFT. Use painting methods, which result in full coverage of joints, corners, edges and exposed surfaces.

D. ZINC COATING

Unless noted otherwise, where structural steel (ferrous metal) is exposed to weather, it shall be zinc coated or galvanized by the “hot-dip” method in accordance with ASTM A123. Provide the following minimum coating weight per square foot of actual surface.

- | | | |
|-----|---------------------------------|--|
| (a) | Steel 1/8 inch
and 3/16 inch | 2.0 Ounces Average
1.8 Ounces Minimum |
| (b) | Steel 1/4 inch
and heavier | 2.3 Ounces Average
2.0 Ounces Minimum |

Provide galvanized fasteners with zinc-coated items.

2.4 SOURCE QUALITY CONTROL AND TESTS

Testing and analysis of components will be performed under provisions of Section 01400.

PART 3 EXECUTION

3.1 ERECTION

A. GENERAL

Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

B. SETTING BASES AND BEARING PLATES

Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

Pack non-shrink grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

C. FIELD ASSEMBLY

Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances.

Splice members only where indicated and accepted on shop drawings.

D. ERECTION BOLTS

On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

Comply with AISC Specification for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing member. Ream holes that must be enlarged to admit bolts.

E. GAS CUTTING

Do not use gas-cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members, which are not under stress, as acceptable to the Engineer.

F. TOUCHUP PAINTING

Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils. Painting shall conform to the requirements of Section 09900.

Cleaning and touchup painting of field welds, bolted connections and abraded areas of shop paint on structural steel is included in Section 09900.

G. REPAIR OF GALVANIZED WORK

Galvanized work damaged during installation shall be repaired with a "hot stick method" using "galv-bar."

3.2 QUALITY CONTROL

A. GENERAL

Comply with Section 01400 for independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

Radiographic Inspection: ASTM E94

Ultrasonic Inspection: ASTM E164

D. FIELD-BOLTED CONNECTIONS

Inspect in accordance with AISC specifications.

E. FIELD WELDING

Inspect and test during erection of structural steel as follows:

Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

Perform visual inspection of all welds.

Perform tests of welds as follows:

Liquid Pentrant Inspection: ASTM E165

Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.

Radiographic Inspection: ASTM E94

Ultrasonic Inspection: ASTM E164

***** END OF SECTION *****

SECTION 05400

COLD FORMED METAL FRAMING

PART 1 GENERAL

1.1 SCOPE

The extent of cold-formed metal framing is shown on the Plans, including schedules, notes, accessories and details to show size, type and location of members.

Types of cold-formed framing units include, but not limited to, the following:

- A. Load-bearing punched channel studs.
- B. C-shaped load-bearing steel studs.
- C. C-shaped steel joists.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
AISI	American Iron and Steel Institute. "North American Specification for the Design of Cold-Formed Steel Structural Members"
AWS	American Welding Society
ASTM A1003	Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members
ASTM A780	Practice for Repair of Damaged Hot-Dip Galvanized Coatings

1.4 SUBMITTALS

Comply with provision in Section 01300.

Product data and installation instructions for each items of cold-formed metal framing and accessories. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

1.5 QUALITY ASSURANCE

A. WELDING

Use qualified welders and comply with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

B. PREINSTALLATION CONFERENCE

Prior to start of installation of metal framing systems, meet at project site with installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site to insure uninterrupted progress of work. Store materials in a manner to permit easy access for inspection and identification, and to avoid deforming members. Keep members off ground, using pallets, platforms or other supports. Protect and package materials from erosion and deterioration.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:

SCAFCO, Steel Stud Mfg.Co.
Superior Steel Studs, Inc.
USG Industries
United States Steel
Wheel Corrugating Co.

2.2 METAL FRAMING

A. SYSTEM COMPONENTS

Manufacturers' standard load-bearing steel studs and joists of type, size, shape, and gauge as indicated on the Drawings. With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories for applications indicated, as needed to provide a complete

metal framing system. Top and bottom track units shall be one gauge heavier than framing components.

All framing components to meet ASTM A1003, Structural Grade, Type H, metallic coated.

Provide galvanized finish to metal framing components complying with minimum G60 coating.

Metal clips to meet A653, Grade 50, with minimum G60 coating.

Finish of installation accessories to match that of main framing components, unless otherwise indicated.

B. FASTENERS

Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.

C. ELECTRODES FOR WELDING

Comply with AWS Code and as recommended by stud manufacturer.

D. GALVANIZED REPAIR

Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A780.

2.3 FABRICATION

A. Framing components may be prefabricated into assemblies before erection. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.

B. Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.

C. Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

D. Wire tying of framing components is not permitted.

PART 3 EXECUTION

3.1 GENERAL

Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations.

3.2 RUNNER TRACKS

Install continuous tracks sized to match studs except gauge shall be one gauge heavier. Align tracks accurately to layout at base and tops of studs. Unless noted otherwise, secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 16-inches on center spacing for nail or power-driven fasteners. Provide two pairs of fasteners at 6-inch on center at corners and ends of tracks.

3.3 INSTALLATION OF WALL STUDS

Unless noted otherwise on the Drawings, secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structures.

Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

Frame wall openings larger than 2 feet square with double stud at each jamb of frame except where more than two are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.

For expansion and control joints frame both sides with separate studs; do not bridge the joint with components of stud system.

Install horizontal stiffeners (blocking) in stud system, spaced (vertical distance) at not more than 48-inches on center. Weld at each intersection.

3.4 ERECTION TOLERANCES

Bolt or weld wall panels (at both horizontal and vertical junctures) to produce flush, even, true-to-line joints. Maximum variation in plane and true position between prefabricated assemblies should not exceed 1/16 inch.

***** END OF SECTION *****

SECTION 05500

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the miscellaneous metal fabrication work including, but is not limited to, the following: preassembled stairs, ladders, handrails, railings, grating, including stair treads and nosings; floor plates and covers, custom fabricated pipe brackets, supports, and pipe sleeves.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
03300	Cast In Place Concrete
05120	Structural Steel
09900	Painting

1.3 REFERENCES

This section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ASTM A36	Structural Steel
ASTM A53	Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe
ASTM A123	Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A240	Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
ASTM A283	Carbon Steel Plates, Shapes, and Bars
ASTM A307	Carbon Steel Externally Threaded Standard Fasteners
ASTM A325	High Strength Bolts for Structural Steel Joints
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
ASTM A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM B241	Aluminum-Alloy Seamless Pipe and Seamless Extruded Steel Tube
NAAMM	National Association of Architectural Metal Manufacturers, "Metal Bar Grating Manual"
AISC	American Institute of Steel Construction
AWS D1.1	Structural Welding Code - Steel
AWS D1.2	Structural Welding Code - Aluminum
SSPC	Steel Structures Painting Council

1.4 SUBMITTALS

Submit under provisions of Section 01300.

Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS

2.1 MATERIALS

A. STRUCTURAL STEEL

Structural steel members and sections as defined in the AISC "Code of Standard Practice" are specified in Section 05120.

B. STEEL CASTINGS

Comply with ASTM A27. Grade 65-35, medium strength carbon steel.

C. CAST IRON

Comply with ASTM A48, Class 20.

D. STAINLESS STEEL

Comply with ASTM A276, Type 316.

E. ALUMINUM ALLOY EXTRUDED BARS, RODS, WIRE, SHAPES AND TUBES

Comply with ASTM B221, Alloy 6061-6.

F. WELDING MATERIALS

As specified in Section 05120.

G. ZINC COATING

Comply with ASTM A123 or ASTM A153.

H. FASTENERS, ANCHORS, AND ANCHOR BOLTS

As specified in Section 05120.

I. PAINTING

Comply with Section 09900.

J. GROUT MATERIALS

As specified in Section 03300.

2.2 PRODUCTS

A. HANDRAILS AND RAILINGS

Handrails and railings shall be clear satin finish, anodized 1-1/2-inch nominal diameter Schedule 40 extruded aluminum tubing conforming to ASTM B241, Alloy 6063 with concealed aluminum spigot splice connectors and fasteners countersunk and flush. Fasteners shall be 316 stainless steel. Maximum post spacing shall be 6'-0" on center.

Post connections shall be cast aluminum R&B Wagner Interna-Rail or approved equal. Mounting shall be cast aluminum R&B Wagner-Interna-Rail drive on flange or approved equal; other acceptable manufacturers are Golden Railings, Inc., or Alumaguard Corporation.

B. GRATING AND STAIR TREADS

Grating and stair treads shall be serrated, aluminum alloy 6063, rectangular bar grating complying with the requirements of NAAMM "Metal Bar Grating Manual"; in addition stair treads shall be provided with 1-1/4" corrugated nosings.

Unless noted otherwise on the Plans, minimum size of aluminum grating shall be 1-1/2" x 3/16" bearing bars at 1-3/16 inch on center with cross bars at 4 inches on center for a maximum span of 4'-6". For spans greater than 4'-6", grating shall be designed for 100 psf uniform load and 250 pounds concentrated load and 1/2 inch maximum deflection.

Stair treads shall be designed for 300 pound concentrated load with 33 1/3 percent impact.

Subject to compliance with the requirements, products which may be incorporated in the work include, but are not limited to the following:

AMICO Bar Grating
IKG Borden
McNichols Co.
Seidlehuber Metal Products

2.3 FABRICATION

Fit and shop assemble components in the largest practical size for delivery and installation at site.

A. STRUCTURAL STEEL MEMBERS AND SECTIONS

Fabrication of structural steel members and sections shall comply with Section 05120.

Provide galvanized fasteners with zinc coated items except as noted below. For all items installed in submerged, intermittently submerged, or areas subject to splash and spill, or corrosive atmospheres, fasteners shall be 316 stainless steel. The term fasteners includes nut, bolts, washers, leveling nuts, and U-bolts.

B. HANDRAIL AND RAILINGS

Unless noted otherwise, handrail and railing assemblies shall include a minimum 1/4" x 4" aluminum kick plate. Fabricate components with joints tightly fitted and secured. Fabricate anchors and related components of the same material and finish unless noted otherwise. Coordinate and accurately form components to suit stairs, landings and building structure. All stair stringers shall have handrail installed on them, unless noted otherwise.

C. GRATING AND STAIR TREADS

Fabricate with bearing bars placed edgewise and joined by straight cross bars. Do not notch, slot or cut bearing bars to receive cross bars. Cross bars shall be secured to the main bearing bars to prevent turning, twisting, or coming loose. Each of the cross bars shall be trimmed flush with outside face of bearing bars. Grating shall be fully banded at ends and at all openings. Provide anchorage as indicated on the Drawings.

D. ACCESSORIES

Provide necessary accessories as required for complete installation of products. Provide anchors, anchor bolts, plates, angles, hangers, struts, and other items required for connecting stairs to structure.

E. ANCHORAGE TO SUPPORTING STRUCTURES

For anchorage to supporting structures, provide 316 stainless steel fasteners for all aluminum items. Provide tapered washers where required to avoid point loading of structural members.

PART 3 EXECUTION

3.1 EXAMINATION

Verify that field conditions are acceptable and are ready to receive the work.

3.2 PREPARATION

Clean and strip primed steel items to bare metal where site welding is required. Supply items required to be cast into concrete or embedded in masonry with setting templates.

Paint embedded aluminum items in accordance with Section 09900.

3.3 INSTALLATION

A. TOLERANCES

Install items plumb and level, accurately fitted, free from distortion or defects. Comply with the following tolerances:

Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-accumulative.

Maximum Offset From True Alignment: 1/4 inch (6 mm).

Allow for erection loads, and provide sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments. Handrail installation shall be sturdy and without play.

B. BOLTING AND WELDING

Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Field weld components as indicated on the Drawings. Perform field welding in accordance with AWS D1.1 or AWS D1.2.

Obtain Owner's approval prior to field cutting or making adjustments not scheduled on the shop drawings.

C. COATINGS

After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete complying with Section 09900. Field galvanizing shall be done by the hot-stick method utilizing Galv-bar, or equal. Spray-on zinc paint is not acceptable.

D. DISSIMILAR MATERIALS

Avoid direct fastening of dissimilar metals to one another. Connections shall include means as required to isolate dissimilar metals from one another. Possible methods of isolation include, but are not limited to, non-metallic bushings/washers at bolts, and epoxy paint coating of contact surfaces. Intended means of isolation shall be noted on the submitted shop drawings. See Section 09900 for epoxy paint requirements.

E. ANCHORING GRATING

All grating shall be mechanically fastened into place. Provide plate fasteners or F-9 fasteners as recommended by the manufacturer. Where removable grating is specified on the Plans, fasteners shall be provided and installed to allow for easy removal of the grating.

***** END OF SECTION *****

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

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SECTION 07210

BATT AND RIGID INSULATION

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes the furnishing of all labor, materials, tools, and equipment required to install batt and rigid insulation, as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals

1.3 REFERENCES

This Section references the latest revisions of the following document:

<u>Reference</u>	<u>Title</u>
ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C1289	Standard Specification for Faced Rigid, Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1320	Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

1.4 PERFORMANCE REQUIREMENTS

Materials of this Section shall provide continuity of thermal and vapor and air barriers at building enclosure elements.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Owens Corning, Johns Manville, CertainTeed, DOW, or approved equal.

2.2 MATERIALS

A. BATT INSULATION

Type III preformed, foil-faced, glass fiber batt or roll conforming to ASTM C665, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

B. RIGID ROOF INSULATION

Type 1, Class 1 rigid, closed cell Polyisocyanurate foam board insulation conforming to ASTM C1289, to the thicknesses needed to meet the R-values shown on the Plans and as required by code.

C. TAPE

Pressure sensitive, aluminum foil tape; Specialty Tape #425 by 3M, or equal.

PART 3 EXECUTION

3.1 EXAMINATION

Verify site conditions before beginning installation. Verify that substrate and adjacent materials are ready to receive insulation, and free of all projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 GENERAL

Comply with insulation manufacturer's written instructions applicable to products and applications.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

Extend insulation to envelop entire area to be insulated with vapor barriers placed to face the interior (warm) side of the envelope. Fill all voids with insulation, fit tightly around all obstructions and tight to the exterior side of mechanical and

electrical services within the plane of the insulation. Remove projections that interfere with placement. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-values.

All miscellaneous voids shall have insulation installed to prevent gaps in insulation using either fiberglass batt compacted to approximately 75 percent of normal maximum volume, or spray polyurethane foam applied according to the manufacturer's written instructions.

Prior to installation of finished surfaces, all vapor-retarder joints and ruptures shall be taped and sealed in each continuous area of insulation to ensure an airtight installation.

3.3 INSTALLATION IN FRAMED CONSTRUCTION

Install blanket insulation in all cavities formed by framing members. Use insulation widths and lengths that fully fill the cavities. If more than one length is required to fill cavities, provide lengths that will produce a snug fit between ends. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members, and lap all ends and side flanges of facings over framing members.

Prior to installation of attic insulation, install eave insulation baffles between roof framing members on the underside of roof sheathing in insulated attic spaces at vented eaves.

For metal-framed wall cavities, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs. For unfaced blankets, locate vapor barrier joints over member faces and extend vapor barrier tight to the full perimeter of adjacent window and door frames, as well as other items interrupting the plane of membrane. Fully tape seal in place. Provide airspace at exterior plane of insulation for ventilation as recommended by manufacturer.

For wood-framed wall cavities, install blankets according to ASTM C1320 and as specified herein. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

***** END OF SECTION *****

DIVISION 8 – DOORS AND WINDOWS

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SECTION 08110

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers furnishing and installing hollow metal doors, frames, and glazing as indicated on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
08700	Finish Hardware
09900	Painting

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ANSI/SDI A250.8	Specifications for Standard Steel Doors and Frames
ANSI/SDI A250.11	Recommended Erection Instructions for Steel Frames
ANSI Z97.1	Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1048	Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
ASTM E2190	Standard Specification for Insulating Glass Unit Performance and Evaluation
HMMA 840	Guide Specification for Installation and Storage of Hollow Metal Doors and Frames

1.4 QUALITY ASSURANCE

Hollow metal doors and frames shall conform to applicable requirements of ANSI/SDI A250.8.

1.5 SUBMITTALS

Submit shop drawings and product data under provisions of Section 01300.

Indicate frame configuration, anchor types and spacing, location of cutouts for hardware, reinforcement, and finish.

Indicate door elevations and internal reinforcement.

1.6 REGULATORY REQUIREMENTS

Conform to applicable Building Code for fire rated frame and door requirements.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The hollow metal doors and frames shall be as manufactured by Curries, Ceco, Republic, Steelcraft, or any other SDI member.

2.2 DOORS AND FRAMES

<u>Location</u>	<u>Material</u>
Exterior Doors and Frames	ANSI/SDI A250.8, Level 3, Model 2
Interior Doors and Frames	ANSI/SDI A250.8, Level 3, Model 2

Provide door and frame types and sizes as shown on the Plans.

2.3 DOOR CORE CONSTRUCTION

Insulated doors shall contain a polyurethane core. Minimum U-value shall be as shown on the Plans.

Non-insulated doors shall contain a honeycomb core.

2.4 FABRICATION

Provide fully welded frames for all new construction. Provide fabricated frames of knock down field assembly type for retrofit applications or for existing door openings.

Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.

Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

Prepare frame for silencers, where required. Provide three single rubber silencers

for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.

Close top edge of exterior doors flush with inverted steel channel closure. Seal weld all door joints watertight. Caulking of door seams is not acceptable.

2.5 FINISH

Both interior and exterior doors and frames shall be made from galvanealed zinc coating per ASTM A653 or A60 material, with a minimum application rate of 0.60 oz/ft². Finish painting shall be in accordance with Section 09900 of these Specifications.

The inside of the metal frame profile shall be coated per Section 09900 of these Specifications. Provide dissimilar metals system. Coating may be shop or field applied.

PART 3 EXECUTION

3.1 INSTALLATION

Frames shall be installed plumb, level, and rigid in accordance with ANSI/SDI A250.11 and with HMMA 840. Doors shall be installed in accordance with HMMA 840.

Coordinate with all wall construction types for proper anchor placement. All door frames installed in masonry construction shall be completely filled with the masonry mortar utilized to install the masonry units or be fully grouted with non-shrink grout after installation of the frame. All door frames installed in cast-in-place concrete structures shall be fully grouted with non-shrink grout.

Door hardware shall be installed per Section 08700 of these Specifications.

Contractor shall protect doors and frames as necessary during construction of the Project.

3.2 CLEARANCES AND TOLERANCES

Clearances between the door and frame head and jambs shall be 1/8 of an inch. Clearance between the meeting edges of pairs of doors shall be 3/16 of an inch plus or minus 1/16. Maximum diagonal distortion shall be 1/8 of an inch, measured with straight edge, from corner to corner. Clearance between the face of the door and the door frame stops shall be 1/16 to 1/8 of an inch.

3.3 ADJUSTING DOORS

Adjust hardware for smooth and balanced door movement.

***** END OF SECTION *****

SECTION 08310

METAL ACCESS HATCHES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of the Contractor furnishing and installing two aluminum access hatches and accessories as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section	<u>Item</u>
01300	Submittals
01800	Testing, Commissioning, and Training
03300	Cast-in-Place Concrete

1.3 QUALITY ASSURANCE

Access hatches shall be guaranteed against defects in material and/or workmanship for a period of 10 years by the manufacturer.

1.4 EQUIPMENT LIST

The metal access hatches to be installed are as follows:

<u>Location</u>	<u>Clear Opening</u>	<u>Type</u>
Scum Pump Station Wet Well	36" x 36"	Type 1
Scum Pump Station Valve Vault	60" Diameter	Type 2

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Metal access hatches shall be as manufactured by Halliday Products, Inc., Bilco, L. W. Hatch, or equal.

2.2 ACCESS HATCH TYPE 1

Type 1 access hatches shall be single door, Halliday S1S Series, or equal. The hatches shall have a 1/4-inch-thick one-piece mill finish, extruded aluminum frame, incorporating a continuous concrete anchor. A bituminous coating shall be applied to the frame exterior where it comes in contact with concrete. The door

panels shall be 1/4-inch aluminum diamond plate reinforced to withstand a live load of 300 pounds per square foot. The doors shall open to 90 degrees and automatically lock with a 316 stainless steel hold-open arm shall incorporate an enclosed 316 stainless steel compression spring assist. The doors shall close flush with the frame and rest on a built-in neoprene cushion/gasket. Hinges and all fastening hardware shall be 316 stainless steel. The unit shall lock with a 316 stainless steel slam lock with removable key and have a non-corrosive handle. The unit shall be guaranteed against defects in material and/or workmanship for a period of 10 years.

2.3 ACCESS HATCH TYPE 2

Type 2 access hatches shall be single-door, Halliday Series R1R, or equal. The hatches shall have a 1/4-inch thick mill finish, extruded aluminum frame, incorporating embed anchor plates. The door panel shall be 1/4-inch aluminum diamond plate, reinforced to withstand a live load of 300 pounds per square foot, uniform live load. Doors shall open to 90 degrees and automatically lock with a T-316 stainless steel hold open arm with aluminum release handle. The door shall close flush with the frame. Hinges and all fastening hardware shall be T-316 stainless steel. Unit shall lock with non-corrosive locking bars and have non-corrosive handles. Unit shall carry a lifetime guarantee against defects in material and/or workmanship.

PART 3 EXECUTION

Units shall be installed as specified herein and as shown on the Plans. The units shall be connected with drain piping as shown on the Plans, and shall be installed according to the manufacturer's recommendations for safe and proper storage.

***** END OF SECTION *****

DIVISION 9 – FINISHES

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SECTION 09250

GYPSUM WALLBOARD

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section consists of all labor, materials, and equipment for all gypsum wallboard, zinc-coated trim, taping, spackling, and texturing necessary to complete all the work indicated on the Plans and as specified. The work shall include installation of gypsum board, exterior and interior grounds, corner beads, taping, spackling, sanding, and texturing of all joints and screw heads to obtain finished walls ready for painting.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
09900	Painting

1.3 REFERENCES

This Section references the latest revisions of the following documents:

<u>Reference</u>	<u>Title</u>
ASTM C36	Specification for Gypsum Wallboard
ASTM C79	Test Method for Gypsum Wallboard
ASTM C514	Specification for Nails for the Application of Gypsum Wallboard
ASTM C630	Specification for Water-Resistant Gypsum Backing Board
ASTM C840	Specification for Application and Finishing of Gypsum Wallboard
ASTM C1002	Specification for Steel Drill Screws for the Application of Gypsum Wallboard
ASTM C1047	Specification for Accessories for Gypsum Wallboard

1.4 QUALITY ASSURANCE

All gypsum wallboard products and joint treatment products shall be obtained from a single manufacturer.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Gypsum wallboard products and joint treatment products shall be as manufactured by the National Gypsum Company, Georgia Pacific, the USG Group, or approved equal.

2.2 GYPSUM WALLBOARD

Gypsum wallboard shall be heavy duty, moisture and abuse resistant wallboard with reinforcing layers at each face, conforming to ASTM C1629 and ASTM C1396, Type X. Thickness shall be 5/8 inch.

2.3 TRIM ACCESSORIES

Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for fastening and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, and one-piece control joint beads. Unless specifically noted as "exposed," all trim accessories shall be beaded type to be concealed with joint compound.

2.4 JOINT TREATMENT MATERIALS

Provide materials complying with ASTM C475, ASTM C840 and recommendations from the Manufacturer for the applications indicated. Provide 2-1/2-inches wide, perforated tape for joints. Provide two separate grades of ready-mixed, vinyl-type joint compound. One type shall be for bedding tapes and filling depressions. The second type shall be for taping and sanding.

2.5 FASTENERS

Screws shall conform to ASTM C1002 with heads, threads, points, and finish as recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

All workmanship and materials shall be of the best quality and any defective work shall be removed and replaced by the Contractor at no additional expense to the Owner. Keep the premises free of accumulations of debris and dust connected with this work and protect adjacent finished surfaces from damage by this work.

The Contractor shall establish and maintain application and finishing environment in accordance with ASTM C840. For non-adhesive attachment of gypsum wallboard to framing, maintain not less than 40 degrees F.

3.2 INSTALLATION

All drywall sheets shall be set with staggered joints and screws set deep enough to receive a cover of spackle, spaced in accordance with Wallboard Manufacturer's standard specifications. Install approved zinc-coated corner molds at openings and terminations of wallboards. Cut all wallboard close to and around wall penetrations and electrical outlets. Provide a complete, covered installation in all areas where gypsum wallboard is to be installed.

3.3 FINISHING

After the wallboard has been installed, it shall be finished. Apply joint compound or bedding compound and embed tape leaving uniform thickness of materials underneath tape. Cover screw heads smooth with finished surface of board after each application of joint material. After initial application has been complete, it shall be allowed to dry and then sanded smooth. Additional coats of joint compound shall be applied and finish sanded until a Level 5 finish has been achieved in accordance with ASTM C840 and left in condition to receive paint. Obtain Owner's approval prior to applying paint.

3.4 ESCUTCHEONS

Provide escutcheons around all pipe, conduit, and similar types of penetrations through gypsum wallboard walls and ceiling.

***** END OF SECTION *****

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section covers the furnishing and installation of protective coatings, complete-in-place. Special shop coatings and/or factory-applied finishes on manufactured or fabricated items may be specified elsewhere. Regardless of the number of paint coats previously applied, at least two field coats of paint shall be applied to all surfaces unless otherwise specified herein. Field painting is not required for factory prefinished equipment items such as pumps, blowers, motors, etc. Touchup of the factory applied coatings may be required.

The word "paint" as used herein shall be taken to include all protective coatings and incidental materials as required with the exception that anodized aluminum or zinc galvanized coatings shall not be considered as paint.

Unless specifically noted otherwise in these Specifications or on the Drawings, all work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If an existing wall or ceiling (or similar surface) is modified in some way, the entire wall or ceiling surface is to be painted.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
03300	Cast-in-Place-Concrete
Division 5	Metals
Division 11	Equipment
Division 15	Mechanical
Division 16	Electrical

1.3 REFERENCED STANDARDS

The following standards are referenced and shall be considered a part of these Specifications:

American National Standards Institute (ANSI):
A159.1, Surface Preparation Specifications;
Z53.1, Safety Color Code for Marking Physical Hazards

International Concrete Repair Institute (ICRI)
Guideline No. 310.2R-2013

American Society for Testing and Materials (ASTM):
D4263, Standard Test Method for Indicating Moisture in Concrete by the
Plastic Sheet Method
E84, Standard Test Method for Surface Burning Characteristics of
Building Materials

National Fire Protection Association (NFPA):
101, Life Safety Code

Steel Structures Painting Council (SSPC):
SP-1, Solvent Cleaning
SP-2, Hand Tool Cleaning
SP-3, Power Tool Cleaning
SP-5, White Metal Blast Clearing
SP-6, Commercial Blast Cleaning
SP-7, Brush-off Blast Cleaning
SP-10, Near-White Blast Cleaning
SP-11, Power Tool Cleaning
SP-13 Surface Preparation for Concrete Surfaces
VIS-89, Visual Standard
Guide 12

1.4 DEFINITIONS

A. PAINT

Includes fillers, primers, sealers, emulsions, oils, alkyds, latex, enamels, thinners, stains, epoxies, vinyls, urethanes, shellacs, varnishes and any other applied coating specified within these Specifications or shown on the Drawings.

B. FINISHED ROOM OR SPACE

One that has a finish called for on Room Finish Schedule, or is indicated on the Drawings, or is specified herein, to be painted.

C. PAINTING COVERAGE RATE

Coverage's expressed in SF/GAL/coat are the manufacturer's published theoretical coverage's in square feet per gallon per coat.

1.5 SUBMITTALS

In addition to the general submittal requirements listed in Section 01300, the following shall be submitted:

1. Written acknowledgment and certification that products submitted meet requirements of standards referenced in this Section.
2. Manufacturer's application instructions for primer and finish coats.
3. Manufacturer's surface preparation instructions.
4. Manufacturer's full line of color samples for color selection by Owner.
5. If products being used are manufactured by a company other than the specified reference standard, provide complete comparison of proposed products with specified products including application procedure, coverage rates, and verification that product is designed for intended use. Information must be provided that demonstrates that manufacturer's products are equal to the performance standards of products manufactured by the Tnemec Company, which is the reference standard.
6. Manufacturer's approval of protective coating systems applicator.
7. List of Applicator's experience and qualifications. A minimum of 5 years of experience in the painting of wastewater treatment plant facilities required.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The following is an approved coating systems manufacturers list subject to compliance with the Specifications contained herein:

1. Sherwin Williams.
2. Tnemec Company.
3. Or equal.

The specified coating shall be understood as establishing the type and quality of coating desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the coatings proposed are equivalent to those named. Proposed coatings shall be submitted for review in accordance with these Specifications. Requests for review of equivalency will not be accepted from anyone except the Contractor,

and such requests shall not be considered until after the Contract has been awarded.

No substitutions shall be allowed that change the number of coats, thickness or generic type of paint required. All materials shall be brought to the jobsite in the original sealed and labeled containers of the paint manufacturer and shall be subject to inspection by the Engineer.

No coating materials other than those specified shall be brought to the jobsite. Thinners, driers and oils brought to the jobsite shall be only those recommended and approved by the paint manufacturer.

All paint shall conform to the applicable air quality regulations at the point of application. Any paint material which cannot be guaranteed by the manufacturer to comply, whether specified by product designation or not, shall not be used.

It shall be the responsibility of the Contractor to ensure the compatibility of the field painting products which will be in contact with each other or which will be applied over shop painted or previously painted surfaces. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to the underlying paint.

All paint used for intermediate and finish coats shall be guaranteed by the paint manufacturer to be fumeproof and suitable for wastewater plant atmospheres containing hydrogen sulfide. Any paint that cannot be so guaranteed shall not be used. Paint shall be lead-free and mercury-free if available, but in no case shall the lead or mercury content cause discoloration in a wastewater plant atmosphere.

Tnemec Company products are the reference standard and Tnemec designations for product type are used herein. Requirements for an approved equal product are listed below:

1. For approval of an equal manufacturer. Bidder shall provide to the Owner in writing a detailed side-by-side comparison of the proposed equal Products Characteristics, Performance Characteristics, and Application Conditions for each Tnemec coating specified in this specification. For consideration for approval this written comparison shall be certified and notarized by an officer of the proposed manufacturer as true and correct.
2. For Products Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Volume Solids, Weight Solids, VOC, Mix Ratio, Zinc Content in Dry Film (by Weight), Spreading Rate per coat, Drying Schedule, Shelf Life and Flash Point.

3. For Performance Characteristics this detailed side-by-side comparison shall include for example, but not limited to, Abrasion Resistance, Corrosion Weathering, Direct Impact Resistance, Dry Heat Resistance, Flexibility, Moisture Condensation Resistance, Pencil Hardness, Salt Fog Resistance, Slip Coefficient and Wet Heat Resistance
4. In addition to the detailed side-by-side comparison for approval of an equal manufacturer, Bidder shall provide to the Owner in writing five similar installations that have had the proposed or equal coating system and date coating system was put into service. In addition the installations names, locations, and owner's name with contact person and telephone number shall be provided.
5. For consideration for approval as an equal coating system the detailed side-by-side comparison shall be submit, with successful bidder's Shop Drawing at the time of the Preconstruction Conference, along with any proposed monetary adjustments to the contract price. As with all shop drawings, final approval rests with the Owner.
6. As a minimum standard any equal coating system shall have a 5-year service history on its coating system.

2.2 PAINT SYSTEMS

A. SUBMERGED METAL

1. Scope

This Section shall apply to all metal, other than bituminous coated pipe and materials, which are to be continuously or intermittently submerged in sewage, water or sludge unless specified otherwise.

2. Surface Preparation

Near-white blast cleaning, SSPC-SP-10.

3. Coatings

Shop Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Field Finish System:

Coat One

Product: PermaShield Tnemec Series 218-141 Gray
MDFT: 6.0 to 9.0 mils

Coat Two

Product: PermaShield Tnemec Series 218-141 Gray
MDFT: 6.0 to 8.0 mils

Total MDFT: 14.5 to 20.5 mils

B. NON-SUBMERGED METAL - MILD CONDITIONS

1. Scope

This Section shall apply to all metal which is not submerged but is located indoors which is not subject to splashing from sewage, water, sludge, oil and grease or other corrosive materials unless specified otherwise.

2. Surface Preparation

Commercial blast cleaning, SSPC-SP-6.

3. Coatings

Shop Primer System:

Coat One

Product: Omnithane Series 1
MDFT: 2.5 to 3.5 mils

Field Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69
MDFT: 4.0 to 6.0 mils

Coat Two

Product: Hi-Build Epoxoline Tnemec Series N69
MDFT: 4.0 to 6.0 mils

Total MDFT: 11.0 mils

C. NON-SUBMERGED METAL - SEVERE CONDITIONS

1. Scope

This Section shall apply to all metal which is not submerged but is located outdoors or is subject to splashing from sewage, water, sludge, oil and grease or other corrosive materials unless specified otherwise.

2. Surface Preparation

Near-white blast cleaning, SSPC-SP-10.

3. Coatings

Shop Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Field Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4.0 to 6.0 mils

Coat Two

Product: Endura-Shield III Tnemec Series 73

MDFT: 3.0 to 5.0 mils

Total MDFT: 10.0 mils

D. COATING OF FACTORY NON-APPROVED FINISHES

1. Scope

This Section shall apply to all interior and exterior steel windows and frames and other similar type of items which have a factory finish which is not an approved corrosion resistant finish.

2. Surface Preparation

Factory coating is to remain. Provide clean surfaces, lightly sand 100 percent of the surfaces, then provide solvent cleaning, SSPC-SP-1.

3. Coatings

Primer System:

Coat One

Product: Typoxy Tnemec Series N27

MDFT: 2.0 to 3.0 mils

Finish System:

Coat One

Product: Endura-Shield III Tnemec Series 73

MDFT: 3.0 to 5.0 mils

Total MDFT: 5.0 mils

E. EXTERIOR PVC SURFACES

1. Scope

This Section shall apply to all PVC pipe and fittings and similar materials that are located outside of buildings and vaults and are exposed to sunlight. Any and all PVC surfaces that are exposed to UV light are to be painted. Interior PVC items do not paint unless otherwise specified. Interior PVC pipe must be labeled and banded as specified.

2. Surface Preparation

Provide clean surfaces, lightly sand 100 percent of the PVC surfaces, then provide solvent cleaning, SSPC-SP-1.

3. Coatings

Finish System:

Provide One Coat of the following:

Product: Endura-Shield III, Tnemec Series 73

MDFT: 3.0 to 5.0 mils

F. PIPE AND FERROUS MATERIALS (IMMERSION)

1. Scope

This Section shall apply to exposed pipe, fittings and materials that are continuously or intermittently submerged or exposed to splash

or spill of liquids or corrosive atmospheres. This includes all piping installed in the wet well and the valve vault.

2. Surface Preparation

Provide surface profile in accordance with ASTM D 4417, Method C

3. Coatings

Tnemec

Primer System:

Coat One

Product: Omnithane Series 1

MDFT: 2.5 to 3.5 mils

Finish System:

Coat One

Product: Hi-Build Epoxoline Tnemec Series 446

MDFT: 8.0 to 10.0 mils

Coat Two

Product: Hi-Build Epoxoline Tnemec Series 446

MDFT: 8.0 to 10.0 mils

Total field applied MDFT: 16.0 mils

Sherwin Williams

Primer System:

Coat One

Product: Dura Plate 6100

MDFT: 20.0 mils

G. GALVANIZED SURFACE TOUCH-UP

1. Scope

This Section shall apply to all galvanized surfaces, which have received minor damage to the galvanized surface during construction.

2. Surface Preparation

Power tool cleaning, SSPC-SP-3.

3. Coatings

Paint System:

Product: Z.R.C. Cold Galvanizing Repair Compound

MDFT: 3 to 5 mils

Total MDFT: 3.5 mils

H. ALUMINUM BURIED IN CONCRETE - DISSIMILAR METALS

1. Scope

This Section shall apply to all surfaces, which are conducive to corrosion due to interactions between dissimilar metals, or to chemical reactions, to include embedments in cast-in-place or precast concrete or masonry grout. This Section applies to aluminum, hot-dipped galvanized steel, and any other metals that have a dissimilar metals or chemical reaction concern when installed or embedded in concrete, or against concrete, mortar or grout.

2. Surface Preparation

Lightly sand with 150 grit sandpaper to degloss and roughen surfaces. Solvent cleaning, SSPC-SP-1.

3. Coatings

Finish Coat

Product: Hi-Build Epoxoline Tnemec Series N69

MDFT: 4 to 6 mils

Total MDFT: 4.0 mils

I. METAL DOORS, FRAMES AND TRIM

1. Scope

This Section shall apply to all interior and exterior hollow metal doors and windows, frames and trim.

2. Surface Preparation

All hollow metal doors, windows and frames shall be bonderized, pickled or phosphatized, which will serve as the primer for and shall be compatible with the finish coats to be applied in the field. Prior to field coat application, the surface shall be solvent cleaned SSPC-SP-1, and shall be clean, dry and free of all dirt, oil, grease and any other contaminants.

3. Coatings

Primer System:

Coat One

Product: Tnemec Series 27 Typoxy

MDFT: 3.0 to 5.0 mils

Finish System:

Coat One

Product: Endura-Shield Tnemec Series 1095

MDFT: 3.0 to 5.0 mils

Total MDFT: 6.0 to 10.0 mils

J. GYPSUM WALLBOARD

1. Scope

This Section shall apply to all exposed gypsum wallboard.

2. Surface Preparation

Sandpaper smooth, dust and contaminant free.

3. Coatings

Primer System:

Coat One

Product: Sealer Tnemec Series 151-1051

MDFT: 1.5 to 2.5 mils

Finish System:

Coat One

Product: H. B. Tnemec-Tufcoat Tnemec Series 1029
EndurTone

MDFT: 2.0 to 4.0 mils

Coat Two	
Product:	H.B. Tnemec-Tufcoat Tnemec Series 1029 EnduraTone
MDFT:	2.0 to 4.0 mils
Total MDFT:	5.5 to 10.5 mils

2.3 COLORS

A. GENERAL

Paint colors used for the finish coatings on process equipment, piping and building surfaces shall conform to the following schedules. All finishes shall be glossy unless otherwise specified. Finish coatings, which are applied in the shop by the manufacturer, shall conform with this color schedule wherever possible. Factory coatings which are damaged during shipment or installation, or which are not of suitable color, as determined by the Engineer, shall be recoated in the field in accordance with manufacturer's recommendation and acceptance by the Engineer. Color samples shall be submitted to the Engineer for approval prior to application of any field coatings.

B. PROCESS EQUIPMENT COLOR SCHEDULE

Process equipment shall be painted in accordance with the following schedule:

Process Unit	Color
Clarifier Mechanisms (non-submerged portion)	Light Blue
Pumps	Light Brown

Other equipment items and process materials shall be painted with finish colors selected by the Engineer.

C. PIPING COLOR SCHEDULE

Piping Identification: Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, shall have flow directional arrows, and shall be color coded as scheduled below.

Piping scheduled to be color coded shall be completely painted with the indicated colors, except surfaces specified to be unpainted shall have segments painted with the specified coding color long enough to

accommodate the required lettering and arrows. All other piping specified to be painted shall match adjacent surfaces, unless otherwise approved by the Engineer.

Location: Lettering and flow direction arrows shall be provided near equipment served, adjacent to valves, on both sides of walls and floors where pipe passes through, at each pipe branch or tee, and at intervals of not more than 50 feet in straight runs of pipe. If, in the opinion of the Engineer, the foregoing requirements will result in an excessive number of labels or arrows on a run of pipe, the number required can be reduced.

Metal Tags: Where the outside diameter of pipe or pipe covering is 5/8 inches or smaller, metal tags shall be provided instead of lettering. Tags shall have the specified identifying lettering stamped in and shall be fastened to the pipe with suitable chains. Metal tags and chains shall be aluminum or stainless steel. Where tags are used, pipe shall be color coded as specified and flow directional arrows shall be painted on the pipe.

Lettering: Lettering on piping shall be painted, stenciled, or snap-on markers. Snap-on markers shall be plastic sleeves as manufactured by Brady "Brady snap-on B-915", Seton "Setmark", or equal. Letter sizes shall be as follows:

Outside Diameter of Pipe or Covering	Minimum Height of Letters
5/8-inch and smaller	Metal Tags -1/4-inch
3/4-inch through 4-inch	3/4-inch
5 inches and larger	2 inches

Color Coding and Lettering Schedule: All piping for the following services shall be color coded and identified using the process names given below. Where scheduled, bands shall be 6 inches wide spaced along the pipe at 5-foot intervals.

Process	Abbreviation	Color of Pipe	Color of Letters
Return Activated Sludge	RAS	Light Brown	White
Scum	SC	Dark Brown	White
Secondary Effluent	SE	Gray	Black

Pipes not tabulated above shall be color coded and lettered as determined by the Engineer

Electrical conduit shall be painted to match adjacent ceiling or wall surfaces as approved by the Engineer.

All valves shall be identified with a valve identification number. Contractor shall provide a computer file (Excel spreadsheet) with this information to the Engineer.

PART 3 EXECUTION

3.1 GENERAL

It is the intent of these Specifications that materials and workmanship be provided such that the highest quality job is obtained. The completed work, prior to acceptance, must be free from runs, skips, mars and any other disfiguring mark due to faulty workmanship or care of the completed work.

It is the responsibility of the Contractor to ensure that all surfaces are prepared in accordance with the written recommendations and directions of the paint manufacturer whose paint is applied.

Approval of conditions shall be obtained from the Engineer prior to applying any or all coats of paint; however, such approval shall not relieve the Contractor of his responsibility of conformance with these Specifications and conformance with the manufacturer's recommendations.

It shall be the responsibility of the Contractor to prevent settling of dust or the occurrence of other conditions detrimental to the finished quality of the job and to repair any damaged paint at no additional cost to the Owner.

Materials or equipment delivered with prime coats shall be touched up as required prior to the application of additional coating(s).

The Contractor shall apply each coating at the rate and in the manner specified by the paint manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built-up to the same thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of paint. Film thickness shall be determined when dry by the Engineer with a magnetic dry film thickness gauge. The thickness gauge shall be calibrated with test shims.

Where thinning is necessary, only the products of the manufacturer furnishing the paint and for the particular purpose shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions as well as with the full knowledge and approval of the Engineer.

No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 40 degrees F. No paint shall be applied when the temperature of the surface to be painted is below 35 degrees F. Paint shall not be applied to

wet or damp surfaces and shall not be applied in rain, snow, fog or mist or when the relative humidity exceeds 85 percent. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 40 degrees F within 18 hours after the application of the paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until conditions improve to be certain that the surfaces are dry prior to application of paint. No paint shall be applied when the ambient temperature is less than 5 percent F above the dewpoint. Further, the day's painting shall be completed well within advance of the probable time of day when condensation will occur, in order to permit the paint film an appreciable drying time prior to the formation of moisture.

All coatings applied to concrete shall be performed during stable or declining temperatures. Any coatings applied where ambient temperatures increase within the cure time to touch shall be removed at Contractor's expense and reapplied.

Manufacturer's recommended drying time shall be construed to mean "under normal conditions". Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times shall be necessary. The manufacturer's recommendations for recoating time intervals shall be strictly adhered to.

Adequate ventilation, which will effectively remove solvents, shall be provided for proper drying of paints on interior surfaces. A minimum of 7-consecutive calendar days at 70 degrees F following the application of the final coat on submerged surfaces shall be required before submergence. Longer periods shall be allowed prior to submergence if recommended by the paint manufacturer or if weather conditions require a longer curing time. Shorter periods may be allowed if Contractor can demonstrate proper temperatures and duration to immersion and provide a letter stating immersion cure has been achieved by the coating representative.

3.2 MIXING AND THINNING

Paint shall be thoroughly mixed each time any is withdrawn from the container. Paint containers shall be kept tightly closed except while paint is being withdrawn.

Paint shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. Only thinners approved by the paint manufacturer shall be used. In no case shall the wet film thickness of applied paint be reduced, by addition of paint thinner or otherwise, below the thickness recommended by the paint manufacturer.

3.3 SURFACE PREPARATION

A. GENERAL

Contractor shall provide lighting per SSPC Guide 12 throughout all preparation, coating and inspection activities.

Surfaces shall be dry and thoroughly cleaned of foreign materials with all defects filled or removed. All trades employed shall leave the surfaces of their work in such a condition that only minor cleaning, sanding and filling is required of the painting trade for surface preparation.

Hardware, switchplates, machined surfaces, nameplates, lighting fixtures and all other surfaces not to be painted shall be removed or otherwise protected. Drop cloths shall be provided, where necessary, to avoid spotting of surfaces adjacent to the item being painted. Working parts of electrical equipment shall be protected from damage during surface preparation and painting operations.

Ferrous metal cleaning shall be in accordance with Steel Structures Painting Council Specifications (SSPC).

<u>Description</u>	<u>SSPC</u>
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Near-White Blast Cleaning	SP-10
Preparation of Concrete	SP-13

The words “blast cleaning” or equivalent phrases of equal intent shall be taken to refer to the applicable SSPC specification when used in the paint manufacturer’s recommendations or these Specifications.

Hand tool cleaning shall be used when power tool cleaning is not possible. Hand and power tool cleaning shall be in accordance with SSPC Specifications SP-2, SP-3 or SP-11, respectively.

The blast cleaning profile depth shall be angular and not less than 2 mils. In the case of equipment to which the manufacturer applies a primer coating in the shop after fabrication, the blast profile depth needs to be as noted above.

B. FERROUS METAL, GALVANIZED METAL AND HOLLOW METAL SURFACES

The Contractor shall assure that fabrication, welding or burning is completed prior to the sandblasting operation. The Contractor shall chip or grind off flux, splatter, slag or other laminations left from welding. The Contractor shall remove all mill scale. The Contractor shall grind smooth rough welds and other sharp projections.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10, submerged surfaces and surfaces to 12 inches above highest liquid level, and areas subject to splash or spillage.

The Contractor shall commercial blast clean, in accordance with SSPC SP-6, all interior and exterior structural steel surfaces, surfaces located 12 inches above submerged areas, and surfaces located in areas not subject to splash or spillage where exposed to open bodies of liquids.

The Engineer reserves the right to accept preparation of these surfaces in accordance with SSPC SP-3 for areas not practical or possible to sandblast to SSPC SP-6 requirements.

The Contractor shall near-white blast clean, in accordance with SSPC SP-10 surfaces, subject to heat in excess of 600 degrees F. The Contractor shall power tool or hand clean in accordance with SSPC SP-2 or SSPC SP-3. The Contractor shall apply prime coat on cleaned surfaces within 2 hours of cleaning. The Contractor shall solvent clean galvanized surfaces in accordance with SSPC SP-1.

C. PREPARATION BY SANDBLASTING

The Contractor shall not sandblast surfaces that will be wet after blasting and before painting. The Contractor shall apply primer to sandblasted surfaces the same day that the surface is blasted and before rusting occurs. The Contractor shall reblast surfaces allowed to set overnight prior to priming or surfaces that show rust bloom.

The sand shall be clean, water washed, with controlled particle size and high silica content. The sand shall have sharp, angular surfaces and contain no clay particles or other extraneous matter.

The profile depth of sandblasted surfaces shall be not less than 1 mil or greater than 2 mils, unless required otherwise by the coating manufacturer.

Compressed air for blasting shall be free of water and oil. The Contractor shall provide accessible separators and traps, shall confine sandblast sand to the area being blasted, shall provide shields of polyethylene sheeting or other such barriers to confine sand and shall plug pipes, holes or openings before sandblasting and keep them plugged until the sandblasting operation is complete and the sand is removed.

The Contractor shall protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from sandblasting. The Contractor shall reblast surfaces not meeting the requirements of these Specifications.

3.4 APPLICATION

A. GENERAL

The Contractor shall mix and apply coatings by brush, roller or spray in accordance with the manufacturer's installation instructions and back brush as required. Spraying equipment shall be inspected and approved in writing by the coating manufacturer. The Contractor shall provide complete coverage's to the mil thickness specified. The thickness specified shall be dry film mil thickness. All paint systems are "to cover." In situations of discrepancy between the manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern. When color or undercoats show through, the Contractor shall apply additional coats until paint film is of uniform finish and color. The Contractor shall not apply consecutive coats until the Engineer has had an opportunity to observe and approve previous coats.

The Contractor shall apply materials under adequate illumination, shall evenly spread and flow on to provide full, smooth coverage, shall work each application of material into corners, crevices, joints and other difficult to work areas, shall avoid degradation and contamination of blasted surfaces and avoid intercoat contamination, shall clean contaminated surfaces before applying next coat and shall immediately smooth out runs or sags, or remove and recoat entire surfaces. The Contractor shall assure that preceding coats are dry before recoating, shall recoat within the time limits specified by the coating manufacturer and shall allow coated surfaces to cure prior to allowing traffic or other work to proceed.

The Contractor shall coat all aluminum surfaces in contact with dissimilar materials. All fabricated and structural steel shall have prime coat(s) applied in the shop and finish coat(s) applied in the field.

During application of either prime or finish coats, brush coat all weld seams, edges, angles, fasteners and other irregular surfaces to insure a monolithic film, pinhole free surface. Finish coats of paint shall be uniform in color and sheen without streaks, laps, runs, drips, sags or missed areas.

All submerged or intermittently submerged materials shall have surface preparation and coatings applied prior to installation unless otherwise approved by the Engineer. All pipe, pipe supports, and pipe hangers that paint shall have surface preparation and coatings applied prior to installation.

B. PRIME COAT INSTALLATION

The Contractor shall prime all surfaces indicated to be painted, shall touch-up damaged primer coats prior to finish coats and shall assure field-applied coatings are compatible with factory-applied coatings. If coatings are not compatible, and if approved in writing by the Engineer, the Contractor shall apply a 2-mil-thick universal barrier coat recommended by the paint manufacturer prior to applying field coats or completely remove factory coatings and reprime.

The Contractor shall prime ferrous metals bedded in concrete to a minimum of 1 inch below exposed surfaces. The Contractor shall assure sandblasting operations do not result in the embedment of sand particles in paint film. The Contractor shall brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over the entire surface being coated. The Contractor shall backroll concrete with a roller if the primer has been spray applied.

C. FINISH SCHEDULE

All work performed under this Contract (both new work and modifications to existing facilities) shall be painted. If the finish schedule requires wall surfaces to be painted in a particular space, the Contractor shall paint all appurtenant surfaces unless specifically noted not to be painted on the Drawings. These items to be painted shall include:

1. Pipe supports, and equipment supports.
2. Conduit and appurtenances.
3. Ferrous metals.

4. New machinery and equipment except:
 - a. Electrical panels;
 - b. Switchboards;
 - c. Switchgear;
 - d. Safety switches;
 - e. Motor starter equipment;
 - f. Busways;
 - g. Raceways.

The Contractor shall paint all exposed interior and exterior surfaces including:

1. Conduit and appurtenances.
2. Ferrous metals.

The Contractor shall not paint the following elements unless specifically noted on the Drawings to be painted:

1. Stainless steel surfaces except as required to identify piping.
2. Exposed to view aluminum surfaces.
3. Galvanized metal surfaces.
4. Fiberglass surfaces except fiberglass piping and piping appurtenances.
5. FRP ductwork unless gel coat color is not acceptable to the Owner.
6. Interior of pipe, ductwork, and conduits.
7. Moving parts of mechanical and electrical units.
8. Code labels and equipment identification and rating plates.

9. Piping, ductwork, or pipe conduit when enclosed between suspended ceiling and overhead slabs or located in pipe chases or surfaces to be lagged.
10. Contact surfaces of friction-type connections.
11. Prefaced masonry, burnished masonry units, or glass masonry.
12. Structural steel or steel deck required to be fireproofed.
13. Pipe and/or duct lagging.

3.5 FIELD QUALITY CONTROL

The Contractor shall be responsible for performing, testing and assuring conformance with all requirements of these Specifications.

The Contractor shall maintain daily records showing:

- Start date of work in each area.
- Date of application for each following coat.
- Moisture content and surface temperature of substrate. Also record weather conditions, ambient air temperature and dew point.
- Provisions utilized to maintain temperature and humidity of work area within paint manufacturer's recommended ranges.

The Contractor shall measure the surface temperature of items to be painted with surface temperature gauges specifically designed for such use. The Contractor shall measure substrate humidity with humidity gauges specifically designed for such use. The Contractor shall measure wet paint with wet film thickness gauges. The Contractor shall measure paint dry film thickness with a Mikrotest gauge calibrated against the National Bureau of Standards "Certified Coating Thickness Calibration Standards." The Engineer may direct measurement of paint thickness at any time during the project to ensure conformance with these Specifications. A sufficient number of dry film thickness measurements shall be made so that there is approximately one measurement for each 100 square feet of surface area painted.

Where a wall or ceiling or other type of surface is disturbed and patched, the Contractor shall repaint entire wall or ceiling. The Contractor shall provide wet paint signs as necessary. The Contractor shall touch up damaged finish coats using the same material as specified for the finish coat.

At the conclusion of all painting activities, Contractor shall submit a painting field test report to the Engineer showing the above information plus results of wet film and dry film thickness tests. Provide four copies of final test report.

3.6 PAINTING SITE

Either shop painting or field painting and surface preparation shall be acceptable when painting work is performed in conformance with this Section, unless the painting is activity specified elsewhere in these Specifications.

3.7 PAINT THICKNESS

All paint thicknesses specified herein are minimum dry film thickness (MDFT). The thickness of paint over metallic surfaces shall be measured with a magnetic thickness gauge; paint thickness over wood or masonry shall vary in accordance with surface texture, but in no case shall the manufacturer's recommended coverage rate be exceeded. The minimum thicknesses given are total coating thickness for the coating specified, including multiple coats of the same material, where applicable.

***** END OF SECTION *****

DIVISION 11 – EQUIPMENT

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SECTION 11000

EQUIPMENT GENERAL PROVISIONS

PART 1 GENERAL

1.1 SCOPE

The provisions of this Section apply to all Sections of Divisions 11, 13, 15, and 16, unless specifically revised therein.

The Contractor shall direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Provisions wherever they may occur.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
03300	Cast-in-Place Concrete
09900	Painting
11002	Equipment Mounting, Supports, Grouting, and Installation
11010	Vibration and Critical Speed Limitations
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

1.3 STANDARDS FOR THE WORK

Pipe, fittings, wiring and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and

repair. Oil and lubrication fittings shall be located clear of and away from guards, base, and equipment and within reach from the operating floor. In order to meet these requirements with equipment as furnished, minor deviation from the Plans may be made as authorized by the Engineer. All such minor deviations from the Plans that may include extending oil and lubrication fittings for accessibility and safety shall be executed at no additional cost to the Owner.

1.4 MANUFACTURER'S INSTRUCTIONS

The recommendations and instructions of the manufacturers of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.5 SUBMITTALS

A. GENERAL

Product Submittals shall be provided to the Engineer for all equipment specified in Divisions 11, 13, 15, and 16, in accordance with Specification 01300, this Section and the respective equipment specification section. Submittals shall be dated and signed as certified for use in construction of this project.

B. MANUFACTURER'S LITERATURE

Manufacturer's literature shall be submitted for equipment, including, as applicable, performance characteristics, fan curves and pump curves, motor data sheets and methods of assembly.

The following minimum requirements shall accompany all manufacturers' literature submittals:

1. Description of materials.
2. Rating data - Mechanical and Electrical as applicable.
3. Motor Data including bearing and enclosure information.
4. List of any special tools and/or spare parts required and to be furnished, if any.
5. Exceptions taken to the specification and detailed explanation why the exception is being taken.

6. Additional specific information that is specified in the equipment sections.
7. For motor driven equipment served by variable frequency drives (VFDs), provide vibration and critical speed requirements of the equipment, minimum speed requirements of motor and driven machinery, acceleration and deceleration requirements of the equipment, and torque and speed information as per Part 1.6 of this Section.

C. SHOP DRAWINGS

Shop Drawings shall be submitted showing sizes and arrangement of equipment, foundations and anchor bolts required, control diagrams, wiring diagrams, pipe hanging details, ductwork layouts and connections to other work. The arrangement of mechanical equipment and appurtenant piping shown on the Plans may be varied as necessary to fit the certified manufacturer's installation drawings. However, the manufacturer's drawings shall not deviate from the Plans and Specifications as to location, size, type and design of equipment.

The following minimum requirements shall accompany all shop drawing submittals:

1. Overall dimensions.
2. Mounting arrangement and dimensions.
3. Connection sizes and orientation.
4. Capacity and location of lifting eyes.
5. Motor arrangement showing location of electrical connections.
6. Detail electrical wiring diagrams, showing component designation and rating, and the connection points and associated terminals and cable identification for connection to the process control system.
7. The Contractor shall ascertain the location of all electrical (power and control) connections in order to properly orient electrical conduits.

D. DESIGN CALCULATIONS

Seismic design calculations shall be submitted for equipment and for supports and anchorage for equipment.

Special seismic certification shall be submitted for all active mechanical and electrical equipment that must remain operable following an earthquake in compliance with ASCE 7-16 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components.

E. FACTORY TEST REPORTS

Factory tests shall be performed for each piece of equipment where specifically called for in the Section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard shall make that requirement a part of these Specifications. Conduct factory tests at the same speeds at which the equipment will operate in the field except as noted.

Where specifically noted, the Engineer may witness performance test. The Contractor shall inform the Engineer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, certified results shall be supplied by the Contractor to the Engineer.

Factory testing of pumps shall be done in accordance with the requirements and standards of the Hydraulic Institute. Tests of other equipment shall conform to the requirements set forth in these Specifications.

F. IDENTIFICATION OF DELIVERED EQUIPMENT

Each piece of equipment delivered to the project site shall be accompanied by a completed form which will contain at least the following information:

1. Owner's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph and page.

5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number).
6. Motor data, type, voltage, frequency, phase, full load amperes, starting method, frame size, enclosure, insulation type, NEMA Code letter, dimensions, service factor, serial number.
7. Date and signature of person certifying performance.

G. MANUFACTURER'S AFFIDAVITS

Equipment manufacturers, or their authorized representatives, shall each submit a signed and dated written report with respect to his equipment certifying the following:

1. The equipment has been properly installed and lubricated
2. The equipment is in accurate alignment
3. The manufacturer was present when the equipment was placed into operation
4. The manufacturer has checked, inspected, and adjusted the equipment as necessary
5. The equipment is free from any undue stress imposed by connecting piping or anchor bolts
6. The equipment is not imposing any undue stress on any connecting members
7. The equipment has been operated satisfactorily under full load conditions
8. The manufacturer has inspected his equipment during the operational demonstrations and system validation tests to the extent specified
9. The equipment is fully covered under the terms of the guarantee

H. OPERATION AND MAINTENANCE MANUALS

Prepare and submit instruction manuals to include all information required and in the format specified in Section 01300 Submittals.

I. SPARE AND LOOSE PARTS

1. Spare and Loose Parts Supplied

Provide an inventory of spare and loose parts required to be supplied under the project. Turn over inventory and parts to the City. The City's written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment.

2. Recommended Spare Parts

Furnish a complete list of recommended spare parts and supplies, with current prices and a source of supply, for each piece of equipment furnished.

PART 2 PRODUCTS

2.1 DESIGN

All equipment shall be designed for the service intended, of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation, shall be adequately stayed, braced and anchored, and shall be installed in a neat and workmanlike manner. Appearance, safety, and utility shall be given consideration in the design of equipment. Materials of construction shall be cathodically compatible.

2.2 STANDARD REQUIREMENTS

A. MATERIALS

Design, fabricate and assemble equipment and systems with new materials and in accordance with acceptable engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field. Make like parts of duplicate units interchangeable. Do not place equipment in service at any time prior to delivery except as required for factory or shop tests.

B. UNIFORMITY

Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

C. SEISMIC REQUIREMENTS

Supports and anchorage of equipment(s) shall comply with the requirements of the 2018 *International Building Code* (IBC) Section 1613 and ASCE 7-16 *Minimum Design Loads for Buildings and Other Structures*, Chapter 13 Seismic Design for Nonstructural Components, as referenced and amended by the IBC. For the following design parameters:

- Building Occupancy Category III
- Site Class D
- The component Importance Factor: $I_p = 1.50$
- Design response acceleration coefficients:

$$S_{DS} = 1.030g$$

$$S_{D1} = 0.548g$$

- Seismic Design Category D

D. STANDARDS

Provide equipment and materials suitable for service conditions and meeting standard requirements of ANSI, ASME, AWWA, ASTM, NEMA, IBC, NPC, UL and OSHA.

2.3 LUBRICATION

Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for a minimum of 1-year's consumption prior to completion, testing and final acceptance.

2.4 EQUIPMENT BASES AND BEDPLATES

Mount equipment assemblies on a single heavy cast iron or welded steel bedplate on a grout or concrete base unless otherwise shown or specified. Provide bases and bedplates with machined support pads, vibration pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Corners shall be rounded or chamfered and ground smooth. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide leveling screws in equipment bases and bedplates to aid in leveling prior to grouting.

2.5 ANCHORS AND FASTENERS

Each equipment manufacturer shall furnish the required anchor bolts, nuts and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1-1/2 inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified. The manufacturer shall submit to the Engineer design calculations regarding recommended sizing and type of anchor bolts, nuts, and washers for securing the equipment, in accordance with the project seismic requirements.

Anchor and assembly bolts and nuts shall be of ample size and strength for the purpose intended. All nuts, bolts and washers shall be Type 316 stainless steel. All leveling nuts shall be Type 316 stainless steel.

All motor-driven equipment shall be furnished with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment, or equipment or piping subject to vibration.

Expansion type anchors are not to be used for any submerged applications unless specifically noted on the Plans.

Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Plans, expansion type anchors may be used.

2.6 SAFETY GUARDS

Cover belt or chain drives, fan blades, couplings, exposed shafts and other moving or rotating parts on all sides with safety guards conforming to all applicable Federal, State, and local codes and regulations; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically, guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide spring loaded hinged doors with latch for service and lubrication access.

All pipes, manifolds, heaters, and other surfaces, which have a surface temperature sufficient to burn human tissue, shall be covered with a thermal insulating material or otherwise guarded against contact.

Guards shall comply with the requirements of these Specifications, WISHA Standards, and "The Principles and Techniques of Mechanical Guarding" (OSHA 2057, 1973), whichever is more stringent.

2.7 LIFTING EYES

All equipment weighing over 100 pounds shall be supplied with lifting eyes. Parts of equipment assemblies, which are normally serviced separately, such as motors, shall have individual lifting eyes.

2.8 ELECTRICAL COMPONENTS

Equipment shall be manufactured, fabricated and installed in a manner which permits conduit connection to electrical power and control equipment from below the connection point, terminal box, or connection box without offsets or bends such that the conduit will drain away from the equipment.

Electric motors, control panels, accessories, etc., shall conform to the requirements of Divisions 11, 13, 15 (Equipment items) and Division 16, Electrical.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

All electrical components and equipment assemblies with electrical components shall be recognized or labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the Project per WAC 296-46B-903(6) and WAC 246-46B-999 requirements.

2.9 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

The Contractor shall maintain a spreadsheet or database tabulation of the motor and load characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. This spreadsheet shall also include any additional information needed to set-up, program or adjust the variable frequency drive which serves motor driven equipment such as minimum and maximum equipment or motor speed, acceleration/deceleration time of the driven equipment such as pumps, compressors, blowers, etc. The spreadsheet shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the most current motor and driven equipment information for the submitted equipment. The updated spreadsheet shall be provided to the variable frequency drive suppliers prior to shop testing of the VFDs. The spreadsheet list shall have the following information as a minimum:

Motor and Driven Equipment Characteristics			
Motor Data:	Full Load Amps		Amps
	Nominal Motor Voltage		Volts
	Nominal Motor Frequency	60	Hertz
	Nominal Motor Speed		RPM
	Input Phase Loss Behavior	Fault	
	Recommended Stopping Mode (i.e. coast, brake etc.)		
Driven Equipment Data:	Maximum Motor Frequency		Hertz
	Minimum Motor Frequency		Hertz
	Acceleration Time		seconds
	Deceleration Time		seconds

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Owner's Resident Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data on a revised motor characteristic spreadsheet.

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments of the motor characteristics and include in the list described in the preceding paragraph.

2.10 NAMEPLATES/DATA PLATES/IDENTIFICATION

Each piece of equipment and its driver shall be furnished with a stainless steel metal nameplate fastened to the item in an accessible position. This nameplate shall contain the manufacturer's name, equipment rating, capacity, size, model, serial number and speed. Data for motors shall be NEMA standard. All information written or printed shall be in English. Each item of equipment shall bear a different serial number. Measurement units shall be given for ratings and capacity.

Nameplates for tanks and pressure vessels shall give working pressure, test pressure, vessel plate thickness and ASME Code data.

Each piece of rotating equipment shall have a direction of rotation arrow.

Each piece of equipment shall be labeled using a plastic laminate label with the functional name and number of the equipment shown on the Plans or provided by the Engineer. Name and number shall correspond to those used on Motor Control Centers and Panels.

Labels shall be fastened to the equipment base or other acceptable location. The letters shall be at least 1/2-inch high with a border trim on all sides not less than 1/4-

inch. Color shall be green background with white letters. Fasteners shall be brass or stainless steel screwed into inserts, anchor shields or tapped holes in equipment or base.

Units of measure shall be shown on the indicating and totalizing dials of all meters, gauges and other measuring devices.

2.11 PROTECTION AGAINST ELECTROLYSIS

Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, non-metallic separators or washers. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings or bushings.

2.12 PAINTING

Painting of all equipment shall be in accordance with Section 09900 of these Specifications.

2.13 NOISE

Mechanical and electrical equipment shall not create sound levels that are in excess of that permitted by WISHA for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved.

2.14 VIBRATION AND CRITICAL SPEED LIMITATIONS

Mechanical and electrical equipment shall meet the vibration and critical speed limitation requirements described in Section 11010.

2.15 PRESSURE GAUGE CONNECTIONS

Provide tapped and plugged suction and discharge gauge connections on the pump nozzles or flanges. Where this is not possible, provide gauge connections on the piping immediately adjacent to the pump.

PART 3 EXECUTION

3.1 INSPECTION

Inspect each item of equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for new equipment installation.

3.2 PREPARATION

Prior to installing equipment, ensure that the areas are clean and that concrete or masonry operations are completed. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service the equipment in accordance with the Operation and Maintenance Instruction Manuals and specific requirements included in applicable Sections of these Specifications.

3.3 SPARE AND LOOSE PARTS

Prior to equipment startup provide an inventory of spare and loose parts supplied under the project. Turn over inventory and parts to the Owner. The Owner's written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment.

3.4 INSTALLATION

A. EQUIPMENT

Equipment shall conform to the approved submittals and Operation and Maintenance Instruction Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects.

B. ANCHOR BOLTS

Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed. Prior to assembly, the Contractor shall coat all stainless steel bolts and nut threads with anti-seizing compound.

C. BASE AND BEDPLATE GROUTING

Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45-degree angle, except around exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for 3 days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform corrective work as required to conform to

the tolerances given in the applicable Operation and Maintenance Instruction Manual.

The Contractor shall make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Plans. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the complete work. Unless otherwise authorized, all grout shall be a non-shrink, non-metallic grout as stated in Section 03300.

Where practicable, the grout shall be placed through the grout holes in the equipment base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

D. PRESSURE GAUGES

Pressure gauges shall be installed on all pump discharge piping at a location where the gauges can be easily read. The gauges shall be located upstream of the isolation valves, if possible. Gauges shall be installed on other equipment items as specified. The gauges are specified in Division 13 and shall be installed as detailed on the Plans.

3.5 EQUIPMENT STARTUP AND ADJUSTMENT

The Contractor, at his/her own expense, shall arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to:

- Supervise the equipment installation in accordance with the Operation and Maintenance Instruction Manual.
- Be present when the equipment is first put into operation.
- Inspect, check, adjust as necessary, and approve the installation.
- Repeat the inspection, check and adjust until all trouble or defects are corrected and the equipment installation and operation are acceptable.
- Witness and supervise operational demonstrations and system validation tests to the extent specified.

- Prepare and submit the specified Manufacturer's Affidavit.

The representative shall be experienced and knowledgeable regarding the equipment being tested.

The Contractor shall give initial lubrication to all equipment in accordance with the manufacturer's recommendations.

The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

All equipment shall be field tested and demonstrated to the Engineer that proper operation and capacity have been fully complied with. For pumps, this shall include measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means, or through a suitably calibrated meter for two points on the performance curve. Current draw and voltage on the motor for each phase shall be measured for each pumping rate measurement. For two-speed pumps, such tests shall be conducted at both speeds. For variable speed pumps, blowers or fans, these tests shall be conducted at minimum and maximum speeds and at the specified duty point.

The Contractor shall furnish and test equipment or measuring devices (including portable flow meters) required that are not part of the permanent installation. Tests for variable speed pumps, blowers, and other equipment shall be performed at 60 Hz and at the initial anticipated flow or capacity levels.

The field test shall demonstrate under all conditions of operation that the equipment:

- Has not been damaged by transportation or installation.
- Has been properly installed.
- Has no mechanical defects.
- Is in proper alignment.
- Has been properly connected.
- Is free of overheating of any parts.
- Is free of vibration in excess of the limits in Section 11010.
- Is free of excessive noise.

- Is free of overloading of any parts.
- Shall operate as specified with the specified control system.
- Is free of critical speeds as specified in Section 11010.

In addition, the entire facilities shall be demonstrated to be in full operating order prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, it shall be immediately removed and replaced, all at the Contractor's expense.

Equipment start-up and adjustment shall take place before instruction of the Owner's personnel is performed.

3.6 INSTRUCTION OF OWNER'S PERSONNEL

Conduct an instruction program for up to six operations personnel designated by the Owner in accordance with Specification Section 01800. Furnish the services of qualified instructors from the various equipment manufacturers for the duration specified in each specific Section. Include instruction covering basic system operation theory, routine maintenance and repair, and "hands on" operation of equipment.

Provide the instruction program at the Owner's convenience before contract closeout. The Contractor shall audio- and video-record all training sessions, and also provide the Owner with any audio-visual training materials the manufacturer utilizes (i.e., DVDs, PowerPoint presentations, videocassettes etc.). Cost of instruction and audio-visual training materials shall be included in the bid price for the equipment.

3.7 SOUND LEVEL TESTING

Measure the sound level developed by all mechanical and electrical equipment provided under the Contract Provisions. Perform testing in all rooms and spaces containing such equipment during the final operation test program with all equipment operating. Use OSHA approved instruments and record the highest sound levels developed when measured according to OSHA standards in each room and space. Deliver a certified copy of records to the Engineer.

***** END OF SECTION *****

SECTION 11002

EQUIPMENT MOUNTING, SUPPORTS, GROUTING AND INSTALLATION

PART 1 GENERAL

1.1 SCOPE

This section specifies minimum requirements for equipment mounting and supports, including concrete housekeeping pads, equipment bases, supports, anchorage, and accessories with weights greater than 200 pounds. If conflict exists between this section and requirements of individual equipment manufacturers, the more restrictive requirements shall prevail.

The Contractor shall provide all supports, anchorage, and mounting of all equipment, and in accordance with the manufacturer's recommendations, and industry standards requirements. Each piece of equipment shall be anchored to resist the greater of the maximum lateral and vertical forces required by the local governing code or by the manufacturer of the equipment, whichever is greater. This force shall be considered acting at the center of gravity of the piece under consideration. No equipment shall be anchored to vertical structural elements without written approval of the Engineer. The Contractor shall provide all elements required to resist the calculated forces described herein or required by the equipment manufacturer. The Contractor shall provide certification that for equipment, 20 horsepower and larger, anchor bolt calculations showing adequacy of bolt sizing and anchor embedment have been performed and signed by a registered structural or civil engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
03300	Cast-In-Place Concrete
Division 11	Equipment
Division 14	Conveying Systems
Division 15	Mechanical

1.3 REFERENCES

This section contains references to the following documents. It is a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed document, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

<u>Reference</u>	<u>Title</u>
ANSI/HI	Baseplate Design
ANSI/HI 1.4	Centrifugal Pumps - Installation, Operation and Maintenance
ANSI/HI 2.4	Vertical Pumps - Installation, Operation and Maintenance
API 610, 1995	Centrifugal Pumps for Petroleum, Heavy Duty Chemical and Gas Industry Services
API RECOMMENDED	Recommended Practices for Machinery
PRACTICE 686	Installation and Installation Design
ASTM C531	Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing
ASTM C579	Compressive Strength of (Method/B) Chemical Resistant Mortars and Monolithic Surfacing
ASTM C638	Tensile Properties of Plastics
ASTM C882	Bond Strength of Epoxy-Resin Systems Used with Concrete
ASTM C884	Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
ASTM C1181	Creep of Concrete in Compression

ASTM D2471

Gel Time and Peak Exothermic Temperature of
Reacting Thermosetting Resins

SSPC

Society for Protective Coatings Specifications,
Vol. 2

1.4 SUBMITTALS

- A. The following information shall be provided in accordance with Section 01300:
1. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (v) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 2. Shop drawings for all equipment bases and anchorage details.
 3. Certification of anchor bolt calculations specified in paragraph 11002-1.01 B.
 4. Machine and equipment base installation schedule with manufacturers' anchor bolt torque requirements, as specified in paragraph 11002-2.01.

PART 2 PRODUCTS

2.1 GENERAL

All equipment shall be mounted on concrete housekeeping pads. Unless otherwise specified, equipment and drivers shall be rigidly mounted on a common cast iron or fabricated steel baseplate or soleplate grouted into place on the housekeeping pads. Under no circumstances shall equipment supports be grouted directly to concrete slabs or floors. Bases for equipment shall be hot-dip galvanized after fabrication unless otherwise specified.

Prior to initiating any installation efforts, the Contractor shall produce a machine base schedule containing the expected dates for setting anchor bolts, casting housekeeping pads, preparation of housekeeping pads for grouting, grouting, and final anchor bolt clamping for each item of equipment. The schedule shall list the equipment, by equipment number, and shall be accompanied by written verification of anchor bolt clamping torque from the equipment manufacturer.

Installation practices shall follow the guidance presented in Chapters 4 and 5 of API Recommended Practice 686, unless superseded by more restrictive requirements of these specifications or manufacturer requirements.

2.2 CONCRETE HOUSEKEEPING PADS

Concrete housekeeping pads for equipment and floor penetrations shall be at least 2 inches larger in plan on all sides than the steel or cast base and not less than 6 inches above the finished floor elevation, unless shown otherwise on the Drawings, and shall be shaped to drain liquids away from the base. Housekeeping pad details shall follow the requirements set forth in Figure A-4 of API 686 unless superseded by more restrictive requirements of these specifications or the requirements of the equipment manufacturer. All conduits, piping connections, drains, etc. serving the equipment, shall be enclosed by the concrete housekeeping pad. Unless otherwise specified, no conduits, piping connections, drains, etc., will be accepted which rise directly from the floor.

2.3 EQUIPMENT BASES

A. GENERAL

1. Unless otherwise specified, mounting bases for equipment 20 horsepower and larger shall be a minimum of 1 inch thick. All bases shall have edges bearing on the grout surface rounded to a radius of not less than 2-inches to avoid producing stress risers on the grouted foundation. Grout pouring holes (minimum 4 inches in diameter) shall be provided in all bases and all bases shall have

grout release holes. Except where vibration isolation systems are specified, all bases shall be grouted as specified in this section. Internal stiffeners shall be provided and shall be designed to allow free flow of grout from one section of the base to another. The minimum acceptable opening in cross-bracing and stiffeners shall be 2-inches high by 6 inches in length. All welds shall be continuous and free from skips, blow holes, laps and pockets.

2. Equipment bases for horizontal pumps shall conform to the requirements of this section, ANSI/HI 1.3.4, API 610 (paragraph 3.3), and shall provide common support for the pump and motor (and flywheel, if one is specified). In the event of conflict, the requirements of this section shall govern. Eight positioning jackscrews shall be provided for all drivers and flywheels (if specified) for all horizontal pump baseplates. All bases for horizontal pumps shall be equipped with jackscrews for positioning and leveling the base prior to grouting.
3. Mounting holes for anchor bolts in the bases, mounting blocks, or sole plates shall be drilled and not burned out and they shall not be open slots. All mounting studs shall be Type 316 stainless steel. Anchor bolts shall be Type 316 stainless steel as specified under paragraph 11002-1.1. A nonseize or nongalling compound shall be used on all threads.
4. Mounting pads for equipment shall be machined after all welding and stress relieving and shall be coplanar to 0.002 inch in all directions. Mounting pads shall extend not less than 1-inch on all sides beyond the position for the equipment.
5. Equipment bases for vertical volute-type pumps weighing more than 2000 pounds shall be soleplates or leveling boxes under individual feet or support brackets integral with the volute casting. Direct mounting on the housekeeping pads will not be permitted.

B. TYPE I BASES

Type I bases shall be structural steel bases with thickened steel pads for doweling. The bases shall be rectangular in shape for equipment other than centrifugal refrigeration machines and pump bases, which may be "T" or "L" shaped to accommodate the equipment drive and accessories. Pump bases for split case pumps shall include supports for suction and discharge base ells, if required by the specified configuration. Perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14 inches

provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. Grout holes shall be provided for the bases of all equipment where vibration isolation is not specified. Sole plates, mounting blocks and baseplates weighing more than 1000 pounds shall be leveled with jackscrews incorporated into the fabrication. Jackscrews shall be located in thickened pads or otherwise in sufficient metal to provide ease in adjusting level.

C. TYPE IV BASES

Type IV bases shall be cast iron. Cast iron bases located within buildings, do not require galvanizing but shall be sealed in accordance with the requirements for bleeding surfaces specified in Section 09900 prior to grouting. Terminations requiring connections to the base shall be nuts welded to the bottom side of the base and plugged with cork, plastic plugs or grease, or acorn nuts. In no case shall the fastener terminate only into the metal base.

D. SOLEPLATES

Where soleplates are provided, the underside shall be scribed with the words "THIS SIDE DOWN" using welding rod material prior to milling the equipment mating surface flat to a tolerance of not less than 0.002 in./ft in all directions.

E. MOUNTING BLOCKS

Where equipment is fabricated or cast with individual support pads or feet and provision of a common base, as in bottom suction pump, the equipment may be supported on individual piers in lieu of a common housekeeping pad. In such instances, the equipment may be supported at the pads or feet on individual sole plates or mounting blocks, which shall be leveled and grouted into place as specified in this section.

2.4 GROUT FOR EQUIPMENT BASES

A. EPOXY GROUT

1. Unless otherwise specified, grout for setting bearing surfaces of baseplates, soleplates, and mounting blocks on equipment pads shall be Epoxy Grout for Equipment Mounting. The epoxy grout for equipment pads shall conform to the following requirements:

<u>Test</u>	<u>Results</u>
ASTM C531	Shrinkage shall be less than 0.080% and thermal expansion less than 17×10^{-6} in/in/oF
ASTM C579	Strength shall be a minimum of 12,000 psi in 7 days when tested by method B, modified.
ASTM C882	Bond strength to Portland concrete shall be greater than 2,000 psi
ASTM C884	Epoxy grout shall pass the thermal compatibility test when overlaid on Portland cement concrete
ASTM D638	Tensile strength shall not be less than 1,700 psi. Modulus of elasticity shall not be less than 1.8×10^6 psi
ASTM C1181	Creep of the epoxy grout shall be less than 0.005 in/in with the test at 70 degrees F and 140 degrees F with a load of 400 psi
ASTM D2471	Peak exothermic temperature shall not exceed 110 degrees F when a specimen 6-inch diameter x 12-inch high is used. Gel time shall be a least 150 minutes

2. The vehicle shall be a two-component (liquid and hardener) system designed to yield the above characteristics when combined with the manufacturer's recommended aggregate system. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperature as high as 150 degrees F, with a load of

1,200 psi. Aggregate for equipment base grout shall be as furnished by the manufacturer of the epoxy grout mix.

B. CEMENTIOUS NONSHRINK GROUT

Cementious nonshrink grout for use with equipment supports for equipment rated 5 horsepower and smaller or weighing less than 1,000 pounds, whichever is less, may be as specified in Section 03300. Procedures for leveling and clamping equipment shall be as specified in this section.

2.5 EPOXY PRIMER

The epoxy primer shall be lead free, chrome free, rust inhibitive, two-component epoxy primer specifically designed for use on metal substrates and in conjunction with epoxy grout. The epoxy primer shall be a product of the epoxy grout manufacturer.

2.6 ANCHOR BOLTS

Anchor bolts shall be stainless steel, set in PVC sleeves. Sleeves shall allow a free length projection of not less than 15 bolt diameters above the concrete required to develop the strength of the bolt. Projection above the nut on the baseplate or soleplate shall be no more than 3/4 inch.

2.7 PRODUCT DATA

A. The following shall be provided in accordance with Section 01300:

1. Results of grout strength tests, as specified in paragraph 11002-3.2 E.

PART 3 EXECUTION

3.1 GENERAL

A. Pumps shall be installed in accordance with this section and ANSI/HI 1.4 and ANSI/HI 2.4. Grouting of equipment bases shall take place prior to connecting any field piping or electrical and instrumentation systems. Unless the Project Representative accepts an alternate installation procedure in writing, baseplates shall be grouted with the equipment removed.

- B. Equipment that is not mounted on vibration isolators shall be anchored directly to the supporting floor system. In addition to the anchorage, all such equipment shall be internally designed so that all static and moving parts are anchored to the supporting framework to resist the all imposed forces. All forces shall be transmitted to the base in order to be anchored as required.
- C. Connecting piping with flexible connections and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system without imposing strain on the equipment connections. Where the equipment manufacturer requires a rigid connection between the machine and connecting piping systems (generally, this will be higher discharge head pumps), the flexible coupling shown may be deleted and the Contractor shall install the equipment in the following detailed manner:
1. The equipment housekeeping pad shall be prepared as specified under paragraph 11002-3.2 B.
 2. The baseplate, soleplate or leveling blocks supporting the equipment shall be installed, leveled, and grouted in place as specified.
 3. The equipment shall be installed, aligned and dowelled in place as specified.
 4. The piping shall be installed and aligned to the equipment connections and the field piping connections without welding one of the joints for one section of pipe between the equipment connection and the field piping and all valving. All flanged joints shall be bolted up and pressure tested.
 5. All piping shall be fully supported by supports designed to accept their full weight.
 6. The final sections of piping shall be aligned with the equipment and field connections without the use of jacks, chain falls or other devices to force it into alignment.
 7. The final piping joints shall be welded only after the previous steps have been completed and accepted by the Engineer.
 8. After completion of installation and initial run period, unbolt the connection to verify no deflection in alignment.

- D. Conduit and piping for future equipment shall be capped flush with the floor or concrete pad in such a manner to allow future connection.
- E. The Contractor shall coordinate location of electrical conduit and piping penetrations within the concrete pad and equipment base. All penetrations shall stub-up on the same side of the equipment as required for connection to the equipment. Equipment drains shall be located as required for drainage from equipment.
- F. Prior to commencing equipment installation work, the Contractor shall cause the manufacturer of the epoxy grout to be used for equipment installation to conduct a training school for the workmen to be using the product. The school shall be not less than 4 hours in length and shall cover all aspects of using the products, from mixing to application.

3.2 INSTALLATION

A. ANCHOR BOLTS

1. Prior to concrete placement, anchor bolts shall be accurately set according to the manufacturer's foundation drawings and firmly secured to prevent shifting during concrete placement. The bolts shall be embedded in the structural concrete to develop the full strength of the bolt. Concrete in housekeeping pads cannot be used for this purpose. All anchor bolts shall be dimensionally checked against the foundation drawings for proper length, diameter, thread length, thread projection, etc., by a representative of the equipment manufacturer prior to placing concrete. Prior to placing concrete for the housekeeping pad, plastic sleeves shall be placed around each bolt to provide for minor adjustment of bolt position prior to grouting. Sleeves shall be filled with a pliable, non-bonding material such as silicon rubber or wax to prevent contact between the concrete or grout and the anchor bolt. Bolt threads and projections in the sleeves (refer to paragraph 11002-2.6) above the structural slab shall be protected in the sleeve by heavily greasing or waxing the threads and shank with paste wax and wrapping with plastic sheeting. The protective wrapping shall be firmly secured with tie wires. The protective wrapping shall be removed prior to placing the grout.
2. The equipment manufacturer shall recommend the size of the anchor bolts for the equipment and shall also furnish the recommended tightening torque for the nuts; however, the minimum size bolt shall be 3/4 inch for equipment rated 20 to

100 horsepower, 1 inch for equipment rated over 100 to 300 horsepower and 1-1/4 inches for 300 to 500 horsepower.

B. CONCRETE HOUSEKEEPING PAD PREPARATION

1. After the concrete is fully cured (sample cylinders, as specified in Section 03300, shall be taken and tested for all housekeeping pads supporting equipment weighing more than 1,000 pounds), the housekeeping pad shall be chipped approximately 3/4" to 1", to remove all laitance and defective or weak concrete. A light duty, hand held pneumatic chipper with a chisel type tool shall be used for chipping the foundation. Abrasive blast, bush-hammer, jack hammers with sharp chisels or needle gun preparation of concrete surfaces to be grouted are not acceptable. The amount of concrete removed shall be such that the final baseplate or soleplate elevation results in not less than 3" of grout between the surface of the housekeeping pad and lower baseplate flange or the underside of the soleplate, unless shown otherwise on the Drawings.
2. All edges shall be chamfered 2" to 4" at a 45-degree angle. All dust, dirt, chips, oil, water, and any other contaminants shall be removed and the surface protected with plastic sheeting until grouting. The grout contact surface on the housekeeping pad shall be coated with one coat (not more than 5 mils) of catalyzed epoxy resin.

C. EQUIPMENT BASES AND SOLEPLATES

All surfaces of equipment bases and soleplates to be in contact with epoxy grout shall be cleaned to SSPC SP-6 and shall be primed with epoxy primer within 8 hours of cleaning.

D. LEVELING AND SHIMMING

1. All machinery shall be mounted and leveled by millwrights. All equipment bases and equipment shall be leveled against steel surfaces. Use of other materials for leveling purposes is strictly and specifically prohibited. Unless otherwise specified, baseplates, mounting blocks and soleplates weighing less than 1,000 pounds shall be leveled on stainless steel blocks 4 inches square and 1-1/2-inches thick with a hole drilled in the center for the anchor bolt, placed under the base at every anchor bolt. Jackscrews acting on flat steel plates shall be used for heavier components. Leveling shall be by use of leveling blocks machined flat on all horizontal surfaces and measuring not less than 4 inches wide horizontally

and shims that shall extend not less than three inches beyond the base of the equipment. Leveling blocks shall be coated with a light oil just prior to beginning the leveling and grouting work. Using precut stainless steel shims coated with a light oil between the base and the steel blocks at the anchor bolts, the Contractor shall level the equipment baseplates, soleplates or mounting blocks against the anchor bolt nuts to a maximum tolerance of 0.005 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Mounting surfaces for equipment shall be coplanar within 0.002 inch in any direction. The shims shall be placed so the tabs on the shims are easily accessible. A minimum of four shims per anchor bolt shall be used. The total shim thickness at each anchor bolt shall be at least 0.015 inch. Leveling shall be against anchor bolts prior to final grouting.

2. Leveling equipment shall be precision surveying equipment. Machinists' spirit levels will not be permitted for leveling purposes for any base plate or equipment foundation with a plan dimension greater than 4 feet.
3. Leveling nuts may be used for mounting equipment less than 500 pounds. The Contractor shall level the equipment against the anchor bolt nuts to a maximum tolerance of 0.005 in./ft or as otherwise required by the equipment manufacturer, if more stringent. Wedges will not be allowed.

E. GROUTING

1. Grout forms shall be built of minimum of 3/4-inch thick waterproof plywood and shall be securely braced (minimum brace size shall be 2" x 4"). Forms shall provide a minimum of 2-inch hydrostatic head above the final elevation of the grout, to assist in flow during installation.
2. Forms must be coated with three coats of paste wax on all areas that will come in contact with the grout to prevent the grout from bonding to the forms. Forms shall be waxed before assembly to prevent accidental application of wax to surfaces where the grout is to bond. Before any forms are installed, all concrete surfaces that will contact epoxy grout shall be free from any foreign material, such as oil, sand, water, grease, etc. Forms shall be liquid-tight. Any open spaces or cracks in forms, or at the joint between forms and the foundation, shall be sealed off, using sealant. All outside vertical and horizontal edges of the grout shall have 45-degree chamfers. Blockouts shall be provided at all shimming and

leveling nut positions to allow removal of shimming equipment after the grout has cured. Jackscrews shall be coated with a light oil or other acceptable bondbreaking compound.

3. The 45-degree chamfer strip shall be located at the final elevation of the grout. The final elevation of the grout on baseplates with exposed I-beam or C-channel supports shall be at the top of the lower support flange. The top of the grout, on baseplates with solid sides and soleplates, shall be 1.0 inch above the bottom of the baseplate or the underside of the soleplate. The grout's final elevation shall not be so high as to bond the anchor bolt nut and washer.
4. The epoxy resin and hardener shall be mixed in accordance with the grout manufacturer's recommendations. Aggregate shall be slowly added to the mixer one bag at a time. The grout should be mixed only long enough to wet out all the aggregate. Grout shall be placed at the center of one end of the baseplate or soleplate and worked toward the ends in such a manner as to force the air out from beneath the baseplate or soleplate and out the vent holes, to eliminate voids. The grout shall be placed in a manner that avoids air entrapment using a head box to pour grout into the grout holes. When the head box is moved to the next grout hole, a 6-inch high standpipe shall be placed over the grout hole and filled with grout. The Contractor shall exercise care to never allow the grout to fall below the baseplate level once the grout has made contact with the baseplate. Grout placement shall be continuous until the all portions of the space beneath the baseplate or soleplate have been filled. Subsequent batches of grout shall be prepared so as to be ready when the preceding batch has been placed. Under no circumstances shall the grouting operation be halted because of lack of grout mix. After the entire baseplate is full, 6-inch high standpipes shall be maintained over each grout hole, to continue purging of air. When the grout has started to take an initial set (determined by a noticeable increase in temperature and no flow of grout at the vent holes) the standpipes shall be removed and excess grout cleaned from all surfaces.
5. A grout sample shall be taken for each piece of equipment to be grouted. The sample shall be placed in a cylinder of sufficient size to yield three 2" x 2" x 2" test samples. The samples shall be tagged with the equipment number, ambient temperature at the time of placement. The samples shall be tested in accordance with the manufacturer's recommendations. Once the epoxy grout cylinder has been completely filled, it shall be placed next to the

foundation of the equipment being grouted and allowed to cure for 48 hours. After 48 hours, the test cylinder shall be tested in accordance with the grout manufacturer's recommendations by an independent testing laboratory. The results shall be reported directly to the Project Representative. Forms shall be removed only after the grout has cured sufficiently and upon specific permission from the Project Representative.

F. COMPLETION

Upon acceptance by the Engineer and the equipment manufacturer's representative after the grout has reached sufficient strength, the shims shall be removed, or leveling nuts or jack screws backed off to allow the grout to fully support the equipment base, leveling block or soleplate. Removal of extended shimming material (direct mounted baseplates weighing 1,000 pounds or less) shall be by sledge hammer, taking care not to damage the grout. The anchor bolts shall be torqued, using calibrated indicating torque wrenches, to develop the full clamping force required by the equipment manufacturer. Anchor bolts shall be torqued in increments of not more than 25 percent of final value in an alternating pattern to avoid stress concentration on the grout surface. Pockets for access to shims, mounting blocks, or leveling nuts shall be filled with grout mix and pointed after the anchor bolts have been torqued to final values.

***** END OF SECTION *****

SECTION 11010

VIBRATION AND CRITICAL SPEED LIMITATIONS

PART 1 GENERAL

1.1 SCOPE

- A. This Section specifies vibration and critical speed limitations for rotating equipment. Individual equipment Specifications Sections may specify more stringent requirements which shall then govern. Submittals for field-testing are only required when specified in the individual equipment Specifications.
- B. This specification outlines the basic standards for acceptance of equipment. Any equipment demonstrating levels above these limits shall be repaired, modified or replaced at the Contractor's expense as determined by the Engineer.
 - 1. General Equipment
 - a. No narrow band spectral vibration amplitude components, whether sub-rotational, higher harmonic, or synchronous multiple of running speed, are to exceed 40 percent of synchronous vibration amplitude.
 - b. The presence of discernible vibration amplitude peaks or vibration spectra at a bearing inner or outer race frequencies shall be cause for rejection.
 - 2. Electric Motors
 - a. Stator eccentricity evidenced by a spectral peak at 2 times electrical line frequency that is more than 40 percent of the peak at rotational frequency.
 - b. Rotor eccentricity evidenced by a spectral peak at 2 times electrical line frequency with spectra side bands at the pole pass frequency around the 2 times line frequency peak.
- C. This specification covers requirements for calculating expected vibration resonances.
- D. This specification covers requirements for on-site field testing of vibration of the installed equipment and reporting the test results.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning and Training
Division 11	Equipment
Division 14	Conveying Systems
Division 15	Mechanical

1.3 QUALITY ASSURANCE

A. REFERENCED STANDARDS

This Section incorporates by reference the latest revision of the following documents. It is a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
AGMA 6000-B96	Measurement of Linear Vibration of Gear Units
ANSI/HI 9.6.4	American National Standard for Centrifugal and Vertical Pumps for Vibration Measurements and Allowable Values

B. HYDRAULIC INSTITUTE STANDARDS

The current Hydraulic Institute Standards are in process of revision. The standards outlined below shall apply except as modified by other Sections of the contract.

C. INSTRUMENTATION

Provide necessary test instrumentation which has been calibrated within one year from date of test to recognized test standards traceable to the national Institute of Standards and Technology, Washington DC or approved source.

D. TESTING QUALIFICATIONS

Tests shall be performed by an experienced vibration analysis expert who shall interpret the results against this specification and provide

recommended acceptance or modification requirements to the Project Representative.

1.4 SUBMITTALS

A. PROCEDURES

See Section 01300 for submittal requirements.

B. The following information shall be provided when specified in the individual equipment Specification Sections:

1. Test plan as outlined in Section 01800.
2. Test data report sheets for each piece of equipment showing mounting location of test instruments.
3. Manufacturer's certified calculations and data showing location of critical speeds in relation to the operating speeds.
4. Any deviation from the vibration or critical speed standards shall be noted on the submittal cover sheet and approved prior to release for manufacture.
5. Test equipment calibration certificates.

1.5 FIELD VIBRATION TESTING

A. GENERAL

Equipment testing for vibration and natural frequencies shall be conducted with equipment, installed, grouted and operational. Test instrumentation shall be portable, temporarily mounted or permanently installed components if suitably calibrated for the test measuring and recording instruments.

B. DEFINITIONS

1. Peak to Peak Displacement

Root Mean Square (RMS) average of the peak to peak displacement multiplied by the square root of 2.

2. Peak Velocity

RMS average of the peak velocity multiplied by the square root of 2.

3. Peak Acceleration

RMS average of the peak acceleration multiplied by the square root of 2.

4. High Frequency Enveloping

A process to extract very low amplitude time domain signals associated with impact or impulse events such as bearing or gear tooth defects and display them in a frequency spectra of acceleration versus frequency. Typical manufacturers' notation is "Spike Energy" by Rockwell Automation, (Entek/IRD) or "PeakVue" by CSI.

5. Low Speed Equipment

Equipment or components rotating at less than 600 rpm.

6. Convert Velocity to Displacement

$$D = 19,100 * V / F$$

D is the peak-to-peak displacement in mils.

V is the peak velocity in inches per second.

F is the frequency in cycles per minute.

C. TEST REQUIREMENTS

1. Measure filtered vibration spectra for peak velocity, peak to peak displacement versus frequency and measure vibration phase in three perpendicular planes at each normally accessible bearing housing on the driven equipment, gear or clutch assembly and the driver. One plane of measurement shall be parallel to the axis of rotation of the component. Measure rotational speeds using a photometric or other tachometer with input directly to the vibration data collector.

2. Fixed speed equipment shall be operated at the design operating condition during the test recording. Variable speed equipment shall be tested to establish performance over the entire speed range.
3. Field test for natural frequency: Excite the installed equipment and support system in three perpendicular planes. Use the same locations as used for vibration tests above. Determine the natural resonant frequency of the driver, clutch or gear, driven equipment and supports.

1.6 VIBRATION ACCEPTANCE CRITERIA

A. VIBRATION DISPLACEMENT LIMITS – PUMPS

Unless otherwise specified, pumping equipment shall not exceed the following Unfiltered Overall Peak-to-Peak Amplitudes (mils).

<u>Operating Speed (rpm)</u>	<u>Non-Clog Pumps</u>	<u>Clean Fluid Pumps</u>
0 – 300	6.0	6.0
301 – 600	5.0	5.0
601 – 900	4.0	3.0
901 – 1,200	3.5	2.0
1,200 – 1,500	3.0	1.8
1,501 – 1,800	2.5	1.5
1,801 – 2,400	2.0	1.0
2,401 – 3,000	1.5	0.8
3,001 – 3,600	1.3	0.7
over 3,600	1.2	0.6

Note: Axial shaft placement is not to exceed 50 percent of the maximum radial shaft displacement relative to the casing.

B. VIBRATION VELOCITY LIMITS

Unless otherwise specified, equipment shall not exceed the following peak velocities (inches/second).

<u>Equipment</u>	<u>Unfiltered Overall Limit</u>	<u>Any Filtered Peak Limit</u>
Non-Clog or Mixed Flow Pumps Clean Fluid	0.35	0.25
Multi-Vane Pumps	0.25	0.20
Motors	0.25	0.20
Steady Bearings	0.25	0.20

Centrifugal Blowers	0.15	0.10
Gear Reducers	< AGMA 6000-B96 limits	
Other Equipment, Radial	0.16	0.10
Other Equipment, Axial	0.10	0.10

1.7 CRITICAL SPEED REQUIREMENTS

A. GENERAL REQUIREMENT

1. No narrow band spectral vibration amplitude components, whether sub-rotational, higher harmonic, or synchronous multiple of running speed, are to exceed 40 percent of synchronous vibration amplitude.
2. The presence of discernible vibration amplitude peaks or vibration spectra at a bearing inner or outer race frequencies shall be cause for rejection.

B. ELECTRIC MOTORS

1. Stator eccentricity evidenced by a spectral peak at 2 times electrical line frequency that is more than 40 percent of the peak at rotational frequency.
2. Rotor eccentricity evidenced by a spectral peak at 2 times electrical line frequency with spectra side bands at the pole pass frequency around the times line frequency peak.

C. Unless otherwise specified, rotating mechanical equipment shall satisfy the following:

1. First critical speed of the constant, variable, and 2-speed driven equipment is to be at least 25 percent above the maximum operating speed or 25 percent below the minimum operating speed.
2. Second critical speed of any 2-speed or variable speed equipment is to be at least 25 percent above or below the maximum operating speed or 25 percent below the minimum operating speed.

D. Critical speeds for equipment with flexible shaft-rotor systems shall be at least 15 percent below the minimum operating speed and 20 percent above maximum operating speed.

PART 2 PRODUCTS

2.1 VIBRATION INSTRUMENT REQUIREMENTS

A. ANALYZERS

Use digital type analyzers or data collectors with anti-aliasing filter, 12 bit A/D converter, fast Fourier transform circuitry, phase measurement capability, time wave form data storage, high frequency enveloping capabilities, 35 frequency ranges from 21 to 1,500,000 cycles per minute, adjustable fast Fourier transform resolution from 400 to 6400 lines, storage for up to 100 - 3200 line frequency spectra, RS232C data output port, circuitry for integration of acceleration data to velocity or double integration to displacement.

1. Manufacturers

- a. Entek-IRD, Division of Rockwell Automation, Enpac1200 with applicable data analysis software or Entek Model 838 analyzer with built in printer.
- b. Computational Systems Inc., (CSI) Division of Emerson Electric, Model 2120A, Data Collector/Analyzer with applicable analysis software.

B. ANALYZER SETTINGS

1. Units

English, inches/second, mils and g's.

2. Fast Fourier Transform Lines

Most equipment 1600 minimum. Motors require enough lines to distinguish motor current frequencies from rotational frequencies. Use 3200 lines for motors with a nominal speed of 3,600 rpm, 3200 lines minimum for High Frequency Enveloping and 1600 lines minimum for low speed equipment.

3. Sample Averages

Four minimum.

4. Maximum Frequency (Fmax)
 - a. 40 times rotational frequency for rolling element bearings.
 - b. 10 times rotational frequency for sleeve bearings.

5. Amplitude Range

Auto Select. Full scale shall not be more than twice the acceptance criteria or the highest peak, whichever is lower.

6. Fast Fourier Transform Windowing

Hanning Window.

7. High Pass Filter

Minus 3 dB at 120 cycles per minute for high-speed equipment.
Minus 3 dB at 21 cycles per minute for low speed equipment.

C. ACCELEROMETERS

1. Low Speed Equipment

Low frequency, shear mode accelerometer, 500 millivolts per g sensitivity, 10 g range, +/- 5 percent frequency response from 0.5 hertz to 850 hertz, magnetic mount.

- a. Manufacturers
 - i. Wilcoxon Research, model 797L.
 - ii. PCB, Model 393C.

2. High Speed Equipment

General purpose accelerometer, 100 millivolts per g sensitivity, 50g range, +/- 2 dB. Frequency response range from 2 hertz to 12,000 hertz when stud mounted or magnetic mount.

- a. Manufacturers
 - i. Wilcoxon Research, Model 793.
 - ii. IRD Model 943.

PART 3 EXECUTION

Not Used.

***** END OF SECTION *****

SECTION 11313

SUBMERSIBLE CENTRIFUGAL PUMPS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing one new submersible non-clog centrifugal pump with guide rails, supports, discharge connection elbows and frames, lifting cable or chains, and any other appurtenances required for a complete and workable system, as shown on the Plans and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
11000	Equipment General Provisions
11002	Equipment Mounting, Supports, Grouting and Installation
11010	Vibration and Critical Speed Limitations
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Scum Pump 2	07 SCP 02

1.4 PERFORMANCE REQUIREMENTS

The submersible pumps shall be capable of meeting the following performance requirements.

Parameter	Performance Requirement
Scum Pump 2	
Design capacity (gpm)	120
Design head (feet)	13
Maximum, shut-off head (feet)	29
Discharge size (inches)	3

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the Contract, the pump manufacturer shall provide an extended warranty covering defects in material and workmanship for 5 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The submersible centrifugal pumps shall be Flygt Model NP 3085 SH 3 454 or equal.

2.2 PUMPS

The pumps shall be capable of handling raw domestic wastewater. The discharge connection elbow shall be permanently installed in the wet well along with the connection elbow and discharge piping. The pumps shall be automatically connected to the discharge connection when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the pump well. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pumping unit shall be guided by no less than two guide bars and pressed tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the sump or wet well. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. Only single electrical cable pump design shall be acceptable.

Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes and other irregularities. Where watertight sealing is required, O-rings made of nitrile rubber shall be used. All exposed nuts and bolts shall be Type 304 stainless steel or better. All surfaces coming into contact with sewage, other than stainless steel or the impeller, shall be protected by a sewage resistant coating as specified.

Each pump shall include heavy-duty submersible cable of sufficient length to reach the junction box with the motor installed. The pump motor cable installed shall be listed and labeled for submersible pump application with P122-MSHA approval, and this shall be indicated by a code or legend permanently embossed on the cable. The cable shall meet Washington State Department of Labor and Industry requirements for submerged installation in a wet well, exposed in a wet well, and/or installed in conduit. Cable sizing shall conform to NEC requirement for pump motors. Cable length shall be adequate to connect without splicing, to the junction box, motor controller, or other enclosure, as shown on the Plans where the cable will be spliced to other conductors or connected to a device or equipment plus additional 8-foot length to be coiled at the access hatch.

The cable entry water seal design shall be sealed in a manner to guarantee complete waterproof protection. To ensure maximum motor protection, the pump cable entry design shall ensure that no entry of moisture internal to the pumps terminal board and/or motor is possible even if the cable is damaged or severed below water level. The cable entry shall be designed in a manner to relieve strain in the cable at the point of entry to the pump. The cable entry shall consist of dual cylindrical elastomer sleeves, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide an easy method of disconnecting and reconnecting the cable when necessary using the same entry seal. Epoxy potted cable entries which require the cable to be cut to disconnect the pump from the cable are not acceptable.

A moisture sensor shall be provided in the stator cavity to detect the presence of moisture in the stator chamber. This sensor shall be for alarm purposes only.. This use of the moisture sensor shall not void the manufacturer's pump or motor warranty.

The pump shaft shall be stainless steel in accordance with ASTM A479 S43100-T. The pump shaft shall rotate in upper and lower rolling element bearings. These bearings shall be permanently grease lubricated and rated for a nominal L10 lifetime of 50,000 hours.

2.3 MECHANICAL SEALS

Each pump shall be equipped with two tandem mechanical rotating shaft seals each operating independently. The seals shall be oil lubricated in a separate chamber located between the pump and motor. The seal system shall not rely on the pumped media for lubrication. The pump seal for each pump shall contain one stationary and one rotating tungsten carbide ring. The motor seal shall contain one stationary and one rotating tungsten carbide ring.

Each mechanical seal shall be equipped with its own independent stainless steel spring system, requiring neither maintenance nor adjustment and shall be easily replaceable.

Shaft seals without rotating members or conventional double mechanical seals containing a common spring which require a pressure differential to offset external pressure and effect sealing are not acceptable.

The oil chamber shall be designed to assure that air is left in the oil chamber to compensate for the expansion of the oil due to temperature variations. The drain and inspection plugs, with positive anti-leak seals, shall be easily accessible from the outside.

2.4 IMPELLER

The impeller shall be of 25 percent chrome cast iron (ASTM A532 Alloy IIIA) dynamically balanced, semi-open, multi-vane, back swept, screw-shaped non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal sewage applications. The screw shape of the impeller shall provide induction effect for the handling of up to 5 percent sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft and held by an impeller bolt.

2.5 WEAR RING

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel, or hard stainless steel ring insert that is drive fitted to the volute inlet.

2.6 VOLUTE

The pump volute shall be gray cast iron, ASTM A48, Class 35B, single piece design and shall have smooth fluid passages capable of handling all pumped media which flows through the impeller. Each volute shall be furnished with a replaceable wear ring or wear plate.

2.7 PUMP GUIDES, RAILS, AND HOISTS

Lower guide bar holders shall be integral with the pump discharge connection. Guide bars shall be ASTM A276 standard weight Type 316 stainless steel pipe of the size required by the pump manufacturer. The guide bars shall not support any portion of the weight of the pump. Guide bar brackets, including intermediate guide bar brackets shall be the pump manufacturer's standard design and shall be Type 316 stainless steel. Each pump shall be furnished with sufficient length of Type 316 stainless steel cable grip-eye and safety chain to be used with a hoisting system for pump removal. Guide cables in lieu of rails shall not be accepted.

Provide each pump with the indicated manufacturer's accessories as identified by the following list. Type and size shall be as recommended by the manufacturer. All accessories shall be constructed of Type 316 stainless steel. For convention of terminology, the items listed are as described by Flygt Corporation; comparable and equal accessories by the other named manufacturers are acceptable.

- A. Safety chain clip.
- B. Cable support grip.
- C. Eye bolt (Type 316 stainless steel) for safety chain.

Each pump shall be furnished with a "grip eye" system. The system shall consist of a sufficient length of nylon line for the application, short length of high tensile strength proof-tested Type 316 stainless steel chain and forged steel "grip eye" for use with mechanical lifting device. System shall be appropriately sized for the weight of the pump to be lifted.

2.8 MOTORS

The motors shall be an induction type with squirrel cage rotor and housed in an air-filled watertight chamber. The stator winding and stator leads shall be insulated copper with moisture resistant, Class F rated 311 degrees F (155 degrees C) insulation or Class H rated 356 degrees F (180 degrees C) insulation. The stator shall be dipped and baked three times in Class F varnish or insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95 percent. The stator core shall be

constructed of high silicon steel laminations to minimize eddy current losses. The stator core laminations shall be heat-shrunk fitted into and locked to the stator housing to obtain the maximum heat transfer. Bolts, pins, or other fastening devices that may leak during operation are not permitted to hold or locate the stator. The motor shall be designed for continuous duty and capable of sustaining 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be cast of aluminum and be able to withstand, without damage, centrifugal loads at twice-rated speed.

The motors for the Pumps shall be rated at a maximum of 2.2 hp, 1,800 rpm synchronous speed (4 pole), 460V submersible electric motor, connected for operation on a 480 Volt, 3 phase, 60 Hz service.

The motor nameplate horsepower (excluding service factor) shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shutoff to run-out. The Pump motors shall be listed as suitable for installation in a Class I Division 1 Group D (hazardous) location.

The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the motor windings. Detectors shall be suitable for operation with 120-volt AC control circuits, Klaxon or equal. The sensor shall have insulated conductor leads brought out with the pump cable and connected to a thermal-sensing device that will shut down the motor in the event of a high-winding temperature condition.

A moisture sensor shall be provided in the stator cavity to detect the presence of moisture in the stator chamber. This sensor shall be for alarm purposes only and shall not be used to shut the pump off. This use of the moisture sensor shall not void the manufacturer's pump or motor warranty.

A thermal sensor and moisture sensor monitoring device shall be provided with each pump for mounting in the electrical equipment supplied under Division 16. The monitoring device shall be supplied to the equipment supplier for mounting in the electrical equipment. The Contractor shall coordinate the delivery of the monitoring device to the equipment supplier. The device shall be UL recognized and shall operate from 120 Vac. It shall monitor the thermal sensors and the moisture sensor and shall operate two independent dry contacts each rated at 2 amps, 120 VAC if either the motor winding temperature or the moisture level exceeds their respective setpoints. It shall release the associated contact when the temperature or moisture level falls below the setpoint value or a reset button is pushed.

The motors shall be manufactured and assembled by the pump manufacturer. The motor shall be designed for operation in 104 degrees F (40 degrees C) ambient temperature and with a temperature rise not to exceed 144 degrees F (80 degrees

C) (total maximum temperature allowed 248 degrees F (120 degrees C). The motor shall be provided with performance curves showing torque, current, power factor, input kW/output kW, and efficiency with data on starting current and locked rotor current.

The motors shall be sufficiently cooled by the surrounding environment and pumped media. Pumps that require water jackets for cooling shall not be allowed.

Motors shall meet the electrical requirements of WAC 296-46B-430, "Motors, motor circuits and controllers, 007 Markings on motors and multi-motor equipment".

If any motor fails during the warranty period, the Contractor shall replace the pump with a new pump.

2.9 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION (SEE SECTION 11000-2.9)

Motor overcurrent protection shall be sized by the motor manufacturer. The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc., for inclusion in the O&M manuals.

The Contractor shall record the size and/or settings of each motor protective device and drive configuration.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite.

Spreadsheet of motor nameplate information, motor settings, drives configuration (if applicable), and photo of each nameplate shall be included in the O&M manuals.

2.10 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes.

In addition, one set of tools required to disassemble and reassemble each pump model shall be provided. The tool sets shall be supplied with a heavy metal portable toolbox with a padlock hasp.

2.11 PAINTING

Pumps, motors, and accessories shall be factory painted in accordance with Section 09900-2.2A of these Specifications.

2.12 FACTORY TESTING

The pump manufacturer shall perform the following inspections and tests on each pump before shipment from the factory:

- A. Impeller, motor rating, and electrical connections shall first be checked for compliance to the customer's purchase order.
- B. A motor and cable insulation test for moisture content or insulation defects shall be made.
- C. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
- D. The pump shall be run 30 minutes submerged, at a minimum depth of 6-feet underwater. Record motor amps during test.
- E. After 30 minute operational pump test (4), the insulation test (2) shall be performed again.

A written report stating the foregoing steps have been performed shall be supplied with each pump at the time of shipment. Failure to comply with this requirement or the failure of the pumps to meet the stated performance requirements shall result in rejection of the pumps by the Engineer.

PART 3 EXECUTION

3.1 INSTALLATION

Submersible pumps shall be installed as shown on the Plans and in strict accordance with pump manufacturer's instructions and recommendations. Pump base shall be installed using Type 316 stainless steel fasteners. All pumps shall be checked for rotation prior to operation.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

Each pump shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Voltage, amperage draw on each phase of power, flow capacity, discharge pressure and other significant parameters shall be recorded. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the equipment manufacturer shall be provided by the Contractor. Services shall include 2 days (two visits) onsite for the supervision of equipment startup, testing, and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip (1 day) shall be for installation inspection, certification, and testing; and one trip (1 day) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 5 years of equipment operation.

***** END OF SECTION *****

SECTION 11319

DRY-PIT CENTRIFUGAL PUMPS

PART 1 GENERAL

1.1 SCOPE

There shall be furnished and installed one new horizontal close-coupled non-clog centrifugal pump in the RAS/WAS Pump Station as shown on the Plans and specified herein. This pump shall pump return activated sludge from the RAS/WAS Pump Station to the Aeration Basins.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
11000	General Requirements for Equipment
11002	Equipment Mounting, Supports, Grouting and Installation
11010	Vibration and Critical Speed Limitations
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Return Activated Sludge Pump 4	06 RP 04

1.4 PERFORMANCE REQUIREMENTS

The pump shall be capable of meeting the following performance requirements.

<u>Capacity</u>	<u>Total Head (Feet)</u>
Shut off, 0 gpm @ 875 rpm	54
Design operating point, 2,250 gpm @ 875 rpm	14
Secondary operating point, 1,750 gpm @ 671 rpm	9

1.5 PUMP WARRANTY

The pump manufacturer shall warrant the units being supplied to the Owner against defects in workmanship and material for a period of 5 years or

10,000 hours under normal use, operation, and service. The warranty shall be in printed form and apply to all similar units.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The pump shall be Cornell Model 8NHTA horizontal close-coupled pumps with 14.38-inch diameter impellers. Because of standardization of equipment by the City of Puyallup, no other pump manufacturer will be acceptable.

2.2 PUMPS

Pumps shall be equipped with enclosed, non-clog type, close-grained gray iron impeller, and statically and dynamically balanced. The pump shall be capable of passing 3.38-inch diameter non-compressible spheres. The impeller shall be keyed and securely fastened to a stainless steel lock screw or locknut. Pumps shall have an inspection opening in the discharge of the casing.

Each pump shall be coupled to its driving motor by a gray iron bracket with machined rabbit fits and by flexible coupling. Pump shaft shall have renewable stainless steel shaft sleeve and shall be supported by sealed ball bearings in a one-piece gray iron bearing frame. Each pump shall be supported by a gray iron stand with suction elbow having a cleanout opening.

The pump casing shall be of back pull-out design with heavy sections to provide long life under abrasive and corrosive conditions, fine grain cast iron ASTM A48, Class 30 with suction and discharge to be ASA 125# flat face flanges. An optional bolted and contoured cleanout plug shall be provided on the volute to facilitate maintenance. All mating surfaces shall have a register fit to insure proper alignment.

The impeller shall be of heavy section cast iron ASTM A48, Class 30. Impellers shall have back vanes to reduce axial thrust and lower the stuffing box pressure. Internal vane edges shall be well rounded to present smooth flow. Impeller shall have a straight non-tapered bore, be dynamically balanced, and will be keyed to the shaft and further secured with a stainless steel washer and a heat-treated alloy steel impeller lock screw.

The Return Activated Sludge Pumps shall be supplied with a backplate constructed of ASTM A48 Class 30 Grey Iron and shall include a double mechanical seal, John Crane Type 21 or equal, of material code BP1C1. The design shall include provision for accepting seal flush water and a drain to pressurize, cool and lubricate the seal.

The bearings shall be grease lubricated with fittings provided to facilitate lubrication.

2.3 MOTOR

Motors shall be by Baldor, US Motors, Reliance or Toshiba/Houston. No other manufacturers shall be accepted.

The motor shall be a standard TEFC electric induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI IEEE standards. Motor shall be constructed with Class F insulated windings, Design B, 30,000 anti-friction AFBMA hour rated bearings, cast iron frame and end bells. The motor shall be rated at a minimum of 20 hp, 460 volts AC, 3 phase 60 Hz, 900 rpm synchronous speed (8 pole), continuous duty at 40 degrees C ambient air temperature with a 1.15 service factor.

Motor shall be labeled and listed by a recognized electrical testing laboratory for the application, or approved by the Washington State Department of Labor and Industries for installation on the project.

Motors shall be rated "Inverter Duty" suitable for operation with the variable frequency drives specified in Division 16, Electrical, and shall be coordinated with the thermal, electrical, and mechanical characteristics of the drives actually supplied. Motors shall be suitable for operation on a PWM drive with output to the motor conditioned by a reactor or filter as shown on the electrical drawings. These motors shall comply with NEMA MG-1 Parts 30 and 31. Motor insulation shall be rated for high dV/dt (2,000 volts minimum) for VFD operation.

The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the windings. Detectors shall be suitable for operation with 120 volt AC control circuits, Klaxon or equal. These sensors shall have insulated conductor leads brought to the motor terminal box and shall be suitable for wiring as a permissive in the motor starting circuit.

Provide breather and drain to vent enclosure and drain condensation. Provide grounding terminal box.

Motors shall meet the electrical requirements of WAC 296-46B-430, "Motors, motor circuits and controllers, 007 Markings on motors and multi-motor equipment."

Motors shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) table 14-4B, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

2.4 MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION (SEE SECTION 11000-2.9)

The Contractor shall maintain a spreadsheet or database tabulation of the motor and load characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. This spreadsheet shall also include any additional information needed to setup, program or adjust the variable frequency drive which serves motor driven equipment such as minimum and maximum equipment or motor speed, acceleration/deceleration time of the driven equipment such as pumps, compressors, blowers, etc. The spreadsheet shall be sent with each equipment submittal for motor driven equipment and shall be updated to reflect the most current motor and driven equipment information for the submitted equipment. The updated spreadsheet shall be provided to the variable frequency drive suppliers prior to shop testing of the VFDs. The spreadsheet list shall have the following information as a minimum:

Motor and Driven Equipment Characteristics			
Motor Data:	Full Load Amps		Amps
	Nominal Motor Voltage		Volts
	Nominal Motor Frequency	60	Hertz
	Nominal Motor Speed		RPM
	Input Phase Loss Behavior	Fault	
	Recommended Stopping Mode (i.e. coast, brake etc.)		
Driven Equipment Data:	Maximum Motor Frequency		Hertz
	Minimum Motor Frequency		Hertz
	Acceleration Time		seconds
	Deceleration Time		seconds

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite. Each digital photo shall be emailed to the Owner’s Resident Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data on a revised motor characteristic spreadsheet.

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments of the motor characteristics and include in the list described in the preceding paragraph.

2.5 PUMP TESTS

A. FACTORY TESTS

The pumps shall be fully tested on water at the manufacturer's plant before shipment. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve. Certified copies of test curves and report shall be submitted to the Engineer prior to shipment. The Standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

B. SITE TESTS

Each pump shall be tested at startup, and voltage, current, capacity, and other significant parameters recorded. The manufacturer shall provide a formal test procedure and forms for recording data.

2.5 SPARE PARTS

One set of manufacturer's spare pump parts shall be provided in labeled, wood boxes, with moisture protection and contents labeled for each pump. The following spare parts shall be provided and stored in protective containers.

Gaskets	1 set
Wear ring	1 each
Impeller nut	1 each
Locking set screw	1 each
Impeller key	1 each
Bearings	1 set
Snap rings	1 set
Grease seal	1 each
Grease retainer	1 set
Shaft sleeve	1 each
Mechanical seal	1 each

2.6 PAINTING

Pumps and motors shall be painted in accordance with Section 09900 (2.2 C) of these Specifications.

2.7 VIBRATION

Vibration and critical speed limitations shall be in accordance with Section 11010 and as set forth in the Standards of the Hydraulic Institute.

2.8 DATA PLATES

All data plates shall be of stainless steel suitably attached to the pump. Data plates shall contain the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data.

A special data plate shall be attached to the pump frame which shall contain identification of frame and bearing numbers.

PART 3 EXECUTION

3.1 GENERAL

Pumps shall be installed as shown on the Plans and in strict accordance with pump manufacturer's recommendations. Pumps bases shall be securely anchored to the concrete equipment pad using stainless steel bolts and stainless steel expansion anchors.

The RAS pumps shall be mounted in the horizontal position with the motor direct coupled. The scum pumps shall be mounted in the vertical position with the motor direct coupled.

All pumps shall be checked for rotation prior to operation. When pumps are put into service, amperage draw on each phase of power shall be checked and recorded immediately. The results of these tests shall be submitted to the Owner.

3.2 MANUFACTURER

The services of a factory trained representative of the pump manufacturer shall be provided. Services shall include two days (two visits) on site for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment, and the cost of these services shall be included in the bid price. The representative shall be available for two additional service calls during the 5-year guarantee period in addition to the 30-day commissioning time after pump acceptance.

***** END OF SECTION *****

SECTION 11337

SECONDARY CLARIFIER MECHANISMS

PART 1 GENERAL

1.1 SCOPE

There shall be furnished and installed equipment for one (1) circular center feed secondary clarifier mechanism as shown on the Plans and specified herein.

The equipment shall include a center drive unit and torque control, walkway and platform with handrail, stationary center influent column, energy dissipating inlet (EDI), center feedwell, rotating drive cage, rake arms with spiral blades, scum skimmer, scum box, effluent weir, scum baffle, sludge collection ring, anchor bolts, and all other appurtenances required or shown on the Plans for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
05500	Miscellaneous Metals
09900	Painting
11000	General Requirements for Equipment
11002	Equipment Mounting, Supports, Grouting and Installation
11010	Vibration and Critical Speed Limitations
11340	Clarifier Algae Sweep System
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Secondary Clarifier Mechanism 3	07 SCM 03

1.4 PERFORMANCE REQUIREMENTS

The secondary clarifier shall be meet the following design conditions, based on projected buildout flows that are higher than the currently permitted capacity of the WWTP:

	Normal Operation <u>Three Clarifiers</u>	Emergency Operation Two Clarifiers <u>At 75% Flow</u>
Total Flow Rate (w/o recycle) (mgd)		
Design	5.16	5.80
Maximum Day	11.02	12.40
Peak Hour	13.50	15.19
Surface Loading (gpd/ft ² .day)		
Design	543	610
Peak Hour	1,421	1,599
Solids Loading (lbs/ft ² /day)		
Design	16.53	18.60
Peak Hour	41.74	46.96
Recycle Rate (mgd)		
Design	1.45	1.64
Peak Day/Hour	3.19	3.59
MLSS (mg/l)	2,850	
SVI	100	
Tank Diameter (ft)	110	
Side Water Depth (ft)	16	
Freeboard (ft)	2	
Dispersion Well Diameter (ft)	9	
Dispersion Well Depth (ft)	3.5	
(includes 6-inch freeboard)		
Feedwell Diameter (ft)	30	
Feedwell Depth (ft)	6	
(includes 6-inch freeboard)		
Scum Box Width (ft)	5	
Motor Horsepower	1	
Design Running Torque (ft-lb)	45,500	
Momentary Peak Torque (ft-lb)	91,000	
Minimum Ball Race Diameter (in)	47	
Drive overturning moment (ft.-lbs.)	450,000	

Note that the tank, dispersion well, feedwell, and scum box dimensions as well as criteria for the clarifier drive are represented as equal sizing to the parameters for the existing clarifiers.

1.5 EXPERIENCE REQUIREMENTS

The equipment supplier shall have at least 15 years experience in the design, application, and supply of circular clarifiers in water or wastewater treatment plants and shall submit a list of not less than 25 operating installations of clarifiers with spiral rake blades and EDI as evidence of meeting the experience requirement. This experience shall be evidenced by process performance data that is submitted showing actual data on a minimum of five existing installations that are operating successfully as required in the submittal section.

To show evidence of being able to provide the quality of equipment and services described in this specification, the equipment supplier shall submit their ANAB-accredited ISO 9001 quality system certification. AIAO-BAR accredited systems are not a recognized equivalent and are therefore specifically prohibited. The quality procedures shall provide for a means of qualifying all sub-vendors and shall specify that the fabrication facility is a critical vendor and shall require inspection. The quality system shall be audited on-site by a third-party independent registrar at least annually. Certification shall remain in effect throughout the project start-up. Mechanism shall be manufactured according to requirements of Machinery Directive 98/37/EC.

1.6 WARRANTY

A written supplier's warranty shall be provided for the equipment specified in this section. The warranty shall be for a minimum period of 5 years from Substantial completion. Such warranty shall cover all defects or failures of materials or workmanship which occur as the result of normal operation and service except for normal wear parts (i.e., squeegees, skimmer wipers, etc.).

1.7 SUBMITTALS

Two copies of all materials required to establish compliance with these specifications shall be submitted for review. Submittals shall include at least the following:

- A. Certified general arrangement drawings showing all important details and materials of construction, dimensions, loads on supporting structures, and anchor bolt locations.
- B. Descriptive literature, bulletins, and/or catalogs of the equipment.
- C. Complete data on motors and speed reducers.
- D. Wiring diagrams and electrical schematics for all control equipment to be furnished.

- E. Calculations documenting the AGMA rating of the drive unit and life of the main bearing; prepared and signed by a registered professional engineer.
- F. Complete descriptive information and electrical schematic for the torque overload device.
- G. Complete sludge transport calculations substantiating the rake blade design, rake tip speed, and floor slope.
- H. Complete process calculations substantiating the sizing of the center column and ports, EDI and outlets, and outer feedwell. These calculations shall be based on parameters from the manufacturers operating experience. These parameters shall be verified by data presented from successful operating installations. Side by side comparison testing of EDI and feedwell design from existing operating clarifiers that have spiral rake blades and are products of the manufacturer shall be presented with the calculations.
- I. Calculations showing withdrawal rates and headlosses of the sludge withdrawal ring.
- J. The submittal shall include data from a minimum of five successfully operating installations that verify the experience of the manufacturer. Data shall include performance verification of influent flow rate (Q), hydraulic loading (OFR), effluent suspended solids (ESS), return sludge solids concentration (RSS), return activated sludge flow rate (RAS) for secondary clarifiers, and waste sludge flow rate (WAS).

1.8 SHOP ASSEMBLY AND INSPECTION

The equipment specified herein shall be factory assembled as far as practical to verify that all mating parts can be field assembled. All mating parts shall be trial fit and match-marked. The manufacturer shall submit certification of shop trial assembly and photographs of assembly before shipment. The customer and installing contractor shall be given the opportunity to witness the shop assembly.

Shop inspection shall be performed by a qualified inspector and certified by the manufacturer. The inspection shall be documented, and all deficiencies noted, corrected, reinspected and final completion formally authorized. Final shipment authorization shall be by the manufacturer to ensure completion of all fabrication, assembly, and inspection requirements. Inspection records and evidence of inspector qualification shall be submitted to the owner upon request.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The clarifier equipment specified in this section shall be as manufactured by WesTech Engineering, Inc. Because of standardization of equipment by the City of Puyallup, no other manufacturer will be acceptable.

2.2 GENERAL DESIGN

A. DESCRIPTION

1. The clarifier mechanism shall be of the center drive type, supported on a stationary influent column, with the flow entering at the bottom of the influent column and flowing upward into the energy dissipating inlet. The flow shall then proceed into the feedwell through gates arranged for impinged flow near the water level for further energy dissipation and settling. The clarifier shall be designed to remove settled sludge from the bottom of the tank and floating scum from around the periphery of the tank.
2. The clarifier shall perform the following integrated functions:
 - a. Dissipate energy and control localized currents.
 - b. Separate solids from the clear liquid.
 - c. Evenly withdraw the clear liquid.
 - d. Transport and thicken settled sludge.
 - e. Prevent sludge dilution at withdrawal point.
 - f. Remove scum from the clarifier surface.

B. MATERIALS

All structural steel shall conform to AISC – Steel Construction Manual latest edition. All steel plates shall conform to ASTM A36. All structural steel shape series of M, MT, S, ST, C, MC, and L shall conform to ASTM A36. Structural steel shapes W, WT, HP shall conform to ASTM A992/A572. All pipe shall be ASTM A53, Grade B. All square and rectangular tubing shall be ASTM A500, Grade B, unless otherwise noted. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of 1/4 inch unless

otherwise noted. All aluminum shall be type 5052, 6061, 6063, or 2014 alloy unless noted. All stainless steel shall be type 316/316L unless noted.

C. FABRICATION

Shop fabrication and welding of structural members shall be in accordance with the latest edition of the "Structural Welding Code", AWS D1.1, (AWS D1.2-Aluminum, AWS D1.6-Stainless Steel), of the American Welding Society. All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16" fillet weld. Intermittent welding shall not be allowed, except on non-ferrous metals.

D. EDGE GRINDING

Sharp projections of cut or sheared edges of ferrous metals shall be ground to a radius by multiple passes of a power grinder as required to ensure satisfactory coating adhesion.

E. SHOP SURFACE PREPARATION/COATING

All iron and steel surfaces, except the drive unit, shall be field cleaned and painted by the contractor to ensure paint compatibility and assign unit responsibility for the coating system. The drive unit shall be coated with the supplier's standard enamel paint system. Painting shall be in accordance with Section 09900 of these Specifications.

F. STRUCTURAL DESIGN

All steel design shall be in accordance with the AISC Manual of Steel Construction, latest edition and the International Building Code (IBC), latest edition.

2.3 DRIVE UNIT

A. DESIGN PARAMETERS

The drive unit shall be designed and manufactured by the clarifier equipment supplier to ensure unit responsibility. The drive unit shall be designed for the torque values previously listed. It shall turn the mechanism at the design collector tip speed. The drive main bearing shall be designed for the total rotating mechanism loads with a minimum L-10 life of 50 years or 438,000 hours. The drive unit shall be capable of producing and withstanding the previously listed momentary peak torque while starting. The drive main gear shall be designed to a minimum

AGMA 6 rating when rated in accordance with the latest AGMA standard. Gear teeth shall be designed for proper load distribution and sharing. Stub tooth design and surface hardening of the main gear shall not be allowed. The main bearing shall be capable of withstanding the listed overturning moment without the aid of any underwater guides or bearings to ensure correct tooth contact for AGMA rating of the main gear.

All spur gearing shall be designed to the latest AGMA spur gear standard for strength and surface durability, based on a life of 175,000 hours. The design running torque rating of the drive gearing shall be based on the smaller of the strength and durability values determined from the above AGMA standard. To ensure safety and ease of maintenance, all components of the drive shall be direct coupled.

No overhung pinions shall be allowed on the speed reducing unit. The lower pinion bearing shall not be located below the turntable base.

Any and all welding on the drive unit shall be done using E70XX weld rod.

B. PHYSICAL CHARACTERISTICS

The drive unit shall consist of a solid internal main spur gear, bearing turntable, pinion, secondary speed reducer, support base, and drive unit bearing. The drive shall be mounted on the center column and support the entire rotating load of the mechanism. The main internal gear shall be forged of alloy hardened steel. The pinion shall be heat treated alloy steel. Support base for the drive shall be of welded steel to assure rigidity. Dust shields shall be provided. The drive bearing shall include a forged steel precision gear/bearing set, with fully contoured raceways hardened to a minimum 58-62 Rc and protected by a neoprene seal. The drive shall be designed so that the balls and nylon spacers can be replaced without removing the access walkway. The main gear to pinion gear mesh shall be oil lubricated. An oil sight glass, fill pipe, and drain shall be provided for the reservoir. Lubrication fittings shall be readily accessible.

C. OVERLOAD PROTECTION

An overload device shall be provided in a stainless steel, weatherproof enclosure. The device shall be actuated by torque generated from the main drive, which shall operate two independently adjustable switches (the alarm switch at 100 percent of design running torque and the motor cutout switch at 120 percent of design running torque). Devices that require the worm to float and measure the thrust of the worm gear shall not be acceptable. These two switches shall be factory adjusted to accurately

calibrate the alarm torque value and the overload position. A visual torque indicator shall be provided and oriented so that it may be read from the walkway. It shall be calibrated from 0 to 160 percent of design running torque.

D. TURNTABLE

The turntable base shall have an annular bearing raceway upon which the rotating assembly rests. It shall have a maximum allowable deflection in accordance with the bearing specifications. The allowable modulus of elasticity shall be a minimum of 29×10^6 psi. The center cage shall be fastened to and supported from the gear casing. Ball bearings shall be of high carbon chrome alloy 52100 steel running in fully contoured races, as part of a precision gear/bearing set. The balls shall be grease lubricated and protected by elastomer seals. Felt seals that allow the entrance of moisture from outside the drive (i.e., rain water, condensate, etc.) will not be allowed.

E. SPEED REDUCING UNIT

The speed reducing unit shall consist of cycloidal, helical, or planetary speed reducers directly connected to a motor without the use of chains or v-belts, and shall be keyed to the pinion.

The main ring gear of cycloidal drives shall be made of high carbon chromium bearing steel and be fixed to the drive casing. An eccentric bearing on the high speed shaft shall roll cycloidal discs of the same material around the internal circumference of this main ring gear. The lobes of the cycloid disc shall engage successively with pins in the fixed ring gear. The movement of the cycloid discs shall be transmitted then by pins to the low speed shaft. Speed reducer efficiency shall be a minimum of 90% per reduction stage.

Speed reducer helical or planetary gearing shall be manufactured to AGMA standards and shall provide at least 95 percent power transmission efficiency per stage. The speed reducer shall have a minimum service factor of 1.25 based on the output torque rating of the drive.

The reducers shall be fitted with radial and thrust bearings of proper size for all mechanism loads and be grease lubricated. As a safety feature, the speed reducer shall be back drivable to release any stored energy as the result of an over torque condition.

F. MOTOR

Motors shall be Baldor, US Motors, Reliance, or Toshiba / Houston. No other manufacturers will be accepted.

The motor shall be standard squirrel cage, induction type, TEFC electrical induction motor meeting NEMA MG-1 and other applicable NEMA, ANSI, and IEEE standards. The motor shall be constructed with Class F insulated windings, Class B, 30,000AFBMA hour rated anti-friction bearings, cast iron frame, and cast iron end bells. The motor shall be 1 hp, 460 volt AC, 3-phase, 60 Hz., 1,800 rpm synchronous speed (4-pole), continuous duty at 40 degrees C ambient temperature with a 1.15 service factor.

Motor shall be mounted in a manner that permits conduit connections to the motor terminal box directly using straight lengths of flexible metal conduits (i.e., without dog legs).

The motor windings shall be provided with thermal detection switches (normally closed) embedded in each phase of the motor windings. Detectors shall be suitable for operation with 120 volt AC control circuits, Klixon or equal. These sensors shall have insulated conductor leads brought to the motor terminal box and shall be suitable for wiring as a permissive in the motor starting circuit.

Motor shall meet the electrical requirements of WAC 296-46B-430, "Motors, motor circuits and controllers, 007 Markings on motors and multi-motor equipment".

Motor shall meet the efficiency requirements of the Washington State Energy Code (Washington Administrative Code, Title 51, Chapter 51-11) Table 14-4, regardless of whether or not a particular motor is exempted from meeting this efficiency by the Washington State Energy Code.

Motor shall be recognized or labeled and listed by a recognized electrical testing laboratory approved by the Washington State Department of Labor and Industries, or the motor shall be specifically approved by the Washington State Department of Labor and Industries for installation on the project.

If any motor fails during the warranty period, the Contractor shall replace the motor with a new motor. Rewinding a failed motor shall not be acceptable.

G. MOTOR PROTECTIVE DEVICE COORDINATION AND DOCUMENTATION

The Contractor shall maintain a spreadsheet or database list of the motor characteristics that are necessary to size, select, and/or set the various motor protective devices, such as thermal overloads, breaker trip devices, motor protection relays, etc. The list shall be sent with each equipment submittal for motor-driven equipment and shall be updated to reflect the motor information for the submitted equipment.

The Contractor shall record the size and/or settings of each motor protective device at the time of startup and after any subsequent adjustments on the motor characteristics list described in the preceding paragraph.

In addition, the Contractor shall take a digital photo of each motor nameplate when the motor arrives at the jobsite, each digital photo shall be emailed to the Owner's Resident Engineer, noting any discrepancy between the motor nameplate data and the submitted motor data.

2.4 WALKWAY AND PLATFORM

A. WALKWAY

One 36-inch wide walkway and platform with handrails shall be supported by the drive unit and influent column at the center and the tank wall at its outer end, and shall be designed to safely withstand a live load of 50 pounds per square foot. Deflection shall not exceed $L/360$ when both the dead load and live loads are applied. It shall consist of two trusses or beams with 1-1/4-inch aluminum I-bar grating between the trusses or beams. The walkway shall be diagonally braced against lateral movement, and provided with handrails 42-inches high, of double-row 1-1/2-inch diameter horizontal aluminum pipe, and 4-inch high kickplates on both sides. Walkway trusses may serve as the handrail if the top chord is 3'-6" above the walking surface.

Stainless steel bearing plates, UHMW-PE slide plates, and anchor bolts for the wall support shall be provided by the equipment supplier and installed by the contractor. Bearing plate dimensions and anchor bolt diameter, length, quantity, and arrangement shall be per the equipment supplier. The contractor shall block out or otherwise modify the tank or support structure to accommodate walkway and supports, if required.

B. CENTER DRIVE PLATFORM

A center drive platform shall be provided which allows 24-inches clearance outside the center drive components. It shall consist of 1/4-inch aluminum checkered plate with necessary stiffeners and supports, resting on the drive unit and center column, and provided with connections to the walkway. The entire platform shall be surrounded by handrails 42-inches high of double-row 1-1/2-inch diameter horizontal aluminum pipe with 4-inch high kickplates.

2.5 INFLUENT AND SLUDGE REMOVAL

A. STATIONARY CENTER INFLUENT COLUMN

A stationary cylindrical steel influent column of 1/4-inch minimum wall thickness shall be provided. One end shall have a support flange for bolting to the tank floor over the influent line, with a similar flange at the top for supporting the drive unit and walkway. The structure and anchor bolts shall provide adequate support for the entire mechanism dead load plus live loads and torque with an adequate factor of safety to eliminate excessive deflection or vibration. Suitable openings shall be provided in the upper portion of the column to allow unrestricted passage of the flow into the energy dissipating inlet.

Prior to the center column being grouted in place, the drive unit shall be installed, positioned, and leveled.

B. DUAL GATE ENERGY DISSIPATING INLET (DG-EDI)

A dual gate rotating circular energy dissipating inlet with bottom shall be supported by the cage and be designed to diffuse the liquid into the feedwell in an impinged flow direction without excessive disturbance or formation of vertical velocity currents. The DG-EDI shall be designed to positively prevent sludge from depositing within the DG-EDI and shall include bottom drain holes.

The diameter, depth, and detention time of the DG-EDI shall be included in the submittal with the design calculations and shall show proper process application as evidenced by the required successful operating installations.

The rotating DG-EDI shall be designed with a full bottom extending to within 1 inch of the center column. It shall include an upper rim angle for stiffness. Multiple, discharge ports shall be provided to induce impinged flow. The gates shall have a fixed bottom to prevent vertical currents as the flow exits the DG-EDI.

The DG-EDI shall be made of not less than 3/16-inch thick steel plate with necessary stiffening angles.

EDI Test Data – The submittal shall include data from side-by-side tests on identical full-scale operating clarifiers at least 100 ft. in diameter, with identical feed and underflow rates. The data shall show that installation of an EDI equivalent in design to that proposed for this project produced a decrease in effluent suspended solids of at least 25 percent.

C. FEEDWELL

The flocculating feedwell shall be located outside of the EDI to diffuse the liquid into the tank without disturbance or formation of velocity currents. Baffled openings shall be provided near the water surface to allow scum to exit the feedwell.

The supports for the feedwell shall be located either above the liquid extending from the cage or bridge, or on the rake arms. Submerged supports from the rake arms shall be designed so as to minimize horizontal flow disruption.

No feedwell support or feedwell spliced connection shall be contained within the annular space formed between the feedwell and EDI. The depth of the feedwell shall be such as to provide proper detention time and an exit velocity at maximum flow that will not scour the settled sludge. The diameter, depth, detention time, and exit velocities shall match the process application calculations as evidenced by the required successful operating installations.

The feedwell shall be made of not less than 3/16-inch thick steel plate with necessary stiffening angles.

D. CENTER CAGE

The center cage shall be of steel box truss construction. It shall be provided with connections for the two sludge rake arms and feedwell supports if required. The cage top shall be bolted to the main gear which shall rotate the cage with the attached arms and feedwell. The cage and each arm shall be designed to withstand 150 percent of the design running torque of the drive without over stressing the members. Loading to develop the torque shall be considered as uniform loads applied to each arm individually.

E. SLUDGE RAKE ARMS

The mechanism shall include two long sludge rake arms of steel truss construction with spiral-shaped steel scraper blades and adjustable stainless steel squeegees. Squeegees shall be fastened to the rake blades with stainless steel fasteners.

Scraper blades shall be designed for sufficient sludge transport capacity to handle the design solids loading rate, with the depth of the blade varying from a minimum at the tank periphery to a maximum at the tank center.

Blades shall properly convey settled sludge to the sludge withdrawal ring. Blades which move sludge away from the center column to the orifices of the withdrawal ring shall also be provided.

The arms shall be adjustable at the cage to assure an even grout thickness over the tank bottom.

The rake speed shall be sufficient to transport the necessary volume of sludge to the sludge outlet, but shall not re-suspend settled sludge.

F. SLUDGE WITHDRAWAL RING

The tank floor slope and sludge withdrawal ring design shall be verified by the clarifier equipment manufacturer. The sludge withdrawal ring shall be located and sized to prevent short-circuiting of the influent to the underflow. It shall be placed at a point of high sludge concentration. It shall be rectangular in cross section as shown on the drawings and shall remove sludge uniformly around the center of the tank.

The sludge withdrawal ring shall surround the center column and shall include appropriate anchorage to the tank floor. The cross section shall be tapered along its length to assure a constant sludge velocity through the ring. Equally spaced orifices shall be cut into the outer ring wall. The orifices shall be sized to avoid plugging. The outer ring wall shall be at a constant radius. The annulus between the column and the ring shall be filled with grout.

Sludge Withdrawal Ring Data – The submittal shall include data from side-by-side tests on identical full-scale operating clarifiers at least 80 ft. in diameter, with identical feed and underflow rates. The data shall show that installation of a sludge collection ring equivalent in design to that proposed for this project produced an average sludge blanket depth approximately one foot lower than a clarifier with only a conventional central sludge hopper.

2.6 SCUM REMOVAL

A. GENERAL

The clarifier manufacturer shall furnish two (2) skimming devices as part of each clarifier mechanism. Each skimming mechanism shall be arranged to sweep the surface of the sedimentation compartment, automatically removing scum and floating material to a scum box at the periphery of the tank.

B. SKIMMER CONSTRUCTION

The rotating scum skimmer shall include a horizontal steel plate skimmer blade supported by vertical steel members extending up from the rake arms. The blade shall extend from a point 6 inches away from the influent feedwell to the hinged scum skimmer assembly at the tank periphery.

C. SCUM SKIMMER ASSEMBLY

A hinged scum skimmer assembly shall be mounted on the outer end of the skimmer blade. The hinged scum skimmer assembly shall be designed to form a pocket for trapping the scum. The hinged arrangement shall insure continual contact and proper alignment between wiper blade, scum baffle, and ramp as the blade travels up the scum box ramp. The wiper blade shall have a wearing strip on its outer end which contacts the scum baffle and a neoprene strip on its lower and inner edge. The neoprene wipers shall be a minimum 1/4-inch thickness. The scum is trapped as the wiper blade meets the ramp and is raised up the ramp to be deposited into the scum trough for disposal.

D. SCUM BOX

The scum box shall be of the size specified, supported from the tank wall and connected to the scum withdrawal piping. It shall be made of 1/4-inch thick welded steel plate. The box shall have a scum trough, vertical steel sides, and a sloping approach ramp that extends from 1-1/2 inches above water level to 5-1/2 inches below. A similar ramp shall be provided at the opposite end to allow the skimmer blade to lower back to the operating position. A flexible connector shall be provided for connection to the contractor supplied scum withdrawal piping in the tank wall.

E. SCUM FLUSHING VALVE

A valve shall be attached to the scum box which automatically opens and allows clarified liquid into the scum box to flush out solids. The valve shall actuate at every pass of the scum skimmer over the scum box, allowing sufficient delay after deposit of the solids before flushing begins. Delay and flush duration shall be adjustable. The opening and closing of the scum flushing valve shall be one smooth continuous movement. The valve shall provide 2 to 5 gallons of flush water per each pass of the skimmer assembly.

F. SCUM BAFFLE

The baffle shall consist of 1/4-inch thick x 12-inches deep fiberglass sections. In the area of the scum box the scum baffle shall extend to 24 inches starting approximately 6 feet before and ending 2 feet after the scum box. The baffle sections shall be curved and fastened to the launder wall with adjustable FRP support brackets, stainless steel fasteners, and anchor bolts.

2.7 DENSITY CURRENT BAFFLE

The clarifier shall include a density current baffle at the tank periphery below the effluent weir designed to deflect density currents away from the weir. The baffle shall be constructed of minimum 1/4-inch thick fiberglass sheets supported on triangular aluminum or fiberglass supports which are anchored to the tank wall. The baffle shall slope downward toward the tank center at a minimum 45 degree angle to prevent build-up of sludge deposits. Vent holes shall be provided to allow trapped gases to escape.

2.8 EFFLUENT WEIR

An adjustable weir shall be provided around the periphery of the tank at the water surface for removal of clarified effluent.

The weir shall consist of 1/4-inch thick x 9-inches deep fiberglass sections with 2-1/2-inch deep 90-degree v-notches at 6-inch intervals. The weir sections shall be curved and fastened to the launder wall with special large washers, anchor bolts, and hex nuts to allow vertical adjustment.

2.9 ELECTRICAL

The equipment supplier shall furnish the clarifier controls housed in a single NEMA 4X, wall-mount, 304 stainless steel enclosure with painted steel back panel, and mounting foot kit. The control panel shall be provided with a

local/off/remote switch, run light, rake cutout light, alarm silence and reset pushbuttons. A thermal magnetic combination motor starter with internally reset thermal overloads, control relays, timers, terminal blocks, fuses and fuse blocks and other supporting hardware shall be provided. A control power transformer shall be included to provide 120VAC for internal controls. The transformer shall have both primary legs and one secondary leg fused.

A top mounted, amber strobing alarm light and horn shall provide indication of a high torque condition. A door mounted reset pushbutton shall be provided that clears all interlocks after the high torque conditions have been removed.

The control panel shall be wired to accept a single 480VAC, 3 phase, 60 Hertz power feed. A 3 pole molded case circuit breaker with pad-lockable disconnect handle shall be provided for short circuit protection. The contractor shall supply and install all other electrical items required to place the equipment into service.

The contractor shall supply and install all field wiring required including but not limited to proper size wire, conduit, fittings, and supports.

2.10 ANCHORAGE AND FASTENERS

A. ANCHOR BOLTS

All anchor bolts shall be a minimum of 1/2-inch diameter and made of type 316 stainless steel. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.

B. FASTENERS

All structural fasteners shall be a minimum of 1/2-inch diameter and made of type 316 stainless steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

2.11 PAINTING

Units and accessories shall be painted in accordance with Section 09900-2.2A and C of these Specifications Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

PART 3 EXECUTION

3.1 GENERAL

The clarifier mechanisms shall be installed in the 110-foot diameter clarifier as shown on the Plans and in accordance with the manufacturer's recommendations. After the equipment has been erected, a 2-inch layer of grout shall be applied to the tank floor, using screws installed on the mechanism rake arms to form the finished surface. The grout shall be given a hard trowelled finish after sweeping into place. Grouting shall not be done until the mechanism has been inspected by the manufacturer. Preparation of the base slab surface shall be approved by the Engineer prior to grouting. Grouting procedure and the grout mix shall be as recommended by the manufacturer and approved by the Engineer. The grout mix shall be sand and cement, and in no event shall the mix contain aggregate.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The equipment shall be field tested when the installation is complete. The field test shall be made by the Contractor in the presence of and as directed by the Engineer. Field testing shall be done using clean water and shall insure a watertight, workable installation. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the equipment manufacturer shall be provided by the Contractor. Services shall include 3 days (two visits) onsite for the supervision of equipment startup, testing and instruction of the Owner's personnel in the operation and maintenance of the equipment. One trip (1 day) shall be for installation inspection, certification and testing; and one trip (2 days) shall be for startup and training. Instruction and training of the Owner's personnel shall not take place until startup is completed and the equipment is fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 11340

CLARIFIER ALGAE SWEEP SYSTEM

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new clarifier algae sweep systems as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
11000	Equipment General Provisions
11337	Circular Secondary Clarifier Mechanisms
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Algae Sweep System Secondary Clarifier 3	07 ASS 03

1.4 PERFORMANCE REQUIREMENTS

The algae sweep systems shall be capable of cleaning algae and debris from the baffle, weir, spillway, and effluent flow launder of circular clarifiers. The clarifier algae sweep system shall also meet the following design conditions:

Parameter	Value
Initial brush spring tension range (lbf)	6.68 – 10.02

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 5 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The algae sweep system shall as manufactured by Ford Hall Company, Envirodyne Systems, or approved equal.

The structural, mechanical and electrical designs shown on the Plans are based on the equipment manufactured by Ford Hall Company. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

In order to assure uniform quality, product functionality, and ease of maintenance; all of the equipment specified in this Section shall be supplied by one manufacturer.

2.2 GENERAL

The algae sweep system shall be custom designed and constructed for the removal of algae and debris from the effluent launders, weirs and scum baffles on circular clarifiers.

The algae sweep system shall be designed to clean the following surfaces: inner baffle surface, outer baffle surface, inner weir surface, outer weir surface, top spillway surface, angled spillway surface, inner launder wall, launder bottom, and outer launder wall.

The algae sweep system shall be designed to work off the power of the secondary clarifier mechanism. The system shall be constructed to avoid any noticeable torque increases. The unit shall be capable of encountering an indefinite stall without incurring damage.

The unit shall be designed with an engaged position for cleaning, and a disengaged position allowing the system to ride idle around the tank.

The systems shall consist of an attachment sleeve mounted to secondary clarifier mechanism as directed by clarifier mechanism manufacturer, a mainframe member, several telescopic brush arms, numerous brushes of various sizes, and an assortment of springs in different configurations to provide the biasing forces. A series of brushes are mounted to the frame member and biased into engagement with the baffle, weir, spillway and walls of the effluent flow channel.

2.3 ATTACHMENT ASSEMBLY

The attachment assembly shall provide a means of attaching the algae sweep system to the skimmer arm and/or rake truss so as not to interfere with any other operations of the skimmer arm (such as the effective skimming of floatable solids or the operation of the skimmer blade assembly at the scum box).

The attachment assembly shall be custom designed for each specific clarifier mechanism. It shall be constructed of Type 304 stainless steel.

2.4 MAINFRAME

The algae sweep system mainframe shall be constructed of Type 304 stainless steel and designed to slip easily into the attachment assembly and be tightened in position with the use of set screws.

The mainframe shall be designed so that the brush arms can be positioned at any point on the mainframe.

2.5 BRUSH ARMS

All algae sweep system brush arms shall be of Type 316 stainless steel and custom designed and installed. The brush arms shall allow for cleaning all aforementioned surfaces and allow for the following:

Flexibility to clean effluent surfaces within a plus or minus 4-inch radial variance (specifically: clarifier walls, weirs, baffle).

To allow brush holder to be adjusted telescopically so that a maximum number of brush arm adjustments are possible.

To have opposite the mainframe end, a brush holder attachment allowing for the insertion of a brush.

To have a means of biasing the arm to the mainframe so as to provide sufficient force to remove algae and debris.

Include a component that allows for each brush arm to be “locked out” or disengaged.

2.6 BRUSHES

Brushes shall be provided that slip easily into the brush holder and provide the cleaning means necessary to remove algae and debris from their respective surfaces.

Brush construction shall be as follows:

Brush backing shall be of durable plastic able to withstand continuous exposure to sunlight, seasonal temperature changes and the corrosive elements found in wastewater.

Brush bristles shall be polypropylene with adequate trim length, density, and stiffness for extended continuous use.

Brushes shall be cut and shaped appropriately so as to clean their respective surfaces without binding.

Replacement brushes shall be stocked and provided by the manufacturer to the exact dimensions needed. Average brush life shall be at least 1 year.

2.7 BRUSH BRIDGE

- A. Provides the algae sweep system launder brush assembly a “bridge” over the effluent hole on which to travel.
- B. The brush bridge shall be constructed entirely out of Type 304 stainless steel.

2.8 SPRING ASSEMBLIES

Each Brush Arm requires spring tension to bias the Brush Arm with the Brush Holder and Brushes into tight engagement with the appropriate effluent surface to be cleaned. The Spring Assemblies require the following:

- A. A minimum of one Spring Assembly, made of Type 316 stainless steel, is required for each Brush Arm.
- B. Spring Assemblies consist of two stainless steel springs and one stainless steel guide.
- C. Each spring will be composed of Type 316 stainless steel wire with a minimum diameter of 0.95 inch and a minimum of 260 active coils per spring length.
- D. Spring coils will have a mean diameter of 0.655 inches. A minimum inner coil diameter of .56 inch and an outer diameter of .75 inch are required of each stainless steel spring.
- E. Springs must have a minimum initial spring tension of 6.68 lbf and a maximum of 10.02 lbf with a minimum load tolerance of 18.44 lbf.

2.9 BRUSH HOLDER

At the end of each Brush Arm, there will be a Type 316 stainless steel Brush Holder to allow the insertion of a Cleaning Brush. A Brush Holder shall be aligned with each of the following surfaces: both sides of the baffle, both sides of the weir and each of the effluent launder surfaces. Each Brush Holder will:

Consist of a “bolted clamp design” to allow for the easy insertion and removal of Brushes.

Include a factory-supplied brush suitable for prolonged exposure to wastewater environment.

Contain a Shear Safety Component.

2.10 SHEAR SAFETY COMPONENT

Each Brush holder will contain a Shear Safety Component having a frangible point designed to break when subjected to a force exceeding an optimum predetermined stress value.

The stress value on each Shear Safety Component will be low enough to release the Brush Holder to forgo any damage to Brush Cleaning unit and/or Skimmer equipment but be high enough to allow standard operation of Brush cleaning system.

2.11 LOCK IN/LOCK OUT DESIGN

Each Automated Brush System shall be designed with an engaged or locked in position for cleaning and a disengaged or locked out position for riding idle around the tank.

Each Brush Arm will have a Lock Out Hook permanently mounted to the Brush Arm that corresponds to a Lock Out Ring, which allows disengagement of the individual Brushes. The Lock Out Ring is mounted to a Lock Out Boss that is attached parallel to the Mainframe.

Each Automated Brush System shall be designed so that the entire Brush system can be disengaged or individual Brush Arms can be disengaged allowing for customized cleaning of weir and effluent surfaces.

2.12 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.13 PAINTING

Units and accessories shall be painted in accordance with Section 09900-2.2A and C of these Specifications. Nameplates, drain holes, vent openings, or lubrication fittings shall not be painted.

PART 3 EXECUTION

3.1 INSTALLATION

The algae sweep systems shall be installed as shown on the Plans and in accordance with manufacturer's instructions and recommendations.

3.2 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the algae sweep system manufacturer shall be provided. Services shall include 2 days (two visits) on site for the supervision of equipment installation, startup, testing, and instruction of the Owner's personnel in the operation and maintenance of the equipment, and the cost of these services shall be included in the bid price. Instruction and

training shall not take place until startup is complete and the equipment is fully operational. The training shall be at a time and location agreed to by the Owner.

***** END OF SECTION *****

DIVISION 13 – SPECIAL CONSTRUCTION

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SECTION 13415

SUSPENDED SOLIDS METERS

PART 1 GENERAL

1.1 SCOPE

The work specified in the Section includes furnishing and installing new suspended solids meter for the RAS pipe at the RAS/WAS pump station, as shown on the Plans and specified herein. Suspended solids meters shall include sensor, transmitter, indicating converter, cleaning system and all necessary accessories and hardware for a complete and workable system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
15050	Piping System
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
RAS Suspended Solids Meter	[06 SS 01]

1.4 PERFORMANCE REQUIREMENTS

Parameter	Performance Requirement
Accuracy (percent)	5
Operating Range (g/L)	0.00001 – 50

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The suspended solids meter shall be Hach Solitax. No other manufacturers will be accepted. Transmitter shall be Hach sc200 Universal Controllers or approved equivalent.

2.2 GENERAL

The suspended solids monitoring system shall consist of a submersible sensor/analyzer, controller, and auxiliary equipment. The systems components shall be designed to operate as a complete system. The suspended solids sensor shall use dual beam infrared scattered light photometers and receptors to monitor water quality.

Sensor shall be suitable for the intended application. The sensor carrier and sleeve material shall be stainless steel. The wiper shaft and arm material shall be stainless steel. O-rings and housing seals shall be nitrile butadiene rubber (NBR).

Sensor shall include a self-cleaning device to prevent erroneous values and maintenance issues from biological activity, scum, and gas bubbles.

The sensor shall be installed with a mounting harness with an isolation valve suitable for sensor insertion into a pipe section, as shown on Plans. All mounting hardware shall be stainless steel.

The sensor shall be supplied with a set of wiper blades. A calibration kit shall be provided with the sensor.

The sensor shall be supplied with a minimum of 30 feet of integral cable with a quick disconnect style plug. It shall be powered from the control unit and require no separate power source.

When connected to a multi-parameter digital controller the overall status of the instrument performance is displayed as a percentage value via a measurement

indicator. When connected to a multi-parameter digital controller the overall time remaining until maintenance tasks are due is displayed in days.

The controller shall contain a LCD dot matrix alphanumeric display with back lighting and shall display suspended solids concentration as well as alarm conditions, alarm setpoints, calibration, output limits and diagnostics. The controller shall be supplied with two relays field selectable for suspended solids and/or diagnostic alarming and two 4-20 mA isolated outputs. The controller shall be suitable for receiving power from a 24 VDC circuit.

The suspended solids meter shall be listed and labeled by a recognized electrical testing laboratory or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

2.3 ANALOG INSTRUMENTATION

The process control instrumentation and equipment shall be of solid state type and of the Manufacturer's latest design. Electronic converters for the element shall have isolated, floating output signal of 4-20 mA DC which is directly and linearly proportional to the process variable. Each device shall be provided with adjustments for gain and bias.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded 2/conductor copper wire in the manner shown on the Plans.

2.4 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools as well as the specific equipment listed below. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

Spare sensor: One unit supplied

2.5 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The suspended solids meters shall be installed as shown on the Plans and in strict accordance with the manufacturer's recommendations.

3.3 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.4 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the suspended solids meter Manufacturer shall be provided. Services shall include a minimum of 1 day onsite. Services shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the suspended solids meters are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 13416

INTERFACE LEVEL ANALYZERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new interface level analyzer systems at the new Secondary Clarifier 3, as well as at the two existing Secondary Clarifiers 1 and 2, as shown on the Plans and as specified herein. The level analyzer systems shall include sensor, transmitter, indicating converter and all necessary accessories and hardware for a complete and workable system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
11337	Secondary Clarifier Mechanism
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Interface Level Analyzer 1	07 ILA 01
Interface Level Analyzer 2	07 ILA 02
Interface Level Analyzer 3	07 ILA 03

1.4 PERFORMANCE REQUIREMENTS

Parameter	Performance Requirement
Resolution (feet)	0.1
Stability (percent/degree C)	0.1

1.5 DELIVERY, STORAGE, AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The interface level analyzer sensor shall be Endress and Hauser Turbimax, or approved equivalent manufactured by Cerlic, Hach, or Royce Technologies. Transmitter shall be Endress and Hauser Liquiline CM442 or approved equivalent.

The structural, mechanical, and electrical designs shown on the Plans are based on the equipment manufactured by Cerlic. Any modifications to the mechanical, structural, electrical, instrumentation and control and other portions of work that may be required to adapt the general layout and details shown on the Plans to the equipment actually furnished shall be at no additional cost to the Owner. All necessary revisions shall be made at Contractor's sole expense. All redesign information prepared by the contractor shall be submitted for review prior to incorporating the redesign into the work.

In order to assure uniform quality, product functionality, and ease of maintenance; all of the equipment specified in this Section shall be supplied by one manufacturer.

2.2 GENERAL

The interface level analyzer system shall consist of a submersible sensor, transmitter, indicating converter and auxiliary equipment. The systems components shall be designed to operate as a complete system.

The sensor shall be an ultrasonic sensor with a single crystal that transmits and receives a ultrasonic signal. The sensor shall be suitable for submersion in wastewater treatment facility mixed liquor with temperatures up to 150 degrees F. The sensor shall be supplied with a stainless steel swing-out mount bracket and stainless steel handrail mount, and provided with at least 30 feet of cable. The

sensor shall be supplied with a protector that prevents damage by the Secondary Clarifier surface skimmers.

The transmitter shall contain a back-lit, digital, and graphical display providing the numerical location of the solids interface in the Secondary Clarifiers. The transmitter shall display sensor fault conditions.

The analyzer enclosure shall be a NEMA 4X weatherproof, corrosion resistant enclosure with a rail mount and swing-out door.

2.3 ANALOG INSTRUMENTATION

The process control instrumentation and equipment shall be of solid state type and of the Manufacturer's latest design. Electronic converters for the element shall have isolated, floating output signal of 4-20 mA DC which is directly and linearly proportional to the process variable. Each device shall be provided with adjustments for gain and bias.

The signal converters shall convert the output signal from the analyzer and transmit the signal via an isolated analog 4-20 mA signal directly proportional to depth. The signal converters shall have automatic zero correction. The signal converters shall be designed to operate from 120 AC, 60 Hz, single phase, power source.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded 2/conductor copper wire in the manner shown on the Plans.

2.4 SPARE PARTS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.5 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The interface level analyzers shall be installed as shown on the Plans and in strict accordance with the manufacturer's recommendations.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the interface level analyzer Manufacturer shall be provided. Services shall include a minimum of 1 day onsite. Services shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the interface level analyzer systems are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 13417

PRESSURE GAUGES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new discharge pressure gauges, as shown on the Plans and specified herein. Discharge pressure gauges shall include all necessary connectors and hardware on all process piping for pumps at the various locations for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
11000	Equipment General Provisions
15050	Process Piping Systems
Division 15	Mechanical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

Item
Scum Pump 2 Discharge Pressure Gauge

All pressure gauges listed above shall be provided with diaphragm seals and flushing connection.

1.4 PERFORMANCE REQUIREMENTS

The discharge pressure gauges shall be provided with a pressure range of 0 to 10 psi. Unless otherwise indicated, the discharge pressure gauge scales shall be selected so that the normal operating pressure falls between 50 and 80 percent of full scale.

Pressure gauges shall be shown on the detailed installation drawings of all piping and connected equipment as specified in Section 15050. Pressure scale range for each pressure gauge shall be in the form of a summary table including all process piping pressure gauges.

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, skid mounted, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the Contract, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The pressure gauges shall be Ashcroft Duragage 1279 or approved equal.

The diaphragm seals shall be Ashcroft Type 101 or approved equal.

2.2 GENERAL

The pressure gauges shall be glycerin filled type and shall have all internal parts immersed. Pressure gauges shall be minimum 4 1/2-inch dial size, with non-metallic case, stainless steel bourdon tube with plastic bushings and pinion, and 316 stainless steel selector. Gauges shall be ANSI grade A or better with an accuracy of ± 0.5 percent.

Gauges measuring liquids shall be supplied with bronze pressure snubber and diaphragm seal. Diaphragm seals shall have silicone DC200 fluid fill and shall have a Type 316 stainless steel body, with 1/4-inch flushing connection and 1/2-inch process connection.

2.3 SPARE PARTS

The Contractor shall provide one spare pressure gauge and diaphragm seal for the pressure range stipulated in Part 1.4, as well as, the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.4 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The pressure gauges and accessories shall be installed as shown on the Plans and as specified herein and in accordance with the manufacturer's instructions.

3.3 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

***** END OF SECTION *****

SECTION 13425

RADAR LEVEL SENSORS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing new radar level sensors and associated equipment as shown on the Plans and as specified herein. The radar level sensors shall include all necessary accessories and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Clarifier 3 Scum Pump Station Radar Level Sensor	07 RLS 01

1.4 PERFORMANCE REQUIREMENTS

The radar transmitter signal shall indicate to ± 0.08 inch. The analog instrumentation shall have an accuracy of ± 0.04 inch.

The sensor shall transmit and receive a radar signal to accurately measure fluid depth at the monitoring site.

The radar level sensors shall be supplied with the following antenna type and enclosure requirements.

Radar Level Sensor	Antenna Type	Beam Angle	Range	Hazardous Area Classification
07 RLS 01	2" Drip-Off	6°	1.5 – 12 feet	Class 1, Div. 2

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the General Conditions, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The radar level sensors shall be Endress & Hauser FMR60. No other models or manufacturers will be accepted.

2.2 RADAR LEVEL SENSOR AND TRANSMITTER

The radar level sensors shall be supplied with a slip-on flange for mounting on a 1.5-inch-diameter NPT threaded connections, as shown on Plans. The transmitter shall operate as a two wire, loop powered 4-20mA device from 16 to 36 VDC.

The radar level sensors and transmitters shall be of the manufacturer's latest design. The transmitter electronics shall be immune from changes in dielectric, specific gravity, vapors, moderate foam and other process variables. Configuration shall be through a local display with push button controls and through a smartphone application interface using Bluetooth® wireless communications. Interface with a PC shall not be required to configure or program the instrument. No calibration with the need to move the process liquid shall be necessary. Bench configuration, prior to installation, shall be possible. The transmitters shall have the ability for false target rejection and obstruction mapping to be performed effectively without the need for a secondary device.

The transmitters shall have the ability to effectively track rapid rates of level change up to 180 inches (450 cm)/minute. Transmitters shall consist of a microprocessor-based electronic radar transmitter (26 GHz) housed in a rugged, watertight, dust-tight, submersible, corrosion resistant NEMA 4X or rated as suitable for Class I Division 2, dual compartment enclosure as specified in

Section 1.4. The design shall be such that the power circuit board and the logic/display circuit board will be isolated from each other to prevent failure of both boards at once.

The transmitter shall operate as a two wire, loop powered 4-20mA device from 16 to 36 VDC. The 4-20mA output shall operate from 3.8mA to 20.5 mA and have diagnostic fault values of 3.6mA, 22mA and HOLD. The equipment shall have 4 to 20 milliamperes standard DC (direct current) isolated floating outputs and shall conform to ISA Standard S 50.1.

The field wiring and electronic compartments shall be located on the same side of the housing and tilted at a 45-degree angle for wiring, configuration and viewing ease. The field-wiring compartment shall house the terminal block and noise filtering components; all electronic assemblies shall remain sealed and protected in the separate electronic compartment. The electronics compartment cover shall have explosion-proof glass that shall allow for viewing the display. The transmitter housing shall be connected to the sensing antenna via a high frequency, quick-disconnect fitting allowing for removal of the antenna from the transmitter while maintaining the antenna in process.

The unit ambient temperature rating shall be from -40 degrees F to +400 degrees F. The sensor shall not require built-in temperature compensation to automatically compensate for air-temperature changes. The sensor shall have manual gain adjustments to maximize performance in the presence of steam, moderate foam, turbulence and other process variables and shall have adaptive gain capability that automatically adjusts for changing process conditions in real time. The sensor shall include variable blocking distance to ignore echoes from within a programmable distance from the sensor.

The radar level sensors shall be listed and labeled by an electrical testing laboratory recognized by the Washington State Department of Labor and Industries or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded 2/conductor #18 gauge copper wire in the manner shown on the Plans.

2.3 MOUNTING ASSEMBLY

Contractor shall construct a mounting bracket as shown on the Plans.

Each unit shall be provided by a weather protection cover.

2.4 SPARE PARTS AND TOOLS

The Contractor shall provide the manufacturer's recommended spare parts and special tools. All parts and tools shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts and tools shall be furnished in sturdy labeled boxes. At a minimum these shall include all special tools and appliances necessary to service, repair, and adjust the equipment.

2.5 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The radar level sensors shall be installed as shown on the Plans and in strict accordance with manufacturer's recommendations and instructions. The radar level sensors shall be permanently mounted at the measuring site and positioned according to the manufacturer's approved method.

Contractor shall construct a mounting bracket as shown on the Plans. All mounting hardware and supports including Type 316 stainless steel fasteners shall be provided by the Contractor.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the radar level sensor manufacturer shall be provided. These services shall not be provided by the

control panel manufacturer or electrical contractor. The manufacturer's representative shall be trained for the particular instruments installed on this project and any associated configuration software.

Services shall include a minimum of 1 day on site. Services shall include inspection of the installation, initial configuration, programming, testing, and startup. This visit shall include adjustments to the equipment as well as instruction of the Owner's personnel in operation and maintenance for each radar sensor. Instruction and training of the Owner's personnel shall not take place until startup is completed and the radar sensors are fully operational and shall be at a time and location agreed to by the Owner.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

SECTION 13426

MAGNETIC FLOW METERS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section includes furnishing and installing magnetic flow meters as shown on the Plans and as specified herein. The flow meters shall include all necessary accessories and hardware for a complete and workable installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
11000	Equipment General Provisions
Division 16	Electrical

1.3 EQUIPMENT LIST

Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Number</u>
Return Activated Sludge Flow Meter 3	06 MFM 03
Effluent Flow Meter 3	08 MFM 03

1.4 PERFORMANCE REQUIREMENTS

The magnetic flow meters shall have an accuracy of ± 0.25 percent of the actual flow rate at velocities of 1.5 ft/sec or greater.

The flow meter shall be provided with the following sizes and flow ranges for the specified application and location:

Flow Meter	Flange Diameter (inches)	Flow Range (gpm)	Transmitter Location
06 MFM 03	12	500 – 2,500	Remote
08 MFM 03	36	400-10,000	Remote

The liquids to be measured will be domestic wastewater, varying in temperature from 50 degrees F to 70 degrees F and in solids concentration from 0 to 1 percent.

1.5 DELIVERY, STORAGE AND HANDLING

All equipment shall be completely factory assembled, crated and delivered to protect against damage during shipment.

All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

1.6 WARRANTY

In addition to the warranty required in the Contract, the equipment manufacturer shall provide an extended warranty covering defects in material and workmanship for 2 years following the date of substantial completion. The warranty shall be in printed form, shall apply to all similar units, and shall include parts and labor.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

The magnetic flow meters and transmitter shall be Endress & Hauser Proline Promag W400. Because of standardization of equipment by the City of Puyallup, no other manufacturer will be acceptable.

2.2 GENERAL

The magnetic flow meters shall be of the low frequency and short form coil design. The field principle of electromagnetic induction shall produce a positive DC pulsed signal directly and linearly proportional to the liquid flow rate. The metering tube shall be constructed of Type 316 stainless steel with Class 150 ANSI flanged end connections. Electrodes shall be protruding (bullet nose) shaped and made of Type 316 stainless steel or Alloy C22. The material of construction of the liner shall be PTFE, NBR hard rubber, or polyurethane. The meter shall secure its power from the transmitter. No electronics shall be mounted in the metering tube of the magnetic flow meter.

Provisions for remotely mounting the transmitter shall be provided where the transmitter is specified to be remote. Remote transmitters shall be provided in a field mount enclosure suitable for surface mounting. Transmitter shall be interchangeable without reprogramming the meters or disconnecting the cables. The transmitters shall convert the output signal from the flow meters and transmit the signal via an isolated analog 4-20 mA signal directly proportional to flow rate. The transmitter shall have automatic zero correction.

The flow meter shall also have a dry contact or opto-isolated transistor pulse flow totalization signal suitable for use with a 24 VDC device discrete inputs (such as

telemetry units) with an input impedance of at least 2 k Ω . The minimum pulse duty cycle shall be adjustable to be at least 250 ms.

The transmitters shall produce a totalization of flow dry contact output pulse signal that is directly and linearly proportioned to total flow.

The magnetic flow meter enclosure shall be NEMA 4X classified. The units shall be listed and labeled by an electrical testing laboratory recognized by the Washington State Department of Labor and Industries or be acceptable to the Washington State Department of Labor and Industries for installation on this project.

Each meter system shall be wet-calibrated at the manufacturer's facility against the master system. A calibration certificate shall be furnished for each meter.

Provide grounding rings or grounding electrodes with each flow meter as required to maintain the specified accuracy.

The flow meters shall be capable of accidental submergence to 3 feet for a period of 30 minutes.

2.3 ANALOG INSTRUMENTATION

The flow meters shall be of the manufacturer's latest design. The equipment shall have 4 to 20 milliamperes standard DC (direct current) isolated floating outputs and shall conform to ISA 50.1. Each output shall be provided with adjustments for gain and bias. The resultant output shall be 4-20 mA DC into approximately 750 ohms. Accuracy shall be ± 0.25 percent of full scale output.

Analog instruments shall operate without loss of loop accuracy due to electromagnetic interference, resistive or inductive losses or similar problems related to field interconnection of components when connected with shielded 2/conductor #18 gauge copper wire in the manner shown on the Plans.

2.4 SPARE PARTS

The Contractor shall supply one spare transmitter.

All spare parts shall be suitably identified and effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. All parts shall be furnished in sturdy labeled boxes.

2.5 FACTORY TESTING

The equipment shall be fully tested at the manufacturer's plant before shipment. Tests shall insure that the equipment will operate as desired under anticipated field conditions. Certified copies of test report(s) shall be submitted to the Engineer prior to shipment.

PART 3 EXECUTION

3.1 INSTALLATION

The flow meters shall be installed as shown on the Plans and in accordance with the Manufacturer's recommendations and instructions. If ground rings are required to maintain the specified accuracy, they shall be installed with the units and bonded to grounding conductor where recommended or required by the Manufacturer.

3.2 FIELD TESTING

The Contractor shall perform the field testing described in Sections 01800 and 11000.

The field test shall insure that the equipment will operate as desired under field conditions. The manufacturer shall provide a formal test procedure and report forms for recording data. The Contractor shall submit the report forms to the Engineer prior to operational testing.

Any defects in the equipment or failure to meet requirements of the Specification shall be promptly corrected by the Contractor.

3.3 MANUFACTURER'S SERVICES

The services of a factory-trained representative of the magnetic flow meter manufacturer shall be provided. Services shall include a minimum of 1 day onsite. Services shall include inspection of the installation, initial configuration, programming, startup, and adjustments and instruction of the Owner's personnel in operation and maintenance. Instruction and training of the Owner's personnel shall not take place until startup is completed and the magnetic flow meters are fully operational and shall be at a time and location agreed to by the Owner. The cost of these services shall be included in the bid price.

The representative shall provide for two additional service calls during the initial 2 years of equipment operation.

***** END OF SECTION *****

DIVISION 15 – MECHANICAL

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SECTION 15050

PIPING SYSTEMS

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section describes process and utility piping, fittings, supports, and accessories shown on the Plans, described in these Specifications, and as required to completely interconnect all equipment with piping for complete and operable systems.

The Contractor shall direct the attention of all subcontractors and suppliers of piping systems and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
01800	Testing, Commissioning and Training
02300	Earthwork
09900	Painting
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 16	Electrical

1.3 STANDARDS FOR THE WORK

Pipe, fittings, and supports shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on Shop Drawing submittals for review.

Piping systems and materials shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. In order to meet these requirements minor deviation from the Plans may be made as approved by the Engineer.

1.4 PIPE MATERIALS

The materials to be utilized for the various pipe sizes and applications on the project shall be as follows, unless otherwise noted on the Plans or herein:

<u>Process</u>		<u>Inside</u>	<u>Buried</u>
Drain ≤ 3 "	D	Solvent Welded PVC (Sch. 80)	Solvent Welded PVC (Sch. 80)
Mixed Liquor	ML	N/A	Concrete Cylinder ⁽²⁾
Non-Potable Water	NPW	Solvent Welded PVC (Sch. 40)	Solvent Welded PVC (Sch. 40)
Potable Water	W	Copper Pipe	Copper Pipe
Return Activated Sludge	RAS	Ductile Iron, FL ⁽¹⁾	Ductile Iron
Scum	SC	Glass Lined D.I., FL	Glass Lined D.I., MJ
Secondary Effluent	SE	Ductile Iron, FL or Stainless Steel ⁽³⁾	Ductile Iron, MJ
Storm Drain	SD	N/A	SDR 35 PVC

- (1) Unless noted otherwise on the Plans.
- (2) Cement mortar lined and coated welded steel pipe or mechanical joint ductile iron pipe are acceptable alternatives to concrete cylinder pipe.
- (3) Above ground SE pipe shall be stainless or ductile iron with flanged and grooved fittings, as noted on the Plans.

1.5 SUBMITTALS

Submittal data shall be supplied in accordance with Section 01300. Detailed installation drawings of all piping and connected equipment shall be submitted. The drawings shall include all piping, valves, fittings, pipe support locations and types, seismic bracing, and appurtenances.

Submit data to show that the following items conform to the Specification requirements:

- A. Pipe, fittings, and accessories.
- A. Valves.
- B. Couplings and couplers.
- C. Pipe supports and seismic braces as required herein.

Submit certified test reports as required herein and by the referenced standards.

PART 2 PRODUCTS

2.1 GENERAL

Pipe sizes are nominal inside diameter unless otherwise noted.

All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class and other appropriate data such as thickness for piping.

Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the complete product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified in Part 3 Execution of this Section.

All water piping shall be certified under NSF 61 for potable water use.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. GENERAL

Ductile iron pipe shall be centrifugal cast pipe conforming to AWWA C151, Class 52, unless otherwise noted, bituminous coated and cement mortar lined in accordance with, AWWA C104. All flanged spools shall be Class 53 as shall all piping where grooved couplings are used. Approved grooved couplings may be used instead of flanged spools and fittings as approved by Engineer.

All above ground piping shall be flanged or grooved piping unless otherwise specified or indicated.

Below ground piping shall be mechanical joints unless otherwise specified or indicated. Mechanical joints shall comply with AWWA C111.

All mechanical joints shall be restrained joints with a restrainer. The restrainer shall utilize the full circumference of the pipe for restraining and utilize standard MJ gasket and bolts. The restrainer shall be Grip Ring as manufactured by Romac Industries, Mega-Lug, or equal. Where noted on the Plans pipe and fittings shall be restrained utilizing a tandem mechanical joint restraint system.

Flanges shall comply with ANSI B16.1, Class 125. Flange gaskets shall be full face. Approved adaptor flanges shall be used instead of flanges where shown on the Plans.

Grooved couplings shall be Victaulic Style 31, or engineer approved equal and shall comply with AWWA C606. Victaulic Style 341 adaptor flanges shall be installed instead of flanges where shown on the Plans.

Fittings shall be ductile iron and shall comply with AWWA C110 or AWWA C153, bituminous-coated exterior and cement mortar lined, 250-psi minimum pressure. Fittings shall be mechanical joint, flanged, or grooved fittings. Fittings with grooved ends shall comply with AWWA C606 and shall be Victaulic or approved equal. Fittings shall not be "Tyton" or other push-on type joint.

The exterior of buried ductile iron pipe and pipe in contact with concrete shall be coated with an asphaltic coating. The exterior surface of ductile iron pipe inside of buildings, structures, and vaults shall be painted in accordance with Section 09900-2.2.F of the Specifications.

All bolts not in contact with potable water shall be coated with Armitite Anti-Seize Compound No. 609, or equal, prior to installation. All bolts in contact with potable water shall be coated with an NSF-61 approved anti-seize compound, SAF-T-EZE, or equal, prior to installation.

B. GLASS LINED DUCTILE IRON PIPE

Glass lined ductile iron pipes shall be lined with a specially formulated internal porcelain coating designed for handling sewage grease, scum, and sludge.

The coating shall consist of special glasses and inorganic materials applied in a minimum of two coats, separately fired, to internal surfaces which are thoroughly grit blasted clean. Following application of the first (base) coat, the items shall be brought to a sufficiently high maturing temperature (above 1,400 degrees F) to fuse the glass to the base metal. Subsequent coatings will be processed in a similar manner, forming an integral molecular bond with the base coat, and the base metal.

The finished lining shall be 8 to 12 mils thick and defects that expose the base metal shall be limited to 0.1 percent of the total glassed surface. Hardness shall be above 5 on the MOHS scale and a density from 2.5 to 3.0 grams per cubic centimeter. The lining shall be bonded sufficiently to the metal surface to withstand a strain of 0.001-inch/inch (the yield point of carbon steel) without damage to the glass lining.

The lining shall be capable of withstanding an instantaneous thermal shock of 350 degrees F, without cracking, blistering, or spalling. It shall be resistant to corrosion by solutions of between PH-3 and PH-10 at

125 degrees F, and shall not show a visible loss in surface gloss after immersion of a normal production sample in an 8 percent sulfuric acid solution of 148 degrees F for a period of 10 minutes.

A sample shall be furnished by the manufacturer and approved for use as a comparison guide for the on-site inspector.

Pipe preparation, coating application, testing, and special handling shall be in accordance with the recommendations of the coating manufacturer and the pipe manufacturer. The pipe or fitting manufacturer shall furnish a certificate attesting to the fact that the lining applicator met the requirements of the coating manufacturer and this specification, and that the material used was as specified herein and as approved by the Engineer.

2.3 PRETENSIONED CONCRETE CYLINDER PIPE

Circumferentially pretensioned reinforced concrete cylinder pipe (CCP) shall consist of a welded steel cylinder, a centrifugally-cast concrete or cement-mortar lining, a continuous mild-steel reinforcing bar helically wrapped around the cylinder, a dense cement-mortar coating over the steel cylinder and reinforcing bar reinforcement, and sized steel rings welded to the cylinder to form a self-centering bell and spigot joint sealed by a compressed rubber gasket.

The CCP, fittings and specials shall be furnished and installed where indicated on the Plans and as specified herein. All piping shall be installed complete in place with all jointing materials and accessories, anchors and blocking and the necessary appurtenances.

All materials used in the manufacture of CCP, fittings, specials and accessories shall conform to AWWA C303.

In addition, the manufacturer shall be certified by an independent agency that all materials, processes, and procedures are in conformance with AWWA C503. The manufacturer shall provide proof of said certification prior to approval of any and all Submittals.

The Contractor shall submit, for the approval of the Owner and the Engineer, the Manufacturer's pipe design, indicating the manufacturing and installation data, and the Manufacturer's layout sheet, showing the location of the pipe, fittings, and specials.

The drawings and data shall include, but not be limited to, the complete details of the design; fabrication and construction; field locations and elevations; installation of CCP, fittings, specials, and connections; complete data covering all

materials proposed for use; and the following for each size of CCP to be furnished and installed.

- A. Pipe design.
- B. Details of fittings and specials.
- C. Joint dimensions.
- D. Test reports.
- E. Laying schedule complete with an explanation of all abbreviations used in the schedule.

Cement shall conform to ASTM C150, Type II. Fine aggregates shall conform to ASTM C33. Joint gasket rings shall conform to AWWA C303, Sections 2.8 and 3.4, except the polymer shall be synthetic rubber. Natural rubber shall not be acceptable. Joint lubricant shall be a vegetable based lubricant suitable for use in potable water. Petroleum or animal-based lubricants shall not be acceptable. Joint grout shall consist of one part Portland cement to two parts clean masonry sand mixed to a pouring consistency. Joint mortar shall consist of one part Portland cement to two parts clean masonry sand mixed to a stiff consistency. The sand shall pass a 16 mesh sieve. Flanged joints shall conform to ANSI/AWWA C207. Gaskets shall conform to ANSI/AWWA C207 and shall be full face type.

All fittings and specials shall comply with Section 4 of AWWA C303. Fittings and specials shall be designed for the same external loads and internal pressures as the adjacent CCP. The use of metal lugs on fittings for ease of handling shall not be permitted.

2.4 CEMENT MORTAR LINED AND COATED STEEL PIPE

Steel pipe shall conform to the provisions of AWWA C200. Fabrication of pipe shall be from steel plate or sheet conforming to ASTM A283, Grade D or ASTM A570, Grade 33. Steel Pipe shall have a minimum steel thickness of 0.25 inches and shall be of the inside diameter, after lining, as shown on the Plans.

Steel pipe shall be cement mortar lined and coated in accordance with applicable provisions of AWWA C205. Cement shall conform to the requirements of ASTM C150, Type V. Joints shall be self-centering bell and spigot sealed by a compressed rubber gasket. Bell and spigot joints shall be coated with Americoat 5105 or approved equal. The exterior joint space shall be mortar-grouted with a grout band and the interior joint space shall be mortar pointed. The grout band

shall have DuPont “Tyvar” fabric backing and Dow “Ethafoam” 222 liner. Pipe with a diameter of 42 inches and smaller shall have a 1/2-inch-thick cement mortar lining and a 3/4-inch-thick cement mortar coating. Pipe larger than 42 inches in diameter shall have a 3/4-inch-thick cement mortar lining and a 1-inch-thick cement mortar coating.

Steel fittings shall be fabricated fittings conforming to the dimensions of AWWA C208. All steel fittings shall be of wall thickness, lining, and coating to match pipe. Details shall be in accordance with AWWA Manual M-11.

Flanged joints shall conform to AWWA C207. Gaskets shall conform to AWWA C207 and shall be of the full face type.

The Contractor shall submit to the Owner details of the design and method of manufacture, details of joints, harnesses, and specials that may be required.

2.5 STAINLESS STEEL PIPE AND FITTINGS

Stainless Steel pipe for general service shall be made of 316 Stainless Steel. Pipe shall be Schedule 40 flanged or grooved, as shown on Plans. Grooved ends shall comply with AWWA C606. Flanged ends shall comply with AWWA C207 Class D. Flange gaskets shall be full face.

The locations of the expansion couplings shall be determined by the Contractor prior to pipe fabrication and shall be subject to review and approval by the Engineer.

2.6 PVC PIPE AND FITTINGS

All PVC pipe 3-inch and smaller shall be Schedule 80. Pipe shall be constructed of material that meets or exceeds ASTM D2241 and D1784 and Commercial Standard CS 256. Joints shall be solvent weld with press fit. Fittings shall conform to ASTM D2466 and D2467 for socket type and ASTM D2464 for threaded pipe.

All PVC pipe greater than 3 inches shall be solid wall PVC storm sewer pipe and fittings shall comply with ASTM D3034, SDR 35 for pipe sizes up to 15 inches. Solid wall PVC storm sewer pipe and fittings shall comply with ASTM F 679 using a minimum pipe stiffness of 46 psi in accordance with Table 1 for pipe sizes from 18 inches to 48 inches. Pipe and fittings shall be furnished with bells and spigots, which are integral with the pipe wall and with a rubber gasket securely locked in place in the bell. Pipe joints shall conform to ASTM D3212 using flexible elastomeric gaskets conforming to ASTM F477.

Provisions for pipe expansion shall be as recommended by the pipe manufacturer.

Bolts for PVC pipe, where required, shall be 316 stainless steel, ASTM A193, Grade B8M, hex head with ASTM A194, Grade 8M hex nuts. Washers of the same material shall be supplied.

2.7 COPPER PIPE

Copper pipe and fittings shall be Type K (buried) or Type L or M (above ground) when used as water service lines, and Type L tube, when use as waste, vent, or drainage lines.

2.8 HOSES

The Contractor shall furnish hoses, nozzles and fittings sized for each yard hydrant and hose bib where shown on the Plans and as described below.

A. HOSE

Washdown hose shall be flexible nitrile discharge hose, Hosecraft Model RM1 or equal. The inner diameter shall be equal to the diameter of the thread connection for each yard hydrant and hose bib, as shown on the Plans. The hose and all fittings shall have a pressure rating of at least 150 psi. Each section shall be 50-feet long have male and female brass couplings with adapters sized to fit yard hydrants and hose bibs. Threaded female fittings shall swivel until tightened. Each Hose shall have a nozzle.

The Contractor shall furnish and install any and all transition or specialized fittings required to connect the hose to the yard hydrant and or hose bib at no additional cost to the Owner.

B. NOZZLES

Nozzles to fit 1-inch through 1-1/2-inch hoses shall be industrial fog nozzles with brass body, rubber protective rim, adjustable from fog-stream to straight stream by a twisting action with the ability to shut off flow completely at the nozzle, maximum working pressure of at least 150 psi, and NPSH threads, Dixon model WHFN150 or equal.

2.9 MISCELLANEOUS FITTINGS

A. FLEXIBLE COUPLINGS

Flexible couplings shall be Romac 501 or approved equal. Middle ring and follower shall have fusion bonded epoxy coating. All buried flexible couplings shall be furnished with stainless steel bolts and nuts.

Harness lugs and tie bolts for harnessed joints on steel pipe shall comply with AWWA M-11, Third Edition and as shown on the Plans. All buried harnessed joints shall be furnished with stainless steel tie bolts and nuts.

B. FLANGED COUPLING ADAPTERS

Flanged coupling adapters shall be Rockwell (Smith-Blair) Type 912 Dresser Style 127 or equal.

C. ADAPTER FLANGES

Adapter flanges for ductile iron pipe shall be manufactured of high strength ductile iron, ASTM A536, Grade 65-45-12. Flange dimensions shall be in accordance with ANSI B16.1, 125-lb. pattern. Gasket shall be Buna-N. Setscrews shall be AISI 4140, high strength, low alloy steel. The adapter flanges shall be Uni-Flange Series 400, or equal.

D. GROOVED PIPE COUPLERS

Grooved pipe couplers for steel pipe shall consist of two ductile iron housing segments conforming to ASTM A536, pressure responsive elastomer gasket, and ASTM A449 zinc electroplated steel bolts and nuts. Couplings shall comply with ASTM F1476 "Standard Specification for the Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications."

1. Rigid Type

Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

a. 2 Inch through 8 Inch

Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 degrees F/120 degrees C. Couplings shall be Victaulic Style 107, or approved equal.

b. Couplings shall be Victaulic Zero-Flex Style 07 or Victaulic Style W07.

2. Flexible Type

For use in locations where vibration attenuation and stress relief are required. The couplings shall be placed in close proximity to the source of the vibration. Couplings shall be Victaulic Style 77 or approved equal.

Grooved pipe couplers for ductile iron pipe shall be Victaulic Style 31 or approved equal.

The gaskets shall be suitable for use in wastewater.

All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. CALDER-TYPE FLEXIBLE COUPLINGS

Flexible couplings shall be Calder-type where specifically indicated on the Plans. Calder-type flexible couplings shall consist of all elastomeric PVC sleeve secured to the pipes with stainless steel clamping bands. Adapter couplings shall be furnished for transitions between piping of different outside diameters as necessary.

Calder-type flexible couplings shall be as manufactured by Calder Co., Fernco, or equal.

F. FLEXIBLE CONNECTORS AND EXPANSION JOINTS

Flexible connectors and expansion joints shall be provided where shown on the Plans. The flexible connectors and expansion joints shall be provided with Class 125 ANSI flanges and be single arch-type multiple ply rubber or synthetic elastomers, complete with steel retaining rings, as manufactured by the Red Valve Company, Inc., the Metraflex Company, or equal. Grooved fittings shall be Victaulic Style 240S stainless steel bellows, or equal.

G. DIELECTRIC INSULATED UNIONS

Dielectric insulated unions shall be used to connect dissimilar metals. They shall separate the metals so that the passage of more than one percent of the galvanic current, which would exist with metal to metal contact, is prevented. Unions shall be of the same material as the pipe to which attached, and pressure and temperature ratings shall be no lower than that of the piping system in which it is installed.

H. SEALS FOR WALL PENETRATIONS

Seals for pipe penetrations shall be bolt-up type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the sleeve. When bolts are tightened the rubber sealing elements shall expand to result in a watertight seal. Bolts and pressure plate nuts shall be Type 316 stainless steel in below grade or "wet" locations, and of carbon steel at other installations. Rubber links shall be suitable for use in water, moist environments, normal atmospheric conditions, and -40 degrees F to 250 degrees F temperatures for standard service.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. GENERAL HANDLING AND PLACING

All piping constructed on this project shall be performed in accordance with the Uniform Plumbing Code. These Plans do not detail all items such as complete venting, etc.; however, it is understood that this work shall be included as a part of this Section and all costs included in the lump sum bid.

Pipe and accessories shall be handled in such a manner as to insure delivery on site in sound, undamaged condition. Particular care taken not to injure pipe coating. No other pipe or material of any kind shall be placed inside of lined pipe or fitting after lining has been applied. All pipe and fittings shall be unloaded, stored, handled in such a manner as to insure against damage. Dropping of pipe or fittings shall be cause for rejection.

The types and sizes of pipes to be used shall be as specified herein and as shown on the Plans. Where sizes of small pipe are omitted from the plans and not mentioned in the Specifications, the sizes to be used shall correspond to plumbing code requirements. In any event, undesignated pipe sizes shall be proper for the function to be performed and as accepted by the Engineer.

All pipe shall be carefully placed and supported at the proper lines and grades and where possible shall be sloped to permit complete drainage. Piping runs shown on the Plans shall be followed as closely as possible, except for minor adjustments to avoid architectural and structural features. If major relocations are required, they shall be approved by the Engineer.

Unions shall be installed in all threaded joint piping to facilitate the removal of sections for maintenance and repair in accordance with the best trade practice. Unions shall be ground joint, malleable iron type. Where unions connect dissimilar materials, the union shall be protected from reaction with dissimilar metals by installation of insulating materials and dielectric unions at contact points.

The interior of all piping shall be cleaned after assembly and before connecting to equipment.

All piping for which no location dimensions are shown shall be installed in a neat and workmanlike manner in accordance with best trade practice. Wherever possible runs and rises shall be grouped and kept parallel. Properly lay out all miscellaneous piping to clear obstructions such as passageways, equipment, larger sized pipes, ventilation ducts, lights, etc.

Whenever pipe requires field cutting to fit in line, work shall be done by a machine in a satisfactory manner so as to leave a smooth end at right angles to axis of pipe.

All piping to be buried below structures, foundations, or slabs shall be installed with extreme care. When all joints have been made, Contractor shall demonstrate to Engineer's satisfaction that all of piping is watertight and that all lines are clear before proceeding with any work above this piping. It shall be Contractor's responsibility to see that these lines are kept clear until final acceptance of the project, providing suitable tight wooden bulkheads or plugs for open end pipes. Any blockage of these systems due to earth, debris, cement slurry or anything else shall be rectified at Contractor's expense before project is accepted.

All pipe shall be installed in strict accordance with manufacturer's recommendations and/or specifications, and best commercial trade practice. Any special tools required for laying, jointing, cutting, etc., shall be supplied and properly used. All pipe shall be kept thoroughly clean until acceptance of completed work, and shall conform accurately to lines and grades given. At all times during pipe laying operations keep trench free of water either by pumping, bailing, or drainage. Seal end of line with a tight-fitting plug when pipe is not being laid.

Valves shall have interiors cleaned of all foreign matter and inspected, both in open and closed positions prior to installation.

All pipes running through concrete walls below water surface or where subject to groundwater pressure shall be assembled as shown on the plans.

Pipes running through concrete not subject to water pressure may be installed through standard steel sleeves, one or two pipe sizes larger than pipe in question. The pipe shall be free of all dirt and grease and thoroughly cleaned to insure a tight bond with the concrete.

All above ground outside pipe carrying liquids shall be insulated.

All buried, submerged, or intermittently submerged piping that is bolted together or uses bolts to hold materials together shall use 316 stainless steel nuts, bolts, and washers. This requirement applies to a distance of 12 inches above the highest water level in any tank, channel, or structure. Otherwise, bolts, nuts, and washers may be hot-dip galvanized steel.

B. GENERAL EXPOSED PIPING INSTALLATION

Unless shown otherwise, piping shall be installed parallel to building lines, plumb, and level.

Piping shall be installed without springing or forcing.

All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.

Flexible couplings shall be provided for all piping connections to motor-driven equipment and where otherwise shown in the Plans. The Contractor may install additional flexible couplings at approved location to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection.

Unions or flexible couplings shall be installed where shown on the Plans, and at all non-motor-driven equipment to facilitate removal of the equipment.

Where equipment drain connections are provided, they shall be valved, with the discharge pipe carried to the nearest floor drain, drain trench, or sump. Where no receptacle for drain exists, drain valves shall be piped to 1 inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.

All exposed or submerged piping shall be painted and color-coded in accordance with Section 09900, unless otherwise specified.

3.2 PVC PIPING

PVC piping socket weld connections shall be made up in accordance with the pipe manufacturer's recommendations and as follows:

Where pipe is cut, remove all burrs and ream inside to provide smooth flow line. Bevel the plain end pipe 1/16 inch to 1/32 inch. Joints shall be first cleaned with cleaner before making up. Apply primer to the female joint. Apply primer to the male joint. Reapply primer to the female joint. Apply glue to the male joint. Apply glue to the female joint. Reapply glue to the male joint. Join pipe quickly with a 1/4 turn. If joint cannot be made up to full depth of socket, cut out and discard. Wipe off excessive cement. Hold for 30 seconds and do not move for 15 minutes after making up joint. Pipe joining below 40 degrees F will not be permitted. Cleaner and cement types shall be as recommended by the manufacturer for the size of pipe being used.

3.3 FLANGED PIPING

Flanged joints shall be made in accordance with best trade practice. Screwed flanges for piping shall be run until pipe projects beyond face and no more than one thread is exposed on backside. All flange faces shall then be machined so as to be perfectly parallel. All flanged pipe shall be accurately dimensioned; no "drawing-up" will be allowed. Gaskets shall be full face, rubber

3.4 GROOVED JOINT PIPING

Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review Contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s)).

3.5 THREADED PIPING

Threads for threaded joint piping shall be neatly cut with sharp tools and jointing procedure shall conform to best practice. Before jointing, all scale shall be removed from pipe by some suitable means such as pounding. After cutting, all pipe shall be reamed. All pipe shall be screwed together with an application of approved pipe compound applied to all male threads. Once a joint has been

tightened, it shall not be backed off unless threads are recleaned and new compound applied. This application neatly made; all compound, dirt thoroughly wiped off outside of every joint.

Unions shall be installed in all threaded joint piping to facilitate removal of sections for maintenance, repair in accordance with best trade practice. All such unions shall be included in bid price whether shown on Plans or not.

3.6 MECHANICAL JOINT PIPING

Mechanical joint piping shall be installed in best trade practice with torque wrenches used to avoid overstressing bolts. Piping shall be installed using recommended procedures outlined in "Handbook of Cast Iron Pipe" as published by Cast Iron Research Association which in part requires that all contact surfaces of rubber seal with pipe be wire brushed, spigot be centrally located in bell. When tightening bolts, it is essential that the gland be brought up toward pipe flange evenly, maintaining approximately same distance between gland and face of flange at all points around socket.

3.7 BELL AND SPIGOT PIPING

All bell and spigot connections shall be made up in strict compliance with the manufacturer's recommendations and all sewer pipe manufacture and handling shall meet or exceed the ASTM and SPAW recommended specifications.

Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing the gasket and knocking it out of position or loading it with dirt or other foreign material. Any gaskets so disturbed shall be removed, cleaned, re-lubricated if required, and replaced before the rejoining is attempted.

Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

Sufficient pressure shall be applied in making the joint to assure that it is home, as described in the installation instruction provided by the pipe manufacturer. Sufficient restraint shall be applied to the line to assure that joints once home are held so, until fill material under and alongside the pipe has been sufficiently compacted.

3.8 PIPE SUPPORTS

Provide all necessary supports, tie rods, bracing, brackets or other types of supports which may be required, as shown on the Plans, or as specified in Section 15066.

3.9 COPPER PIPE

All copper water service lines shall be tested, cleaned, and chlorinated, as described below. All waste, vent or drainage lines shall be flushed clean, and shall be tested by plugging the lowest point and filling the waste, vent or drainage piping with water to the level of the top of the vent pipe, but no joint in the system shall be submitted to a test of less than 10 feet of head. Under this condition, all joints shall remain watertight for a period of not less than 1 hour.

Piping shall be pressure-tested with water to a pressure of 125 psi.

3.10 FLEXIBLE COUPLINGS

Flexible couplings shall be installed in accordance with recommendations of manufacturer and used where indicated on the Plans. Finished joint shall be airtight or watertight under test pressure of pipeline. Buried flexible couplings shall be coated with asphalt base paint after assembly.

3.11 PIPE BEDDING

All pipe shall be bedded as specified in Section 02300.

3.12 TESTING

A. GENERAL

All piping shall be tested and inspected in accordance with the provisions of Division 7 APWA/WSDOT, except as modified herein. Where new piping systems are being connected to existing piping systems the existing piping systems shall be tested prior to connecting to the new pipe to the existing piping. Once the new piping system has been connected to the existing piping system the entire system shall be tested again.

All piping systems will be tested to demonstrate leak tightness prior to acceptance. The Contractor shall provide all equipment and labor necessary to perform all testing required herein, the costs to be included in the lump sum bid price.

Each particular piping system shall be tested as hereinafter specified. All leaks shall be repaired or defective material replaced and the test repeated as directed by the Engineer. After compliance with test requirements and approval of the Engineer, the field painting, where required, may be started. All pressure testing shall be done prior to any finish painting or pipe insulating.

The Contractor shall be responsible for repair of any damage resulting from or caused by leak testing.

B. PRESSURIZED LIQUID PIPING

Force mains shall be pressurized with water to 50 psig and remain leaktight for a period of 4 hours.

Potable and non-potable water piping shall be pressurized with water to 125 psig and remain leaktight for a period of 1 hour.

All cross-connection protection equipment shall be tested by a certified inspector prior to putting the piping into service. Submit test report to Owner.

C. DISINFECTION

Before being placed into service, all new and modified potable water pipes and appurtenances shall be sterilized and a satisfactory bacteriological report obtained in accordance with Section 7-09.3(24) of the WSDOT Standard Specifications.

As each pipe is laid, sufficient high-test dry calcium Hypochlorite (65 to 70 percent chlorine) shall be placed in the pipe to yield a dosage of not less than 50 mg/l available chlorine, calculated on the volume of water which the pipe and appurtenances will contain. Minimum free chlorine residual after 24 hours shall be 25 mg/l.

During the process of sterilizing, all valves, hydrants, and/or other appurtenances shall be operated to insure complete contact.

All closure fittings shall be swabbed with a very strong chlorine solution at least as strong as liquid household bleach (5 to 6 percent chlorine).

Following chlorination, all pipes shall be flushed to remove any solids until a test shows no more than 0.2 parts per million available chlorine. If no hydrant is installed at the end of the main, then a tap shall be provided large enough to develop a velocity of at least 2.5 FPS in the main.

Before placing the lines into service, a satisfactory report shall be received from the local or state health department on samples collected from representative points in the new pipe after the 24-hour sterilization period has elapsed. Samples for bacteriological tests in the presence of the Owner and transported by the Owner.

Should the initial treatment result in an unsatisfactory bacteriological test or should corrective work be required because of testing, then the chlorination procedure shall be repeated by the Contractor at their own expense until satisfactory results are obtained. These repeat procedures shall follow Section 7-09.3(24) of the WSDOT Standard Specifications, as appropriate and as necessary for the addition of chlorine. The cost of disposal of water used for disinfection shall be borne by the Contractor.

***** END OF SECTION *****

SECTION 15066

PIPE AND CONDUIT SUPPORT SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

The work specified in this Section includes pipe and conduit hangers, brackets, and supports. Pipe and conduit support systems shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, structural attachments, and other accessories as shown on the Plans and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Measurement and Payment
01300	Submittals
01800	Testing, Commissioning, and Training
09900	Painting
15050	Piping Systems
16050	Basic Electrical Materials and Methods
16130	Raceways and Boxes

1.3 REFERENCES

All pipe and conduit support materials and methods shall conform to the latest, applicable requirements of documents listed hereafter. In case of conflict between this section and the listed documents, the requirements of this Section shall prevail.

ANSI A13.1	Piping and Piping System
ANSI B31.1	Power Piping
ASME	Boiler and Pressure Vessel Code
ANSI/MSS SP-58	Pipe Hangers and Supports C Materials, Design and Manufacture
ANSI/MSS SP-69	Pipe Hangers and Supports C Selection and Application
SMACNA	Seismic Restraint Manual C Guidelines for Mechanical Systems
IPC	International Plumbing Code

1.4 SUBMITTALS

In accordance with the requirements of Section 01300, submit the following project data prepared by a licensed Professional Engineer:

- A. Manufacturer's technical data for all hangers, brackets, supports and documentation of conformance with appropriate standards and these specifications.
- B. Location of pipe and conduit support, including type of structural and pipe attachments, shown on detail drawings and/or specified under paragraph 1.5 of Section 15050.

PART 2 PRODUCTS

2.1 GENERAL

The Contractor shall design, provide, and install pipe and conduit support systems, which include hangers, brackets, supports, anchors, expansion joints, and structural attachments. The support system shall be pipe rack, trapeze pipe hangers or individual pipe clamps, hangers, supports and structural attachments as specified herein. The support system shall be designed in conjunction with the pipe and conduit to be supported. Seismic restraints shall be provided in accordance with SMACNA Manual as referenced in paragraph 1.3.

In certain locations, pipe supports, anchors, and expansion joints have been indicated on the Plans, but no attempt has been made to indicate every pipe support, anchor, and expansion joint. It shall be the Contractor's responsibility to provide a complete system of pipe and conduit supports. Pipe support schedule under paragraph 2.7 of this Section sets forth minimum requirements for pipe supports.

2.2 PIPE RACKS AND TRAPEZE HANGERS

Pipe and conduit racks and trapeze hangers shall be constructed of galvanized steel channels, rods, posts, post base, clamps, brackets, fittings, and accessories for supporting pipes in equipment and pump rooms. All components for pipe and conduit rack and trapeze shall be Unistrut or equal.

2.3 PIPE CLAMPS AND HANGERS

In areas where pipe racks and trapezes are not used, pipe shall be supported with clamp hangers and stanchion saddle support system. The clamps and hangers shall be fastened to threaded rods hanging from structural attachments. Pipe supports shall be selected for the size and type of pipe to which they are applied.

Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item.

All pipe clamps and hangers, including all accessories, shall be galvanized steel for indoor use and Type 316 stainless steel for outdoor use.

Pipe and conduit clamps and hangers shall be as manufactured by Anvil or equal and shall be as follows:

Type	Pipe Size (In.)	Pipe Material	Anvil Figure
Swivel Ring, Split Type	3/4 to 8	All type	104
Split Clamp	1/2 to 3	All type	138R
Adjustable Ring	1/2 to 6	All type	97
Adjustable Ring	1/2 to 4	Copper	CT-269
Adjustable Clevis	3 to 24	All type	590
Pipe Clamp	3 to 42	All type	216
Socket Clamp	4 to 24	Cast Iron	595
Pipe Stanchion	4 to 24	All Type	63
Stanchion Saddle	4 to 36	All type	259
Adjustable Saddle Support	3 to 36	All type	264
Riser Clamp	2 to 24	All type	40
Adjustable Pipe Roll	6 to 12	Stainless Steel	177, 181, or 274

2.4 STRUCTURAL ATTACHMENTS

Structural attachments shall be concrete insert channels or individual inserts for new concrete, surface-mounted channel or individual inserts for existing concrete or where applicable, steel, roof plate supported attachments in the control building, complete with all accessories required. All structural attachments including all accessories shall be galvanized steel for indoor use and stainless steel for outdoor use, and shall be provided by a single manufacturer. Structural attachments shall be as measured by Unistrut Corporation or approved equal.

2.5 PIPE SUPPORT ATTACHMENTS TO CONCRETE

All pipe support attachment to concrete shall be in adhesive anchors unless noted otherwise.

Products which may be incorporated in the work include, but are not limited to, the following:

- A. HIT RE 500 Injection Adhesive Anchor, Hilti, Inc.

- B. HIT HY 150 Injection adhesive Anchor, Hilti, Inc.
- C. Power-Fast, Powers Fasteners, Inc.

2.6 PROTECTION SADDLES

Protection saddles shall be used for protecting pipe insulation against damage at pipe supports or as shown on the Plans. The nominal thickness of covering shall be the same as that of pipe insulation. The protection saddles shall be curved carbon steel plate and shall be Anvil Figure 160 through Figure 166 or approved equal.

2.7 SPACING

Maximum support spacing shall conform to the following table:

Pipe Size Inches	Pipe Material	Maximum Spacing Feet
1" & Smaller	Iron or Steel	6
	Copper Plastic Tubing	4-1/2 continuous continuous
1-1/4 to 2"	Iron or Steel	8
	Copper or Plastic	5
2-1/2 to 4"	Iron or Steel	10
	Copper or Plastic	6
6" or more	Iron or Steel	12
	Plastic	8

PART 3 EXECUTION

3.1 DESIGN

Pipe and conduit support systems shall be designed in accordance with applicable reference standards specified in paragraph 1.3. Pipe and conduit supports shall be designed and selected to withstand seismic loads as specified under Section 11000.

- A. Weight balance calculations shall be made to determine the required supporting force at each pipe support location and the pipe weight at each equipment location. Design loads for inserts, clamps, and other support items shall not exceed the manufacturer's recommended loads.
- B. Pipe supports shall be able to support the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being

induced into the pipe or connected equipment. Allow clearances for pipe expansion and contraction.

- C. Wherever possible, pipe attachments for horizontal piping shall be pipe clamps, or as shown on the pipe support detail sheet. Horizontal or vertical pipes should be supported preferably at locations of least vertical movement.
- D. All pipe supports shall provide a means or vertical adjustment after erection.
- E. Where practical, riser pipe shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamps.

3.2 INSTALLATION

Pipe support system shall be installed strictly in accordance with standards and codes referenced in paragraph 1.3 of this Section and piping support system manufacturer and piping manufacturer's recommendations.

In addition, all piping shall be rigidly support and anchored so that there is no movement or visible sagging between supports.

Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper-plated. Those portions of pipe supports, which contact other dissimilar metals, shall be rubber or vinyl coated.

Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead-ending. Anchors shall be located as required to force expansion and contract movement to occur at expansion joints, loops, or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint.

Pipe supports and expansion joints are not required in buried piping, but concrete thrust blocking or other approved anchorage shall be provided as indicated on the Plans or specified in other sections.

*****END OF SECTION *****

SECTION 15100

VALVES

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of valves and accessories as shown on the Plans, described in these Specifications, and as required to completely interconnect all equipment with piping for complete operable systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01200	Payment
01300	Submittals
01800	Testing, Commissioning and Training
Division 11	Equipment
Division 15	Mechanical

1.3 SUBMITTALS

Submit Catalog cuts and shop drawings in accordance with Section 01300 to demonstrate that the valves and appurtenances conform to the Specifications requirements.

The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for all valves.

1.4 QUALITY ASSURANCE

All materials and equipment furnished under this Section shall be by the manufacturer specified.

See Section 15050 for Piping specifications and requirements.

PART 2 PRODUCTS

2.1 PLUG VALVES

Plug valves shall be non-lubricated eccentric plug type with port area exceeding 80 percent of full pipe area. The valve body shall be of ASTM A126, Class B cast iron. The plug shall be one piece construction of ASTM A536, 65-45-12 ductile iron or ASTM A126, Class B cast iron. The plug shall have a cylindrical

seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with grease and/or petroleum-resistant neoprene or Buna-N compound, 70 Type A durometer hardness per ASTM D2240. All plug valves shall be furnished with a 1/8-inch overlay seat of not less than 90 percent pure nickel of minimum 200 Brinell hardness. Seat area shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

Shaft bearings shall be sleeve-type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 stainless steel ASTM A743 Grade CF8M, or sintered oil impregnated bronze in 1/2- to 36-inch sizes. Non-metallic bearings shall not be acceptable. Shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable. Valve pressure ratings shall be 175 psi through 12 inches and 150 psi for 14 inches and larger. Each valve shall be given a hydrostatic and seat test with test results being certified.

Valves shall be furnished with end connections as shown on the Drawings. Flanged valve shall be faced and drilled to the ANSI 125 standard. Mechanical joint end shall be to the AWWA C111, grooved end per AWWA C606. Screwed ends shall be to the NPT standard. Valves shall be DeZurick PEC Eccentric or equivalent equipment manufactured by Pratt, Victaulic, or Milliken, or equal.

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, handwheels, etc., as indicated on the Drawings. All valves and larger than 4 inches shall be equipped with gear-handwheel actuators. All gearing shall be enclosed in a cast iron housing.

2.2 CHECK VALVES

Check valves shall be swing check, outside lever and spring, iron body, stainless steel shaft, bronze mounted with bronze and 316 stainless steel fittings, 125 pound service, Millikin, Mueller A2600 or equal.

2.3 PVC BALL VALVES

Ball valves shall be PVC Class 1245 4-B, conforming to ASTM D1784, true union type, threaded per ANSI B1.20.1, full port design, rated 150 psi, Nibco Chemtrol Tru-Block, Asahi/America, or equal.

2.4 YARD HYDRANT VALVES

Yard hydrant valves shall be non-freeze type, Zurn Z-1390 post hydrant, or equal. Bury depths shall be as shown on the Plans. Hydrants shall be provided with 1-1/4-inch male hose thread connection and shall have bronze interior parts and seats. Hydrant to include a tapped 1/4-inch drain port in valve housing.

2.5 VALVE BOXES

There shall be furnished and installed with all valves installed underground, two-piece adjustable valve boxes with a minimum inside diameter of 5 inches. The valve boxes shall be set concentric with the axis of the stem and adjusted to the final grade. Valve box lids shall be identified with a letter/number code and opening direction designation as shown on the Plans.

2.6 VALVE IDENTIFICATION TAGS

Each shut-off or control valve, shall be provided with a 1-1/2-inch minimum diameter heavy brass tag. Tags shall bear the identifying number of the valve and one or more identifying letter symbols of the service line.

Numbers and letters shall be block type with 1/2-inch-high numbers and 1/4-inch-high letters stamped on the tags and filled with black enamel.

Attach tags to the valves by split-key rings soldered so that the ring and tag cannot be removed.

Furnish a drawing and a neatly typed valve directory listing each valve number, type of valve and its location. Submit the directory and drawing to the Owner for approval.

PART 3 EXECUTION

3.1 GENERAL

All valves and accessories shall be installed in a manner and location as shown on the Plans or as required for the application and in accordance with manufacturer's instructions. Valve size is fully equal to line piping in which the valve is installed unless otherwise noted on the Plans. Support all valves where necessary. In case on conflict between these Specifications and a governing code, the more stringent standard shall prevail.

All valves of the same style or type shall be furnished by a single manufacturer.

Provide all accessories necessary for proper valve operation as specified or required for the application.

Valves shall be installed with the operator in a position for convenient operation. Particular care shall be taken to ensure that space is available for operation of lever or handwheel operated valves without interference to walls, piping or equipment. Any valve which is installed, in the opinion of the Engineer, in a manner that operation is inconvenient shall be modified or removed and reinstalled in a manner suitable to the Engineer at the expense of the Contractor. Operations for manual valves shall be lever or handwheel as is standard with the manufacturer unless another type of operator is specified or required by the manufacturer.

***** END OF SECTION *****

SECTION 15700

HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 GENERAL

1.1 SCOPE

The work specified in this Section shall consist of the heating, ventilation, and air conditioning equipment and other associated items as shown on the Plans, and as further specified herein.

All permits shall be obtained in accordance with Section 01160.

1.2 RELATED WORK SPECIFIED ELSEWHERE

<u>Section</u>	<u>Item</u>
01300	Submittals
Division 16	Electrical

1.3 QUALITY ASSURANCE

Submittals shall be in accordance with Section 01300.

All equipment supplied in this Section shall be provided to produce complete, operable systems with all elements properly interconnected as shown in schematic diagrams or to provide specified operations. If a specific dimensioned location is not shown for interconnections or smaller system elements, the Contractor shall select appropriate locations and show them on shop drawing submittal for review.

Equipment and material shall be new and without imperfections and shall be erected in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work to ensure connecting and disconnecting accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Oil and lubrication fittings shall be located clear of and away from guards, base, and equipment and within reach from the operating floor whenever possible. In order to meet these requirements with equipment as furnished, minor deviation from the Plans may be made as approved by the Owner.

The manufacturer's recommendations and instructions of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.4 PROJECT MEETINGS

Attend a minimum of two site meetings, each up to 2 hours in duration. The first site meeting will be held after 95 percent of the HVAC equipment and controls have been installed. Any required training should be scheduled and performed at this first site meeting. A follow up site meeting shall be scheduled 6 months after the complete installation of the HVAC and controls to ensure proper operation. Any additional training required should be scheduled and performed at the follow up site meeting.

1.5 EQUIPMENT LIST

Refer to Heating, Ventilation and Air Conditioning Schedules shown on the Plans.

1.6 SUBMITTALS

Submit manufacturer product data on HVAC equipment, as listed in this Section, under the provisions of Section 01300.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

Equipment manufacturers and model numbers shall be as shown on the Plans except where indicated herein.

2.2 GRILLES

Grilles shall be tested in accordance with ASHRAE Standard 70, current edition.

A. SUPPLY/EXHAUST GRILLES

Grilles shall be of steel construction. Grilles shall consist of 0 degree deflection fixed louver type with blades spaced 3/4-inch on center. The blades shall run parallel to the long dimension of the grille. Grilles shall be finished in a powder coat. Exhaust grilles shall be Price 95 series, or equal.

B. COLOR SELECTION

Grille color to be selected by Owner from the manufacturer's standard palette.

2.3 FANS

Fans shall be bear the AMCA Certified Ratings Seal for both sound and air performance and be UL tested and approved.

A. ROOF EXHAUST FANS

Roof mounted exhaust fans shall be of down-blast type. The fan, fan housing, and accessories described below shall be one unit supplied by the same manufacturer. Hood construction shall be of heavy extruded aluminum. Fan wheel shall be of backward inclined centrifugal type and be constructed of aluminum. Fan wheel shall be statically and dynamically balanced. Motor shall be a DC electronic commutation type motor specifically designed for fan applications. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor shall be included. Speed shall be controllable down to 20% of full speed and shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be permanently lubricated, heavy duty ball bearing type. The fan shall be complete with bird screen, vibration isolators, and gravity back-draft damper designed with edge seals. Roof exhaust fans shall be Greenheck G series, or equal. (Check against CUE roof exhaust specifications from Greenheck and update.)

B. ROOF SUPPLY FANS

The fan, fan housing, and accessories described below shall be one unit supplied by the same manufacturer. The hood shall be constructed of heavy gauge galvanized steel. The cover shall be removable for service and insulated to prevent condensation. Supply fan shall be complete with permanent washable 1-inch aluminum filters, ceiling grille, roof curb, and gravity backdraft damper designed with edge seals. The fan shall be provided with a baked enamel finish. Fan wheels shall be of the forward curved centrifugal type, constructed of heavy gauge steel, double width and double inlet scroll, and dynamically balanced to ensure smooth, vibration-free operation. Motors shall be permanently lubricated, heavy duty, ball bearing type. Fan shall be controlled as shown on the Plans. Roof supply fans shall be Greenheck RSF series, or equal. (Check against RBF specifications from Greenheck and update.)

2.4 ELECTRIC HEATERS

Heaters shall be UL Listed, CSA Certified and meet requirements of the National Electrical Code.

A. DUCT HEATERS

Provide electric resistance, duct mounted heaters. Duct heater element housing and terminal box shall be fabricated of heavy gauge stainless steel. Element housing shall be configured for slip-in mounting. The terminal box shall be provided with a hinged, latching cover, door-interlocked disconnect switch, and multiple concentric knockouts for field wiring. Heating elements shall be constructed of nickel chromium resistance wire supported by ceramic insulators. The heater shall be rated for the voltage, phase and number of heating stages indicated in the schedule. Terminal blocks shall be provided for all field wiring and shall be sized for installation in accordance with NEC requirements. The heater shall be furnished with the control option, accessories and special features shall be as specified in the Plans. Duct heaters shall be Greenheck IDHC series, or equal.

2.5 DUCTLESS SPLIT SYSTEMS

Ductless split systems shall AHRI certified. Unit shall be constructed in accordance with UL standards and be UL listed. Unit efficiency shall meet or exceed those listed in the latest edition of the Washington State Energy Code.

A. VRF OUTDOOR UNITS

1. General

The system shall be a split system, heat pump with variable-speed inverter compressor technology. The system shall consist of a horizontal discharge, single-phase outdoor unit, a matched capacity indoor unit that shall be equipped with a wired wall-mounted controller. The system shall use R410A refrigerant. The outdoor unit shall be compatible with the indoor unit. The connected indoor unit shall be of the same capacity as the outdoor unit. The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions. The outdoor unit shall be capable of operating at 0 degrees F ambient temperature without additional low ambient controls. The outdoor unit shall be able to operate with a maximum height difference of 100 feet between indoor and outdoor units. System shall operate at up to a maximum refrigerant tubing length of 100 feet between indoor and outdoor units without the need for line size changes, traps, or additional oil. The unit shall be precharged for a maximum of 100 feet of refrigerant tubing. The outdoor unit shall be completely factory assembled, piped, and wired. The

outdoor unit sound level shall not exceed 52 dBA in cooling and 53 dBA in heating.

2. Cabinet

The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford a reliable equipment mount and stability. Easy access shall be afforded to all serviceable parts by means of removable panel sections.

3. Fan

The unit shall be furnished with AC fan motors. The fan blades shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

4. Coil

The condenser coil shall be of copper tubing with flat aluminum fins. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of an electronic expansion valve (EV) metering device. The EV shall be control by a microprocessor-controlled step motor.

5. Compressor

The compressor shall be twin rotary compressor with variable compressor speed inverter technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. The outdoor unit shall have an accumulator and high-pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

6. Electrical

The electrical power of the unit shall be 208/230 volts, single phase, 60 hertz. Power for the indoor unit shall be supplied from the outdoor unit. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.

B. WALL-MOUNTED INDOOR UNITS

The system shall consist of a wall-mounted indoor section with wired, wall-mounted controller and a horizontal discharge, single-phase outdoor unit.

1. Unit Cabinet

The indoor unit cabinet shall be wall mounted by means of a factory-supplied mounting plate. The cabinet shall be formed from high-strength molded plastic with front panel access for filter. The indoor unit shall factory assembled, wired, and tested. Contained within the unit shall be all factory wiring and internal piping, drain left mechanism, control circuit board, fan, and fan motor. The unit, in conjunction with the wired, wall-mounted controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch.

2. Fan

The evaporator fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall a minimum of three speed settings, low, medium, and high. The fan shall have a selectable auto fan setting that will adjust the fan speed based on the difference between controller set point and space temperature.

3. Vane

There shall be a motorized horizontal vane to automatically direct airflow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower noise levels, and shall close the outlet port when operation is stopped. There shall also be a set of

vertical vanes to provide horizontal swing airflow movement selected by remote control.

4. Filter

Return air shall be filtered by means of an easily removable, long-life, high-efficiency filter.

5. Coil

The indoor unit coil shall be of nonferrous construction with precoated aluminum fins on copper tubing. The coils shall be pressure tested at the factory. A condensate pan with drain connections shall be provided under the coil. The unit shall also include a built-in, automatic condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan. The lift mechanism shall be equipped with a positive-acting liquid level sensor to shut down the indoor unit if liquid level in the drain pan reaches maximum level. Both refrigerant lines between the indoor unit and outdoor unit shall be fully insulated.

6. Electrical

The indoor unit shall be provided with a system allowing the indoor unit to be powered and controlled directly from the outdoor unit providing primary power and integrated by directional, digital control signal without additional connections. The indoor unit shall not have any supplemental electrical heating elements.

7. System Control

The control system shall consist of a minimum of two microprocessors, one on each indoor and outdoor unit, interconnected by a single nonpolar two-wire cable. Field wiring shall run directly from the indoor unit to the wall-mounted controller with no splices. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation, and controlling the outdoor unit. The control voltage from the wired controller to the indoor unit shall be 12/24 volts DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC.

The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

The indoor unit shall be connected to a wall-mounted wired controller to perform input functions necessary to operate the system. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation, and controlling the outdoor unit.

2.6 THERMOSTATS

Provide thermostats, as required to control heating and ventilating equipment. Thermostats shall be located on an interior wall that does not receive direct solar exposure unless otherwise indicated. Adjustment screws and temperature-setting indicator shall be accessible without opening the enclosure.

A. PROGRAMMABLE THERMOSTATS (FOR EQUIPMENT SPACES)

Programmable thermostats shall be wired remote controller for ductless split system heat pumps. Thermostat shall include weekly timer with up to 8 pattern settings per day. The controls shall include an LCD display, On/Off button, Increase/Decrease Set Temperature buttons, mode selector, Timer Menu and Timer On/Off buttons, and fan speed selector. Thermostat shall display room temperature in either Fahrenheit or Celsius and shall be in increments of 1 °F or 0.5 °C. Programmable thermostat shall be Mitsubishi PAR series, or equal.

2.7 SENSORS

A. HOT-WIRE AIRFLOW SWITCHES

Hot-wire airflow switches shall be hot-wire anemometer type for mounting within ductwork. Construction shall be polycarbonate housing with conformal coated sensing elements in the airstream. Sensing element shall sense the air speed and have an accuracy of 5% plus 10 fpm from the trip point. Switch shall include an adjustable trip point with a range of 30 to 4,000 fpm, adjustable alarm delay up to 256 seconds, and output via solid state relay. Sensor shall have minimum operating conditions of 14 degrees F to 140 degrees F and relative humidity of 5-95%. Hot-wire airflow switches shall be Degree Controls, Inc., S500 series, or equal.

2.8 TAPE

Non-combustible, three inches in size, foil backing, pressure-sensitive lap of facing material. NASHUA 322, NASHUA FSK (High Pressure) or equal.

2.9 DUCT SEALANT

Duct sealant shall be Foster 32-19 Duct-Fas, or equal.

2.10 ADHESIVE

Adhesive shall be Foster 85-60 Quick-Tack, or equal.

2.11 LINE HIDE SET

Line hide set shall be plastic duct to aesthetically contain HVAC piping and wiring. Sets shall be weather resistant, UV stabilized, paintable, PVC duct and fittings. Sets shall be suitable for use in ambient temperatures ranging from -4 °F to 140 °F. Mounting shall be done using stainless steel fasteners. Line hide sets shall be Mitsubishi Line-Hide, or equal.

2.12 METAL DUCTWORK

Metal ductwork for air supply and return air shall be fabricated in accordance with ASTM A527 (galvanized sheet metal) or ASTM A167, ANSI Type 302/304 (stainless steel sheets) if S.S. ductwork is shown on the Plans. Metal ductwork shall be rigidly constructed and installed. Slip joints shall be in the direction of air flow. All joints shall be sealed tight. Bonding materials for sealing duct system and attaching insulation shall be supplied by manufacture. Ducting shall be United McGill, SMACNA or equal.

Hangers shall be secured to the ceiling or walls and shall be adequate to support ductwork. Where ducts go through walls, there shall be 1/4-inch clearance left and this area shall be sealed tight with compatible mastic and foam rubber and the penetration area covered over with flanges that are secured to the ductwork only. Volume dampers shall be located as shown on the Plans, and at a minimum of one damper for each branch duct installed. Dampers are to be of the same material as the ducts they are installed in. Fire dampers shall be installed in ductwork as directed by the Building Permit or required by the Owner.

Ductwork shall be installed and supported to comply with the requirements and recommendations of Sheet Metal and Air Conditioning Contractors National Association (SMCACNA) HVAC Duct Construction Standards. Sheet metal plenum shall be constructed of not lighter than 18-gauge galvanized steel and

reinforced with 1-1/2-inch by 1-1/2-inch by 1/8-inch angles as required to prevent drumming or breathing. Access openings and covers shall be provided for cleaning, wiring and servicing motors, filters, fans and dampers located within or blocked by sheet metal work.

2.13 DUCT HANGERS AND SUPPORTS

Comply with requirements and recommendations of Sheetmetal and Air Conditioning Contractors National Association (SMACNA) HVAC Duct Construction Standards.

Conform to requirements of SMACNA “Seismic Restraint Manual Guidelines for Mechanical Systems.”

Furnish standard and fabricated hangers and supports complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

Hanger straps and rods shall be in accord with SMACNA Duct Construction Standards.

Fasten bracing to ductwork, including riveting, bolting, and tack welding per SMACNA.

Provide galvanized steel band or fabricated angle iron brackets for wall supports, except in wet well area where stainless steel components are required.

A. HANGER RODS

Carbon Steel, with hex nuts and flat washers.

B. CONCRETE INSERTS

1. Continuous channel - Unistrut.
2. Universal, malleable iron - Type 18, FS WW-H-171.

Beam Clamps and Attachments as required.

2.14 SEISMIC SUPPORTS

All HVAC supports, tie rods, bracing, brackets or other types of supports shall be designed in accordance with the current edition of the International Building Code (IBC) and ASCE 7-10. Evaluate the seismic loads in accordance with IBC and Chapter 13 of ASCE 7-10 for the seismic design parameters shown on the Plans.

2.15 FILTERS

Air filters shall be 80 percent efficiency, disposable type, and not less than MERV 12 rated. Filter shall UL Class 2 listed unless specifically noted otherwise on the Plans.

PART 3 EXECUTION

3.1 INSTALLATION

All materials shall be installed as shown on the Plans and according to manufacturer's recommendations. Adjust all dampers and louvers to provide tight seal when closed and unobstructed flow when open. Provide all necessary controls, and coordinate all control wiring with Division 16. All installed equipment shall function in manner intended.

The heating/cooling system shall be installed as shown on the Plans and shall be connected to any ductwork with flexible connections. The Contractor shall be responsible for the installation of any condensate drain piping and conduit/wire runs for controllers/thermostats.

3.2 TESTING, ADJUSTING AND BALANCING

A. QUALIFICATIONS

All work shall be performed under the direct supervision of an AABC Certified Test and Balance Engineer. Resumes including education, experience, and certification of each person on the project shall be submitted for review and approval by the Owner. Notify the Owner 10 days prior to testing. The Owner shall witness the testing and balancing.

B. INSTRUMENTATION

All instruments used will be currently calibrated and listed in the TAB report showing instrument description, serial number, and date of calibration.

C. AIR BALANCE

When systems are complete and ready for operation, the TAB Agency will perform a final air balance for all air systems and record the results. The volume of air for the supply, return, exhaust, and outside air equipment and terminals will be tested and balanced within the tolerances of the

AABC Standard. The general scope of balancing by the TAB Agency will include, but is not limited to, the following:

1. Filters

Check air filters and filter media and balance only systems with essentially clean filters and filter media.

2. Fan Speed

Measure and record RPM at each fan speed.

3. Voltage and Amperage Readings

Measure and record the final operating amperages and voltage for each motor.

4. Static Pressure Profile

Static pressure profiles shall be measured and recorded across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter, and exhaust fan, and at the furthest air device or terminal unit from the air handler supplying that device. Static pressure profiles shall also be provided for systems, which do not perform as designed.

5. Equipment Air Flow

Adjust and record exhaust, return, outside, and supply air CFM and temperatures, as applicable, at each fan and coil.

6. Outlet Air Flow

Adjust each exhaust inlet and supply diffuser, register and grille to within the tolerances shown in the AABC Standard. Include all terminal points of air supply and all points of exhaust.

D. REPORTS

The report will contain all required information as described within this specification, including the information formatted and shown in the AABC Standard. Include with the data the date tested, personnel present, records of test instruments used, and a list of all measurements taken. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the reports shall be certified by the Agency's Test and Balance

Engineer. Six copies of the final report shall be submitted to the Owner indicating a summary of actual operating data and any abnormal operating conditions.

E. EXECUTION

1. Provide additional dampers, and clean filters as specified herein and shown on the Plans.
2. Put all system and equipment into operation and continue operation until all adjusting, balancing, testing, demonstrations, instructions, and cleaning of systems have been completed.
3. Do not begin testing and balancing until systems are completed and in good working order.
4. Check motors for proper rotation, coupling and drive alignment, belt tension, and freedom from vibration, etc.
5. Make all changes to drives and dampers as necessary to accomplish specified airflows.

*****END OF SECTION*****

DIVISION 16 – ELECTRICAL

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SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. General requirements for electrical work.
 - a. Systems Descriptions
 - b. Area classifications
 - c. Submittals
 - d. Records
 - e. Coordination
- B. Related Sections include but are not necessarily limited to:
 - 1. General Conditions.
 - 2. Division 1 - General Technical Requirements.
 - 3. Division 2 - Site work.
 - 4. Division 3 - Concrete.
 - 5. Division 11 - Equipment.
 - 6. Division 13 - Special Construction.
 - 7. Division 14 - Conveying Systems
 - 8. Division 15 - Mechanical.
- C. Installation of systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.

1.3 WORK DESCRIPTION

- A. Provide the labor, materials, and equipment necessary to furnish, install, and place into operation the power, lighting, instrumentation, control, alarm, and associated electrical systems of this Contract.
- B. Provide functioning systems in compliance with manufacturer's instructions, performance requirements specified or indicated, and modifications resulting from reviewed shop drawings and field coordinated drawings.

- C. Provide electrical connections to motors, instrumentation, controls, meters, and any other electrical device installed or provided as part of the project.
- D. Test, adjust and calibrate equipment and start-up all electrical equipment, instrumentation equipment, and its associated mechanical attachments as necessary to place the project into operation.
- E. Mark and identify circuits, equipment, and enclosures with wire numbers, nameplates, and warning signs.

1.4 SYSTEMS DESCRIPTIONS

- A. Provide complete 480Y/277 and 208Y/120 volt power distribution systems including raceways, wiring, and power supply to equipment:
- B. Provide complete area lighting, building exterior lighting and site lighting system including all lighting fixtures, raceways, wiring, poles, pole foundations, photoelectric and switching/control equipment.
- C. Provide complete process control systems including programmable logic controllers (PLCs), individual controllers, monitoring and/or metering equipment, instrumentation equipment, and associated raceways, wiring, control panels, enclosures, and similar items.
- D. Provide a complete communications system including raceways, conductors, cables (copper), fiber optic cables, patch panels (workstation and fiber), communications outlets, racks, backboards, and associated enclosures.

1.5 AREA CLASSIFICATIONS

- A. Areas of the project are classified as “damp” or “wet” as defined in Article 100 - Definitions of the NEC. For the purposes of this specification, areas considered as damp under the NEC shall be considered wet. Areas are also classified as wet as listed below:
 - 1. Areas outdoors or underground.
 - 2. Areas in below grade vaults, manholes, or pullholes.
 - 3. Areas in buildings or structures that are below grade.
- B. Hazardous (Classified) Areas: Areas of the project may be classified as hazardous in accordance with NFPA standards. Hazardous (Classified) locations are generally indicated on the plans and/or noted in these specifications. Refer to Appendix for area classification letter giving details of each classification area.
 - 1. Hazardous areas may also be considered corrosive.

- C. Corrosive Areas: Corrosive areas are those areas where equipment or devices will be exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the device or equipment. Corrosive areas are generally indicated on the drawings and/or noted in these specifications.
 - 1. Corrosive areas may also be considered hazardous.
- D. Process Areas:
 - 1. Secondary Clarifiers
 - 2. RAS/WAS Building Lower Level
 - 3. Scum Pump Station
- E. Finished Areas: Areas that will require concealed construction in walls and ceilings. Finished areas are generally indicated on the drawings and/or noted in these specifications.

1.6 DEFINITIONS

- A. Outdoor Areas:
 - 1. Those locations on the Project site where the equipment is normally exposed to wind, dust, rain, snow, or similar natural environmental conditions.
- B. Indoor Areas:
 - 1. Those locations on the Project site where the equipment is normally protected from wind, dust, rain, snow, and similar natural environmental conditions by a building or structure with a complete floor-wall-roof/ceiling enclosure.
- C. Shop Fabricated:
 - 1. Manufactured or assembled equipment for which a NRTL test procedure has not been established.
- D. NRTL: Nationally Recognized Testing Laboratory.
- E. NEC: National Electrical Code
- F. NFPA: National Fire Protection Association
- G. NECA: National Electrical Contractors Association

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the InterNational Electrical Testing Association (NETA).

1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies, or equal, to supervise on-site testing specified in Part 3.
 2. Comply with NEC for components and installation.
 3. Comply with WAC and RCW requirements.
- B. Listing and Labeling: Provide products specified in these specifications that are listed and labeled.
1. The Terms "Listed and Labeled": As defined in the NEC, Article 100.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
 3. Comply with WAC and RCW requirements.
- C. Electrical Component Standard: Provide components that comply with NFPA 70.
- D. When a specific code or standard has not been cited, the applicable codes and standards of the following code-making authorities and standards organizations apply:
1. American Association of State Highway and Transportation Officials (AASHTO).
 2. American Iron and Steel Institute (AISI).
 3. American National Standard Institute (ANSI).
 4. American Society for Testing and Materials (ASTM).
 5. ETL Testing Laboratories, Inc (ETL).
 6. Insulated Cable Engineers Association (ICEA).
 7. Institute of Electrical and Electronic Engineers (IEEE).
 8. Illuminating Engineering Society of North America (IES).
 9. Instrument Society of America (ISA).
 10. Joint Industrial Council (JIC).
 11. Lightning Protection Institute (LPI).
 12. National Electrical Manufacturers Association (NEMA).
 13. National Fire Protection Association (NFPA).
 14. Occupational, Health and Safety Administration (OSHA).
 15. Underwriters Laboratories, Inc. (UL).
- E. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, plans and specifications, or within either document itself, the more stringent condition governs.

1.8 SUBMITTALS

- A. See Section 01300.
- B. Make submittals as soon as practical after the date of notice to proceed, but prior to purchase, fabrication, or installation of materials or equipment. Make submittals as a single package for each specification section or group related sections in one submittal, with proposed products and materials grouped according to the sections specified in Division 16. Do not split submittals having a common bill of materials. Group Division 16 submittals with Division 13 submittals where submittals have related items.
- C. Submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- D. Product Data:
 - 1. Provide manufacturer's product technical data, including, but not limited to:
 - a. Identification of the manufacturer.
 - b. Manufacturer's product descriptive bulletin.
 - c. Current, voltage, nameplate, load, impedance, and other electrical data pertinent to the Project and necessary to assure compliance with the Specifications and Plans.
 - d. Equipment weights and dimensions.
 - 2. Clearly indicate by using arrows or brackets precisely what is being submitted on. Designate optional accessories, which are being included and those which are excluded in the submittal.
- E. Shop Drawings: Submit Shop Drawings containing detailed drawings, diagrams and instructions for installing, operating and maintaining the material and equipment proposed for installation in the electrical work.
 - 1. See individual Division 16 sections for specific additional requirements.
 - 2. Prior to submittal, coordinate the electrical equipment (particularly motor control equipment, switchboards, control panels, and instrumentation) and materials, with other applicable equipment and systems of the contract documents, particularly process equipment and systems. Any modifications to the electrical equipment or other equipment, due to the use or submittal of process or other equipment which is different from that specified, shall be reflected in the submittal of the electrical equipment so

affected. (Refer also to section 01300, 1.1 SCOPE and Section 01300, 3.5 PREQUALIFICATION AND SUBSTITUTION.)

- a. Where electrical equipment submitted by the Contractor is a different size than the scaled dimensions shown on the plan, section or elevation drawings of the Contract Documents or requires clearance (for Code compliance, ventilation or other reasons), the Contractor shall mark and submit copies of the Contract Documents (or provide a modified AutoCAD drawing) showing the actual size of the proposed equipment, its placement drawn to scale in red pencil on the copies and any necessary clearances which demonstrate the suitability of the proposed equipment for the conditions of installation i.e. adequate space, clearance etc.. Submittals which do not meet this requirement will be rejected as incomplete.
 - b. Where equipment dimensions, layout, conduit connection routing, or conductor and conduit quantities, sizes or types are required to be different than indicated on the Contract Plans to accommodate the submitted equipment, the submittal shall clearly indicate the required changes (increased sizes, ratings of equipment or devices) and shall note that they are being provided to accommodate the submitted equipment without additional cost. The submittal shall indicate increased ratings, sizes. Submittals which do not meet this requirement will be rejected as incomplete.
 - c. Enclosures for equipment submitted by the Contractor shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans. Submittals which do not meet this requirement will be rejected.
 - d. Lugs or connections for equipment submitted by the Contractor shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans. Submittals which do not meet this requirement will be rejected.
3. Provide technical drawings as follows:
- a. Provide diagrams and drawings similar to the Contract Plans and named in a similar fashion for all technical drawings submittals.
 - b. Use diagrams and symbols for shop drawings that conform to Joint Industry Conference (JIC) Electrical Standards for Industrial Equipment and/or NEMA, Industrial Control Systems, ANSI and IEEE standards, latest revisions. Prepare drawings on size A, B or D sheets in a format similar to the

- Contract Plans or other nationally recognized drawing standard.
- c. Provide electrical elementary wiring diagrams for the electrical control systems showing the interconnecting wiring of electrical control items, such as motor starters and controllers, control systems, interlocks, switches, programmable controllers, microprocessor controllers, and relays. Use equipment manufacturer's approved submittal drawings as a reference for motor control centers, variable frequency drives, control panels, field instruments etc.
 - d. Provide scaled and dimensioned panel or enclosure face layout drawing; panel/subpanel material of construction, dimensions, and weight; conduit and wiring access locations; and material wiring and terminal block drawings for each control panel.
 - e. Provide schematic interconnection diagrams and/or Process Instrumentation Drawings (PID) diagrams for each separate control system or control panel. Each control diagram shall show a schematic representation of process equipment and locations of switches, meters, automatic valves, and indicators, controllers and recorders. Correct operating settings and ranges for each control instrument shall be marked on these diagrams.
- F. Clearly indicate on submittals that equipment or material is NRTL listed or is constructed utilizing listed or recognized components. Where a NRTL standard has not been established clearly identify that no NRTL standard exists for that equipment.
- G. Operation and Maintenance Manuals:
- 1. See specific sections for information specific to each type of equipment which is to be included in O&M manuals.
 - 2. Provide preliminary manuals of each equipment item to the Owner for review no later than when the electrical equipment is submitted for approval and accepted.
 - 3. Provide final manual copies before the equipment is shipped to the job site. For equipment which also requires third part (NETA) testing, provide reports with O&M manuals after installation but before equipment is put into use. Equipment installation will not be accepted without O&M manuals and third party testing reports.
 - 4. Drawings and Bill of Materials included in final manuals shall show "as shipped" wiring and components. Provide updates to the final manuals with Record Drawings of the work upon completion

- of the work, folded and punched for insertion into the manual after they are reviewed by the Owner.
5. Clearly indicate by using arrows or brackets precisely what has been provided. Designate optional accessories, which are being included and those which are excluded in the manual.
 6. Final manuals for the electrical system shall consist of 3-post, expandable metal hinge binders labeled with the job name and the Contractor's name with tab dividers for each major type of equipment.
 - a. Provide manufacturer's installation, operation, maintenance, and service information for each item of equipment furnished under Division 16.
 - b. Assemble and index each section listing the contents individually on the tab divider for that section.
 - c. Compile a spare parts list and a suppliers index for each section and assemble in the section provided.
 - d. Assemble records of tests, measurements, and calibration settings made for each device. Provide Record Drawings of the work upon completion of the work. Fold, punch, and insert these records into the manual after they are reviewed by the Owner.

1.9 RECORDS

- A. Maintain and annotate on the job at all times a separate set of Record Drawings in accordance with the General Conditions. Show changes from the Contract Documents plan drawings including: routing of raceways, stubups, actual equipment and fixture locations, equipment sizes and dimensions and building or structure outline changes. Review the drawings with the Owner as the work progresses whenever requested and provide color copies of record drawings when requested. At the end of the project, forward to the Owner a complete set of drawings marked in red pencil in a manner consistent with the Contract Plans, indicating the changes made on the job.
- B. Equipment furnished under this Contract for use on future work and all concealed materials, including conduits, shall be dimensioned from visible and permanent building/structure features or drawn to scale on the record drawings.
- C. Record voltage, current, and megohmmeter and ground ohmer resistance test measurements made on the electrical work, the size, type and settings of trip units, fuses, and overload relay elements installed in the equipment. Record the setting of all pressure, temperature, level, and

similar instrumentation and control devices. When the project is operating, turn over these records to the Owner.

D. Digital Record Photographs

1. Requirements for the Photographs

- a. Digital photographs shall be at the native resolution of the camera or smart phone. The file format of the photographs shall be JPEG using the modest compression. (Where the compression levels are described, the typical description of the compression level might be “good”.)
 - b. JPEG files shall be stored so that the EXIF (Exchangeable Image File Format) data is maintained. Prior to taking any photographs, the camera time should be set so that EXIF data includes the time and date of the photograph. The JPEG files shall be stored so that the creation (or modification) time and date of the file also reflect the time and date of the photograph. (The EXIF data should be viewable under Windows 7 or Windows 10.)
 - c. The camera shall have a native resolution of at least 8.0 megapixels.
 - d. Photographs of signs, nameplates, or labels shall be taken using macro modes. The photographs shall be taken so that settings, serial numbers, catalog numbers, order numbers, etc. are legible. The photographs of reflective items shall be taken at an angle to the item to reduce glare.
2. Take photographs of electrical equipment possibly requiring coordination when the equipment arrives on site. The photographs shall include nameplates and labels if available. The equipment shall include but not necessarily be limited to, the following:
- a. 480 VAC Motors
 - b. HVAC equipment
 - c. Motorized actuators
 - d. Control Panels
3. Take photographs of conduits prior to concealing them. The photograph files shall be labeled with location or shall contain adequate context to determine location such as a tape measure showing distance from a wall or depth below grade. The photographs shall include the following:
- a. Conduit placement prior to pouring concrete or backfilling
 - b. Conduit placement prior to covering walls

- c. Stub up locations prior to placing equipment such as Switchgear, Switchboards or Motor Control Centers.
4. Take photographs of electrical equipment following installation or modification. The photographs shall include nameplates, labels, and similar identifiers. The equipment shall include but not necessarily be limited to, the following:
- a. Motors and motor drive equipment.
 - b. Control Stations
 - c. HVAC equipment
 - d. Motorized actuators
 - e. Control Panels
 - f. Instrumentation providing electrical signals including transmitters, sensors, and switches.
 - g. Motor Control Centers
 - h. Panelboards
 - i. Safety Disconnect Switches
 - j. Circuit Protective Devices showing catalog number, serial number and adjustable trip settings.
 - k. Motor Overload showing catalog number, serial number and adjustable trip settings
5. Photographs shall be supplied to the Owner at least once every day. Photographs shall be supplied to the Owner no later than one day after they are taken. Photographs shall be supplied on optical media (CD-R, DVD-R, or DVD+R), by email or by another method by prior arrangement with the Owner.

1.10 COORDINATION

- A. Coordinate and schedule connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- B. Coordinate the interruption of electrical systems to any part of the facility in use by the Owner at least 48 hours before interruption of the system.
- C. Coordinate the cutting of existing structures with the new and existing electrical systems. Identify, locate, and protect existing and underground, underslab or embedded conduits/cables where excavation or cutting of existing structures is to be performed.
- D. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

- E. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
- F. Coordinate requirements for access panels and doors where electrical items requiring access are concealed by finished surfaces.
- G. Coordinate the electrical work with the requirements of equipment provided under other Divisions. Portions of the electrical design are based upon the equipment specified in other Divisions. Where modifications to the specified electrical systems or equipment devices or materials are required to accommodate actual electrical requirements of equipment which is specified under other Divisions of the Contract but which has electrical requirements different from those specified under those Divisions for the equipment, make modifications to the electrical system or systems required to accommodate the equipment, and pay for all such changes. No additional payment, “extras”, or additive change orders are allowed for changes required to accommodate substitutions or changes proposed by the Contractor.
- H. Where changes in the work, or substitutions in material or equipment specified under this Division are proposed, ensure that sizes, weights, openings, etc., are provided that do not require changes in the work outside this Division. If changes to work outside this Division are required to accommodate substitutions or changes proposed by the Contractor, submit complete descriptions of these changes for approval by the Owner, and pay for all such changes. No additional payment or “extras” are allowed for changes required to accommodate substitutions or changes proposed by the Contractor.
- I. Coordinate the installation of electrical equipment with other trades:
 - 1. Arrange for the building-in of equipment and materials during structure construction. Arrange for the building in of anchors, supports, sleeves, or other equipment and materials during concrete placement, framing, precasting or other structure construction. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed. Install sleeves for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls. Gypsum wall sleeves may be cut-in after erection if desired.
 - 2. Where equipment or materials cannot be built-in during construction, arrange for chases, slots, box-outs or other openings

- in the structure, as required to allow installation of equipment after structure construction is complete.
3. Where penetration of completed or permanent construction elements such as walls, beams, ceilings, floors, etc. is required, obtain approval from Owner for penetration (drilling, cutting, shooting, punching) of structural components prior to penetrating the element or component.
 4. Accurately locate panelboards, outlets, switches, control stations and similar devices with respect to equipment and the finished work of others. Verify dimensions and locations with the general, civil, structural, mechanical, process, architectural and other Contract plans as well as shop drawings/supplier's drawings and trades.
 5. Coordinate installing large equipment requiring special access openings or positioning prior to closing in the building.
- J. Coordinate electrical work with work under other Divisions. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Cooperate in locating equipment to avoid interference with work of others, and plan this work to harmonize with the work of other trades so that all work may proceed as expeditiously as possible. No extras are allowed because of moving work required to avoid interference with work of other trades or contractors.
- K. Coordinate connecting electrical circuits to components furnished under other Divisions. Coordinate the location of motors, switches, panel connections and other points of connection with the equipment manufacturers or vendors prior to conduit installation, and route circuits to the actual connection point. Remove and reinstall conduit, outlet boxes and other electrical connections, even if removal and reinstallation of building materials is necessary, where electrical connections are not made to the appropriate equipment location.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01600.
- B. Receive, handle, and store electrical materials and equipment in accordance with the manufacturer's instructions.
- C. Protect materials and equipment from damage, corrosion, or disfiguring; protect nameplates on electrical equipment from defacing. Deliver equipment to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent

damage from construction operations. Remove protection only after equipment is safe from such hazards. Field repair of material or equipment made defective by improper storage or site construction damage by other trades is not acceptable.

- D. Repair, restore, or replace damaged, corroded and rejected items at no additional cost to the Owner.
- E. Provide dry, heated storage for materials and equipment intended to be installed indoors which is not protected by packaging suitable for outdoor storage by the manufacturer and for equipment that requires an electrical connection or heater to mitigate water condensation and like hazards.
- F. Keep electrical equipment rooms clean and vacuumed after each day when work is performed in the area. Do not place electrical equipment rated for indoor installation into its final location until this location is weathertight and heated with openings to the outside closed with temporary weather barriers or with the installation of permanent doors, fans, and ducts. (The final location shall be the electrical equipment location shown on the Contract Plans or otherwise described in the Contract Documents.)
- G. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage - either inside or on top of enclosures.
- H. Protect nameplates on electrical equipment from defacing.
- I. Repair, restore, or replace damaged, corroded and rejected items at no additional cost to the Owner.

1.12 EXTRA MATERIALS

- A. Provide extra materials including spare parts where noted in individual specification sections.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site or house equipment in a storage area not accessible to the Owner. Provide an inventory and listing of the spare parts to the Owner when the parts (and spares) arrive onsite.

PART 2 — PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refer to individual Division 16 sections.
 - 1. Provide equipment, which is of a similar type, made by one manufacturer throughout the project unless otherwise noted in the Specifications.
- B. Submit requests for substitution in accordance with Specification Section 01300

2.2 MATERIALS

- A. Except as otherwise indicated, provide new materials and equipment which are standard products of manufacturers regularly engaged in production of such equipment. Provide similar items of equipment of the same manufacturer and quality. Where systems are specified, provide components of the system from one manufacturer.
- B. Trade names and catalog numbers may be used in the Plans or Specifications to establish quality standards and basis of design:
 - 1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.
 - 2. If no other manufacturer is listed then any manufacturer of equal equipment may be acceptable.
- C. Provide material or equipment approved and labeled for the purpose for which it is to be used by a nationally recognized electrical testing laboratory (NRTL) or other organization acceptable to the State of Washington Department of Labor and Industries.
 - 1. Where NRTL test procedures have been established for the product type, provide electrical equipment approved under that procedure and bearing the NRTL label.
- D. Where voltage, current, power, temperature or other ratings are specified that do not correspond to standard ratings of the manufacturer selected by the Contractor, furnish the next rating level which increases the capacity of the device or material in question.
- E. Furnish materials, devices, equipment or supplies of materials that are inherently non-corrosive or are coated or covered in a manner, acceptable to the Owner, which renders them non-corrosive. Do not provide materials which contain polychlorinated biphenyls, asbestos or other hazardous or detrimental materials. Do not install materials in a manner, location or construction that produces galvanic action or any

other materials corroding or eroding action. Material that may cause rusting or streaking on a building/structure surface shall not be used.

- F. Fabricate equipment or devices in the field equivalent in every respect to manufactured items used for the same purpose. Where cutting, drilling, grinding, or similar actions are performed on galvanized or painted metal, regalvanize or repaint, respectively, to match original finish.
- G. When equipment is shop fabricated for the Project, use electrical devices and enclosures which are NRTL listed and labeled or recognized.

PART 3 — EXECUTION

3.1 INSTALLATION

- A. Make arrangements for and pay for necessary permits, licenses, and inspections.
- B. Equipment shall be installed in accordance with the requirements of the National Electrical Code, National Electrical Safety Code, and applicable state and local regulations and ordinances.
- C. Install equipment in accordance with the manufacturer's instructions and the NECA “NEIS” (National Electric Installation Standards).
- D. Provide on-site testing as listed in individual specification sections. Test results shall be in writing.
- E. Equipment Dimensions and Clearances:
 - 1. Dimensions indicated for electrical equipment and dimensions indicated for the installation of electrical equipment are restrictive dimensions. Verify that equipment will fit within the indicated locations and spaces. Do not use equipment that impinges upon the required clearance, reduces actual clearance, or exceeds the indicated dimensions:
 - a. Except as approved in writing by the Owner.
 - 2. Do not use arrangements of equipment that impinge upon the required clearance, reduce actual clearances or exceed the space allocation.
- F. Equipment Access:
 - 1. Install equipment so it is readily accessible for operation and maintenance.
 - 2. Access to equipment shall not be blocked or concealed by conduits, supporting devices, boxes, or other items.

3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.
- G. Install materials and equipment in a manner, location and construction that does not produce galvanic action or any other materials corroding or eroding action. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.
- H. Screen openings and seal all raceways into equipment to prevent the entrance of moisture, rodents and insects.
- I. Plans indicate the approximate location and arrangement of electrical equipment and the approximate location of other equipment requiring electrical work. The general arrangement of panelboards, outlets and other equipment is diagrammatic and approximate as to locations. To avoid interference with structural members and equipment of other trades, it may be necessary to adjust the intended location of electrical equipment. Where minor changes are required because of structural or finish conditions or for the convenience of the Owner, provide such changes without additional expense to the Owner. Unless specifically dimensioned or detailed, the Contractor may, at his discretion, make minor adjustments in equipment location without obtaining the Owner's approval. Minor adjustments are defined as a distance not to exceed:
1. 1 FT at grade, floor and roof level in any direction in the horizontal plane.
 2. 1 FT for equipment other than lighting at ceiling level in any direction in the horizontal plane.
 3. 1 FT for lighting fixtures at ceiling level in any direction in the horizontal plane.
 4. 1 FT on walls in a horizontal direction within the vertical plane.
 5. Changes in equipment location exceeding those defined above require the Owner's approval.
 6. Particular attention shall be paid to door swings, piping, radiation, ductwork, and structural steel:
 - a. In general, waste and vent lines and large pipe mains and ductwork shall be given priority for the locations and space shown.
 - b. Electrical lighting fixtures shall, in general, be given priority for ceiling space.
 - c. No additional compensation will be allowed for the moving of misplaced outlets, wiring, or equipment.

3.2 DEMONSTRATION

- A. Demonstrate equipment in accordance with Section 01800.
- B. Demonstrate to the Owner that the electrical installation is working by operating all electrical systems and equipment. Simulate control and emergency conditions, artificially where necessary, for complete system tests. Adjust installed equipment for proper operation of all electrical and mechanical components.

3.3 ASSISTANCE

- A. Provide assistance to the Owner during the demonstration or testing of equipment by operating devices and equipment, during construction observation by opening enclosures for inspection, checking record drawing information, and similar tasks, as necessary, in the Owner's judgment to verify all work provided.

***** END OF SECTION *****

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Supporting devices.
 - 2. Electrical identification.
 - 3. Electrical demolition.
 - 4. Cutting and patching
 - 5. Cleaning and finish touchup painting.
 - 6. Testing

1.3 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of material specified.
 - 1. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
 - 1. Testing Reports. (See section 3.8 for further information)

1.4 QUALITY ASSURANCE

- A. Refer to Section 16010 paragraph 1.7.

PART 2 — PRODUCTS

2.1 SUPPORTING DEVICES

- A. Provide tubing, channel and angle support systems, hangers, sleeves, brackets, fabricated items, and fasteners for secure support of electrical equipment, devices, components and materials:
 - 1. Material:
 - a. Wet locations (including outdoors and in below-grade structures): Stainless steel or hot-dipped galvanized.
 - b. Class I Hazardous locations and/or Corrosive areas: 304 stainless steel or 40 mil PVC coated galvanized steel.
 - c. Other locations: Steel, except as otherwise indicated, protected from corrosion with zinc coating, cadmium plating, or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
- B. Conduit clamps: one hole or beam clamps
 - 1. Rigid Steel Conduit: cast iron hot dipped galvanized clamps with cast iron hot dipped galvanized clamp back (AKA foot or spacer).
 - 2. PRMC: cast iron PVC coated or stainless steel clamps with cast iron PVC coated or stainless steel clamp back (AKA foot or spacer).
 - 3. EMT: stamped steel clamps – cad plated or galvanized.
- C. Anchors: stainless steel in wet, hazardous or corrosive areas; cadmium plated or galvanized steel in dry areas.
 - 1. lag screws or Type A tapping screws for wood.
 - 2. Toggle bolts with springhead for light loads in masonry.
 - 3. thru-bolt with fender washers for loads in masonry.
 - 4. toggle bolts with springhead for hollow partitions.
 - 5. epoxy set or self drilling anchors with threaded studs for concrete.
 - 6. clamps or U-bolts for structural steel.
 - 7. Epoxy set or self drilling anchors with extension rods for hollow tile over concrete.
 - 8. hanger rods: 1/4-inch diameter or larger threaded steel, except as otherwise indicated.

D. Sleeves:

1. Wet, hazardous or corrosive areas:
 - a. ASTM A 53, Type E, Grade A, Schedule 40, hot dipped galvanized steel, plain ends.
 - b. Hot dipped galvanized cast iron, with weep rings.
2. Dry Areas:
 - a. PVC, schedule 40.
 - b. 0.0276-inch or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.

2.2 ELECTRICAL ENCLOSURES

A. Enclosures for use with Electrical Equipment:

1. Standards:
 - a. NEMA ICS-6, Enclosures for Industrial Controls and Systems.
 - b. UL 508, Industrial Control Equipment.
 - c. UL 698, Industrial Control Equipment for Use in Hazardous Locations.
2. Provide NEMA enclosure types as indicated on the Contract Documents. Where the enclosure type is not indicated by the Contract Documents provide enclosures as follows:
 - a. NEMA 1: Use in electrical rooms and in dry indoor finished areas.
 - b. NEMA 12: Use in unclassified (non-hazardous and non-corrosive) indoor locations which are neither wet nor damp.
 - c. NEMA 4X: Use in all non-hazardous wet or corrosive locations.
 - d. NEMA 7: Use in all hazardous locations.

B. Shop or Factory Finishes:

1. Exteriors of painted enclosures shall be ANSI gray.
2. Interiors of painted enclosures shall be either white or light gray.

2.3 ELECTRICAL IDENTIFICATION

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Contractor's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NEC and these Specifications.

- B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide.
- C. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 - 1. Size: Not less than 4 mils thick by 6 inches wide.
 - 2. Compounded for permanent direct-burial service.
- D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- E. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched for mechanical fasteners 1/16 inch minimum thick for signs up to 20 sq. in., 1/8 inch thick for larger sizes. Engraved legend in white letters on black face.
- F. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or stainless-steel No. 10/32 machine screws with nuts and flat and lock washers.
- G. Wire markers: machine printed, black ink, alpha-numerical identifiers on yellow polyolefin shrink tubing. Kroy K4350 Shrink Tube, or approved equal.
 - 1. Where it is not possible to use shrink tubing (i.e. on pre-terminated cables) it is acceptable to use the following:
 - a. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

2.4 TOUCHUP PAINT

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Non-equipment Surfaces: Matching type and color of undamaged, adjacent finish.
- C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 — EXECUTION

3.1 INSTALLATION

- A. Comply with NECA's "Standard of Installation."
- B. Install the equipment and materials in a neat and workmanlike manner employing workmen skilled in the particular trade and in accordance with the manufacturer's instructions and industry standards. Maintain

adequate supervision of the work by a person in charge at the site during any time that work under this division is in process or when necessary for coordination with other work.

- C. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated. Mount enclosures for individual units at fifty-four inches above floors to centerline of controls.
- D. Install items level, plumb, parallel and perpendicular to other building systems and components, except where otherwise indicated.
- E. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- F. Give right of way to raceways and piping systems installed at a required slope.
- G. Make all penetrations of electrical work through floors, walls and roofs water, rodent, insect and weather-tight.

3.2 ELECTRICAL SUPPORTING METHODS

- A. Support electrical equipment, devices and materials from framing members or structure with sufficient clearance for maintaining and servicing.
 - 1. Provide backing plates, and/or framing material to support equipment, devices and materials which are located between the framing members which are part of the building or facility structure.
 - 2. Provide metal structure fabricated of structural shapes such as C-channel or square tubing (not strut channels, unistrut, B-line, etc.) for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other equipment and devices except where components are mounted directly to structural features of adequate strength.
- B. Fastening and Supports: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building/structure/support.
 - 1. Use supports as detailed on the Plans and as specified:
 - a. Where not detailed on the Plans or specified, use supports and anchoring devices rated for the equipment load and as recommended by the manufacturer.

2. Attach enclosures mounted on equipment with machine screws or clamps as required. Do not drill equipment frames or sheets without permission of the equipment supplier/manufacturer and the Owner. Do not mount safety switches or external equipment to other equipment enclosures, unless enclosure mounting surface is adequately reinforced structurally to accept mounting of external equipment.
 3. Base rating and size of supports and anchoring devices on dimensions and weights verified from approved equipment submittals. Attach wall mounted enclosures with a minimum of three fasteners, and more if the manufacturer so recommends.
 4. Stand off outdoor wall-mounted equipment and indoor equipment mounted on earth or water bearing walls a minimum of one-quarter inch where enclosures are mounted on walls in wet areas (outdoors, below grades, etc.). Use corrosion resistant spacers such as neoprene, or fiberglass or plastic shim washers to maintain ¼ IN separation between the equipment and the wall.
 5. Do not cut, or weld to, building structural members without permission of the owner. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.
 6. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.
- C. Raceway Supports: Comply with NEC and the following requirements:
1. Conform to manufacturer's recommendations for selecting and installing supports.
 2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
 3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
 4. Spare Capacity: Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
 5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
 6. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.

7. Use double nuts or jam nuts with regular nuts on threaded rods and bolts.
 8. Trim rod ends to within ¼ inch after installation of last nut, clamp or similar hardware; smooth cut ends or install cap nut.
- D. Provide concrete foundations or pads required for electrical equipment:
1. Floor-mounted equipment shall be mounted on a concrete base except the concrete base shall be shortened in height by the thickness of the channel base when the equipment is provided with channel bases such as can be provided with control panels, motor control centers and switchboards. Pad shall be poured on top of the finished floor or slab.
 2. Install concrete pads and bases according to requirements of Division 3 and per structural plans and specifications.
- E. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
- F. Cable supports - provide cable ties and straps for clamping, tying, securing and banding wires and cables in all junction boxes, panelboards and terminal cabinets. Support each circuit independently; group phases of three phase circuits.

3.3 IDENTIFICATION

- A. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Plans or required by codes and standards. Use consistent designations throughout the Project.
- C. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
- D. Tag or label power circuits in enclosures using tags or adhesive marking tape. Identify source and circuit numbers in each cabinet, pull box, pull hole, vault, maintenance hole, junction box, and outlet box. Color coding may be used for voltage and phase indication.
- E. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above power and communication lines. Where multiple

lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches, use a single line marker.

- F. Provide engraved phenolic name plates (white with black background) on equipment enclosures giving the name and circuit identification (Panel/MCC/Enclosure served from and circuit location or ID) of the enclosed device/equipment in one-quarter inch letters.
- G. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.
- H. Provide electrical danger, caution, warning or safety instruction signs including arc flash signs in accordance with WAC/RCW, WISHA/OSHA and other applicable state/federal safety requirements.

3.4 DEMOLITION

- A. Demolish all existing electrical devices and circuits which are noted for demolition. Demolition includes, but is not limited to:
 - 1. Remove all conduit, conductors, fittings, device boxes, hangers, panels, devices, etc., which are not concealed in the building structure or below grade/slab.
- B. Do not remove or damage fireproofing materials. Repair or replace fireproofing removed or damaged.
- C. Locate, identify, and protect electrical equipment and materials to remain. Where existing work to remain is damaged in the course of the work, remove damaged portions and install new products of equal capacity, quality, and functionality at no additional cost to the Owner.
- D. Remove existing conductors from conduits or other enclosures, unless otherwise indicated, where existing work is to be abandoned in place. Cut and remove buried cable or raceway indicated to be abandoned in place at the point where it stubs up or emerges from burial 12 inches below the surface of adjacent grade or construction; cap and patch surface to match existing finish.
- E. Remove demolished material from the Project site and legally dispose of demolished material by wastehaul to approved landfill or recycling facility.
- F. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation and/or reconnection. Coordinate the process, mechanical, HVAC, and other equipment scheduled to be

relocated and/or reused with other Divisions, and disconnect the equipment from and reconnect the equipment to the electrical systems.

3.5 TEMPORARY POWER

- A. Provide temporary power to existing branch circuit panels, branch circuits, and/or directly to electrical devices as required to keep all portions of the existing facility, which are occupied by the Owner, or required for facility operation, in operation at all times. Obtain approval by all appropriate code authorities, including the Department of Labor & Industries Electrical Inspection Department, for any temporary connections provided.

3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair disturbed surfaces to match adjacent undisturbed surfaces.

3.7 CLEANING AND TOUCHUP PAINTING

- A. Clean dirt and debris from all surfaces. Thoroughly vacuum the interior of enclosures to remove dirt and debris.
- B. Replace nameplates damaged during installation.
- C. Apply touch-up paint as required to repair scratches, etc. Field paint in accordance with Section 09900. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3.8 TESTING

- A. Testing shall be performed by a person currently certified by the InterNational Electrical Testing Association.
- B. Additional testing requirements specific to other sections are specified in those sections.
- C. Test electrical equipment as described in individual specification sections after installation but before it is energized and placed in service. All equipment shall be tested as recommended by the manufacturer. Report all test results in writing. Where tests disclose a defect in the work, rework or repair equipment which performs unsatisfactorily during or as a result of system testing at no additional expense to the Owner and retest to confirm the rework or repair until retesting confirms

that the defect has been corrected. Test in accordance with the manufacturer's installation and testing instructions and the applicable electrical standards (i.e., NEMA, IEEE, ISA, ANSI, or other) for the class of equipment. If equipment or system fails retest, replace it with products which conform with Contract Documents. Continue remedial measures and retests until satisfactory results are obtained. Remedial measures and retests will be done at no cost to the Owner.

- D. Test motor driven equipment motors before energization. Insulation test shall consist of megohmmeter check phase-to-ground, per IEEE Standard 43, and polarization index test per the manufacturer's recommendations.
 - 1. Perform load tests of each motor and prepare a written report of the findings showing the following:
 - a. Nameplate Ratings (horsepower), (speed), (voltage), (phase), (ampere rating of motor at full load).
 - b. Measured Load in amperes on each phase at full speed.
 - 2. For load tests for each pump/blower/ process equipment motor:
 - a. Note the operating conditions at the time of the test.
 - b. Note the suction and discharge conditions (pressure, water level, temperature, humidity, where such conditions affect load).

3.9 DEMONSTRATION

- A. Demonstrate equipment in accordance with Section 16010.

***** END OF SECTION *****

SECTION 16060

GROUNDING

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 16120 for grounding conductor requirements.

1.3 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of component specified.
 - 1. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Field Test Reports: Indicate and interpret test results for compliance with manufacturer's published standards and performance requirements. (see Section 3.4 for further information)
- D. Operation and Maintenance Manual: At the completion of the project, the operating and maintenance information shall be updated to reflect any changes during the course of construction. The Operation and Maintenance Manual shall include the following:
 - 1. Approved testing reports.
 - 2. Product Data

1.4 QUALITY ASSURANCE

- A. Refer to Section 16010 Basic Electrical Requirements 1.7 Quality Assurance
- B. Comply with UL 467, "Grounding and Bonding Equipment".

PART 2 — PRODUCTS

2.1 GROUNDING AND BONDING PRODUCTS

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.2 WIRE AND CABLE GROUNDING CONDUCTORS

- A. Comply with Section 16120 Conductors and Cables." Conform to NEC Table 8 (Conductor Properties), except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductors: Insulated with green color insulation.
- C. Grounding-Electrode Conductors: Stranded cable, bare or varnish coated.
- D. Ground Rods: $\frac{3}{4}$ inch diameter, 10 foot long, copper clad steel.

2.3 CONNECTOR PRODUCTS

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items. Burndy, Thermoweld, or Cadweld.

PART 3 — EXECUTION

3.1 APPLICATION

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Install insulated equipment grounding conductor with circuit conductors for the items below.
 - a. Service and Feeders.
 - 1) Bond the conductor full size to the equipment to which the circuit connects and to any portion of the raceway where it is metallic. Provide boxes or fittings suitable for connecting equipment grounding conductors where metallic conduit transitions to non-metallic.
 - b. Single or three-phase motor or appliance branch circuits.
 - c. Flexible raceway runs.
 2. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables. Bond the conductor at each end of non-metallic raceway to grounded metallic raceway or equipment.
 3. Provide boxes or fittings suitable for connecting equipment grounding conductors where metallic conduit transitions to non-metallic.
- B. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-30.

3.2 INSTALLATION

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Plans or Specifications exceed NEC requirements.
- B. Ground the secondary electrical system to the building structure, metallic piping systems and supplemental grounding electrodes. Coordinate grounding connections made to the water system with the mechanical work and install bonding jumpers wherever deemed necessary.

3.3 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.

3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Clean all varnish, oxide, scale, concrete, etc. from conductors before firing joints. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
 - C. Equipment Grounding-Wire Terminations: Make the grounding conductor connections to motors or equipment ten horsepower and above, or twenty amperes and above, with conductor termination and a 5/16 inch minimum bolt tapped to the motor frame or equipment housing. Ground connection to smaller motors and equipment may be made by fastening the conductor termination to a connection box.
 - D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal electrical enclosures without mechanical and electrical connection to electrical enclosures, terminate each conduit with a metallic, insulating grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in electrical enclosures. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
 - E. Connect discontinuous sections of metallic raceway using grounding (bonding) connections at each end of metallic raceway with equipment grounding conductor in the non-metallic portion of the raceway.
 - F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
 - G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

3.4 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Engage an independent electrical testing organization to perform acceptance tests described below.

- B. Test installation of grounding electrodes and ground rods before electrical circuitry has been energized.
- C. Acceptance Tests:
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.13. Certify compliance with test parameters. Maximum grounding resistance value shall be 3 ohms.
 - 2. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - 3. Measure resistance of equipment grounding connections for service, feeder and motor circuits to ground at the load end with a Biddle ground ohmmeter.
- D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner. Check connections of affected equipment and conductors. Replace, repair, or correct defective connections or conductors. Provide additional ground rods or larger grounding electrode where the grounding electrode resistance is higher than specified. Revise and retest until resistance is within specifications.
- E. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

***** END OF SECTION *****

SECTION 16120
CONDUCTORS AND CABLES

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of conductor or cable specified.
 - 1. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
 - 1. NETA Testing Reports. (See section 3.5 for further information)
 - 2. Communications Cable Testing Reports. (See section 3.5 for further information)

1.4 QUALITY ASSURANCE

- A. Refer to Section 16010 paragraph 1.7.

PART 2 — PRODUCTS

2.1 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Thermoplastic Insulation Material: Comply with NEMA WC 5.

- C. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
- D. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
- E. Conductor Material: Copper.
- F. Stranding:
 - 1. Class B for power applications.
 - 2. Class C for control applications.
- G. Size and Type:
 - 1. Stranded conductor for No. 10 AWG and smaller gauge 120 VAC branch power circuits; except receptacle, lighting and switch leg circuits which shall be solid conductor.
 - 2. Stranded conductor for 277 or 480 VAC power circuits, and for any power circuit larger than No. 10 AWG.
 - 3. Stranded conductors for control circuits.
 - 4. Grounding conductors: solid conductor in sizes No. 6 AWG and smaller gauge; stranded in No. 4 AWG and larger gauge.
- H. Cords: Type SO, size No. 14 AWG or larger.

2.2 INSTRUMENTATION AND SPECIALTY WIRE

- A. Low voltage instrument cable: 600 volt rated, multi-conductor cable with overall neoprene or PVC jacket. Individual conductors PVC or polyethylene insulated, with or without nylon overcoat.
 - 1. Unshielded instrument cable Belden 9486 (18 gauge), 9488 (14 gauge) or equal, Alpha or NEC.
 - 2. Shielded single pair instrument cable (2/C#18) Belden 9341 or equal, Alpha or NEC.
 - 3. Shielded three conductor instrument cable (3/C#18) Belden 3089A or equal, Alpha or NEC.
 - 4. Shielded multi-pair (#18 gauge) instrument cable Belden 1048A (2 pair), 1049A (4 pair), 1050A (8 pair), 1051A (12 pair) or equal, Alpha or NEC.
- B. VFD Cable: Low voltage, shielded power cable. Three conductor copper cable rated 600 volt, with cross linked thermosetting polyethylene insulation on each conductor, three bare grounding conductors (one in each interstice), with a corrugated copper shield and overall PVC jacket. Cables shall have the following maximum nominal outer diameter (OD) and minimum bend radius:

Conductor Size	Nominal OD (Inches)	Minimum Bend Radius
#16	0.40	4.0
#14	0.45	4.5
#12	0.50	5.0
#10	0.60	6.0
#8	0.70	7.0
#6	0.80	8.0
#4	0.90	9.0
#2	1.05	10.5
#1	1.20	12.0
#1/0	1.3	13.0
#2/0	1.4	14.0
#3/0	1.55	15.5
#4/0	1.7	17.0

1. VFD cables with nominal outer diameters and minimum bend radiuses that are greater than shown in the above table will be rejected.
2. Belden VFD Power Cable Model numbers 29520C through 29532C (depending on cable size).

C. SCADA communications wire: Coordinate the with the actual Remote I/O protocols being used.

1. Remote I/O Cabling
 - a. DeviceNet wiring: NEC Class 1 Wiring (8 Amp Capacity), 2/C#15STP, 2/C#18STP (ODVA DeviceNet Thick Cable). The #18 pair shall have a characteristic impedance of 120Ω. Terminate both ends of network with 121Ω (±5%), ¼ Watt capacity resistors. Provide Allen-Bradley 1485C-P1Axxx (where xxx is the cable length in meters), Belden 7897A, or equal.
 - b. Profibus DP: 2/C#22STP with a characteristic impedance of 150Ω. Provide Belden 3079A or equal.
 - c. Modbus Plus: RG-6, Quad Shield cable. Provide Belden 3092A or equal.
2. RS-485 (also known as EIA-485, EIA/TIA-485, Modbus RS-485): 2/C#22TP+1/C#22, Overall shield with drain. Characteristic impedance on the twisted pair wires shall be 120Ω nominal. Terminate both ends of network twisted pair with 121Ω(±5%), ¼ Watt capacity resistor. Provide Belden 3106A or equal.

- D. Category 5e Cable: Provide Category 5e cable as shown on drawings. Cable shall be UL Type CMP (plenum). For plenum cable, all 4 cable pairs shall be insulated with FEP. Cables shall be field connectorized and tested by the Contractor unless otherwise shown on the drawings. Cable shall be manufactured by:
 - a) AMP
 - b) Berk-Tek
 - c) Approved Equal.
- E. Specialty wire: As specified in the section describing the system it serves.

2.3 CONNECTORS AND SPLICES

- A. Provide UL-listed, factory-fabricated wiring connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- B. Conductor Connections, Splices or Taps:
 - 1. Solid Conductors size 18 through 10 AWG: Twist on insulated spring connectors.
 - 2. Stranded Conductors size 18 through 6 AWG: insulated, solid barrel, crimp type plated copper alloy connectors.
 - 3. Conductors size 4 AWG and larger: plated copper alloy compression splicing sleeves installed by high pressure compression tools and insulated with heat shrink Raychem sleeves.
 - 4. Outdoors or wet areas: wire splice kits, epoxy resin, hardener, and mold. 3M Scotchcast or equal.
- C. Terminations: suitable for 75 degree Celsius rated copper conductor.
 - 1. Service and feeder circuits: compression indent barrel connectors with one or two hole spade lug ends.
 - 2. Conductor size 18 through 10 AWG: insulated, solid copper barrel, crimp type, plated copper alloy spade tongue terminal, made for the wire size and terminal on which they are installed and crimped with an approved plier or tool for the connector.
 - 3. Conductor size 8 AWG and larger: compression, indent, solid copper barrel, one or two hole lugs.
- D. Motor connections: insulated, solid barrel, crimp type, ring tongue plated copper alloy.

2.4 INSULATING MATERIALS

- A. Fillers: Scotchfill, or equal.

- B. Tape: 7 mil vinyl plastic tape, logo bearing, Scotch 33+, or equal.

PART 3 — EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

- A. Service/Feeders: Type USE/RHW/RHH insulated, stranded conductors, in raceway.
- B. Branch circuits: Type USE/RHW/RHH insulated, stranded conductors, in raceway except Type THHN/THWN insulated, solid conductors, may be used indoors, above grade only, for 120 volt lighting and receptacle branch circuits in sizes #12 AWG and #10 AWG.
- C. Equipment Grounding Conductors: Same type insulation and conductor as the circuit conductors supplying the equipment to be grounded.
- D. Grounding Conductors (other than equipment grounding conductors): bare copper with varnish coat.
- E. Class 1 and 2 Control Circuits: Type USE/RHW/RHH, size #14 AWG or larger, in raceway; Type MTW/THWN, size #14 AWG or larger, in raceway may be used indoors above grade or above grade in weatherproof enclosures.
- F. Instrumentation Circuits: Shielded or unshielded instrument cable, as indicated on the Contract Plans.

3.3 INSTALLATION

- A. Install wires and cables in raceway system, according to manufacturer's written instructions and NECA's "Standard of Installation", after raceway system is complete, and following "Examination" article of this section. Where existing conductors or cables are removed and later repulled through new or existing conduits, test the conductors after each pulling operation, and replace the conductors or cables with new conductors or cables if the test results are not acceptable per NETA standards.
- B. Provide individual neutral conductors for each 120 volt or 277 volt circuit. Common neutral conductors for multi branch circuits are not permitted unless specifically noted and shown on the plans.

- C. Install service, feeder, motor, control, instrumentation, communication and signaling circuits continuously without splices from equipment terminal to equipment terminal or motor lead. 120 and 277 volt single phase branch circuits may be spliced or connected at taps or connection for outlet devices. Do not splice circuits at other locations without written permission from the Owner.
- D. Color code conductors as follows:
 - 1. Grounding conductors: Green.
 - 2. 480/277 volt, three phase systems:
 - a. Phase A - brown
 - b. Phase B - orange
 - c. Phase C - yellow
 - d. Neutral - gray
 - 3. 208Y/120, three phase systems:
 - a. Phase A - black
 - b. Phase B - red
 - c. Phase C - blue
 - d. Neutral - white
 - 4. Use control wiring of colors different than power wiring (such as pink or purple). Use the same color scheme throughout each system for any control or signal wires performing the same function.
 - 5. Use wire with insulation of required color for conductors of No. 8 AWG and smaller. For wire larger than No.8 AWG which is not available in specified colors, use self-adhesive, wrap-around cloth type markers of solid colors to code the conductors. When conductors are marked in this manner, mark each conductor at all accessible locations such as panelboards, junction boxes, pullboxes, pullholes, auxiliary gutters, outlets, switches, and control centers.
 - 6. Do not use white, gray, or green color for any power, lighting, or control conductor not intended for neutral or grounding purposes. Low voltage control circuits, or 18 AWG and smaller control conductors, may use gray, green or white as a trace color in addition to the base color of the conductor.
 - 7. Connect power circuit conductors of the same color to the same phase throughout the installation. Viewing all equipment from the front, make connections so phase color sequence is in the same order as that for panelboards, switchboards, motor control centers,

- etc. If the phase order of the wires must be reversed to accommodate motor rotation, the adjustment shall be made at the motor terminal box or for cord connected equipment only, at the load side of the safety disconnect switch. Reversing the phase order at the motor controller or disconnect switch is not acceptable.
8. When connecting or reconnecting low voltage (600 volts or less) switchboards, motor control centers, and panelboards which serve existing loads, verify the phasing and rotation prior to the connection, and make connections to maintain the same phasing and rotation to the new switchboards, motor control centers, panelboards, and existing loads as existed prior to removal of the loads from the original (or temporary) distribution system. Verification of rotation alone is not acceptable. Phasing must also be verified. (This may be done by checking for presence of AC voltage between analogous phases of different devices/equipment. Presence of nominal AC voltage between analogous phases of different devices/equipment indicates incorrect phasing.)
 - E. Install wiring to equipment neutral and grounding blocks on the bottom or furthest back row first. Leave unconnected blocks accessible for future neutral or grounding connections.
 - F. Leave six inches or more of free conductor at each connected device or equipment terminal and nine inches of free conductors at each unconnected outlet. Tape free ends of conductors at unconnected outlets and coil neatly in outlet box.
 - G. Install wires neatly in enclosures. Bend or form wires in neat runs from conduits to terminals. Arrange wires so that they may be grouped by conduit or function in the enclosure. Install cable ties and straps to support and bundle wires in enclosures. Arrange wires to allow wire tags and numbers to be easily read without bending or flexing wiring.
 - H. Install grounding conductors according to Section 16060.
 - I. Pulling Conductors:
 1. Make all cable pulls by hand. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, or wrapping extra conductor into an eye, that will not damage cables or raceway.
 2. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Install pullboxes or

- pull fittings where necessary to prevent exceeding manufacturer's recommendations.
3. Cut cable or conductor ends off after pulling and clean all lubricant and/or pulling compound from conductors before terminating.
- J. Support cables according to Section 16050.
 - K. Seal around cables penetrating fire-rated elements according to Division 7 Section "Firestopping." with approved fire-stopping materials.
 - L. Identify wires and cables according to Section 16050 "Basic Electrical Materials and Methods" and as follows:
 1. For power circuits:
 - a. At each connection, except at motors, tag for phase rotation and circuit number.
 - b. At each motor tag for winding lead numbers. Make all phase rotation changes for motor direction changes at the motor to maintain correct color phase sequence in equipment.
 - c. In each enclosure or box where more than one ungrounded power conductor is spliced or connected, tag for panelboard identification and pole number.
 2. For control circuits:
 - a. Tag at ends of wire. Both ends of the wire shall have the same wire label.
 3. Labels shall identify circuits and signals. In the description below, equipment tag ID refers to the motor driven device controlled by the motor controller such as a Neat Polymer Pump (16NPP01). The device tag ID refers to a piece of ancillary equipment associated with the equipment reference by the tag ID, such as a disconnect switch (1DS) or solenoid valve (1SV). Labels shall be identified as follows unless otherwise noted in the specifications:
 - a. Wires from motor control centers to devices shall be labeled with the device tag (MCC terminal #)(device terminal number) – for example, 05SV01(8)(3) - would reference a wire to solenoid valve 05SV01 landed on terminal 8 in the motor control center and landed on terminal 3 at the solenoid valve (the device end may not have a terminal number, in that case the wire label would only have one terminal label 05 SV01 (8) in the above example).
 - b. Wires from control panels to devices shall be labeled with the device tag (CP terminal #)(device terminal number) – for

- example, 05MFM01(0501)(1) - would reference a wire to magnetic flow meter 05MFM01 landed on terminal 0501 in the control panel and terminal 1 at the flowmeter.
- c. Wires from motor control centers to control panel/MCC Remote I/O Sections shall be labeled with Equipment tag ID (MCC terminal #) (CP terminal #) – for example, 16NPP01(8) (0301) - would reference a wire for pump 16NPP01 landed on terminal 8 in the motor control center and continued to terminal 0301 in the control panel.
 - d. Wires from device to device (i.e. disconnect switches to control stations) shall be labelled with Device #1 tag (device #1 terminal number)-device #2 tag (device #2 terminal number) – for example, 1DS(1)-1CS(4) would reference a wire landed on terminal 1 on a disconnect switch and continued to terminal 4 in a control station.
 - e. 2-conductor and 3-conductors cables to devices shall be labeled with the device tag located on a label on the outer insulation. The individual conductors will have only the motor control center/control panel terminal and the device terminal. As an example for a flowmeter circuit, “05MFM01” would be located on the outer insulation of the 2-conductor cable to flowmeter 05MFM01 and (S140)(1) would be located on one of the conductors, which would represent terminal S140 in the control panel and terminal 1 at the flowmeter.
 - f. Wires from motor control center I/O or PLC sections to individual MCC units shall be labeled with the MCC equipment tag (MCC terminal #)(I/O terminal #) – for example, 03TWP01(5)(C140) - would represent pump 03TWP01 MCC unit wire landed on terminal 5 in the MCC and landed on terminal C140 in the motor control center I/O section.

3.4 CONNECTIONS

- A. Use the proper high pressure compression tool for terminating indent type compression connectors or terminations on conductors of size #8 AWG or larger gauge. Use an approved pliers or tool for crimping connectors for conductors of size #10 AWG or smaller gauge.
- B. Make splices or tap connections with filler, and tape that possess equivalent or better mechanical strength and insulation ratings than conductors being connected. Insulate to same thickness as connectors being spliced or connected.

- C. Shielded cables used for analog signals shall be terminated with not greater than 1 inch of conductor left outside the shield. This applies to field wires entering the panel for termination, and to panel conductors. Conductor twist shall be maintained over the unshielded length to as close as possible to the point of termination. Where the overall jacket is cut back to expose the individual conductors, provide a heat shrink sleeve over the jacket, the signal, and the shield (drain) conductors. Insulate the shield (drain) conductor where not covered by the jacket or the sleeve. Where shield (drain) conductors are not terminated, cut the conductor even with the jacket so that it is covered by the sleeve to prevent inadvertent contact with other devices, terminals, or conductors in the panel.
- D. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer, and in compliance with other Sections of Division 16.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform field quality-control testing.
- B. Test installation of wires and cables before electrical circuitry has been energized.
 - 1. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system.
 - 2. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters.
 - 3. Remove and replace conductors with visible damage on conductor insulation ends due to installation in an incomplete or damaged conduit system such as, but not limited to, missing bushings or burrs on conduit ends.
- C. Test Category 5e Horizontal UTP Cable for compliance to ANSI/TIA/EIA 568A, ANSI/TIA/EIA TSB67, and ISO/IEC 11801 standards after installation but prior to start/commissioning of the network system. Test with building electrical systems powered on (i.e. Lights, HVAC, etc.)
 - 1. Test each end-to-end link, utilizing 100Mhz sweep tests, for continuity, polarity, NEXT, attenuation, installed length, wire map,

- impedance, resistance, and ACR. Each cable shall be tested in both directions.
2. Testing device shall be a Level 2 testing instrument, re-calibrated within the last six months, with the most current software revision based upon the most current EIA/TIA testing guidelines, 100Mhz rated, capable of storing and printing test records for each cable within the system. Device shall be a LANCAT, Microtest, Fluke, or equal.
 3. Tests shall be conducted on cables terminated on a patch panel.
- D. Correct malfunctioning conductors, cables, and connections at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new materials and retest.

***** END OF SECTION *****

SECTION 16130
RACEWAYS AND BOXES

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
 - 1. Raceways include the following:
 - a. RMC.
 - b. PRMC.
 - c. EMT.
 - d. FMC.
 - e. LFMC.
 - f. PVC.
 - g. RTRC.
 - h. Wireways.
 - 2. Boxes, enclosures, and cabinets include the following:
 - a. Device boxes.
 - b. Outlet boxes.
 - c. Pull and junction boxes.
 - d. Cabinets and hinged-cover enclosures.
- B. Related Sections include the following:
 - 1. Section 16050 for raceway and box supports.
 - 2. Section 16120 for conductors installed in raceways and boxes.
 - 3. Section 16140 for devices installed in boxes.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. LFMC: Liquidtight flexible metal conduit.
- D. RMC: Rigid metal conduit.
- E. PRMC: PVC coated rigid metal conduit.

- F. PVC: Rigid polyvinyl chloride conduit.
- G. RTRC: Reinforced thermosetting Resin Conduit (Fiberglass).
- H. NPT: National Pipe Thread
- I. NEMA: National Electrical Manufacturers Association
- J. ANSI: American National Standards Institute

1.4 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type raceway and box specified.
 - 1. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.

1.5 QUALITY ASSURANCE

- A. Refer to Section 16010 Paragraph 1.7.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.
- B. Coordinate conduit stub up locations with approved equipment shop drawing submittals prior to locating conduit stub ups in the slab. Locate conduit stub ups per equipment manufacturer's recommendations and the requirements of the Plans and Specifications.

PART 2 — PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. RMC:
 - 1. Conduit: Hot dipped galvanized steel with threaded ends meeting ANSI C80.1.
 - 2. Couplings: unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.
 - 3. Nipples: same as conduit, factory made through eight inches, no running threads.

- B. PRMC (PVC-Coated Rigid Steel Conduit and Fittings): NEMA RN 1.
 - 1. Minimum 40 mil exterior PVC coating, and 2 mil interior urethane coating.
 - 2. Manufacturers:
 - a. RobRoy Industries
 - b. Thomas & Betts Ocal
 - c. KorKap
- C. EMT:
 - 1. Conduit: Galvanized steel tubing meeting ANSI C80.3.
 - 2. Couplings: steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. No indent or setscrew type.
- D. FMC:
 - 1. Conduit: flexible, galvanized steel convolutions forming a continuous raceway.
 - 2. Connectors: galvanized steel, screw in or clamp style, approved for grounding.
- E. LFMC:
 - 1. Conduit: flexible, galvanized steel convolutions forming a continuous raceway, covered by a liquid tight PVC layer. Electri-Flex Type LA or American Sealtite, Type UA. The use of thinwall conduit is not permitted.
 - 2. Connectors: Hot-Dip galvanized steel or hot-dip galvanized malleable iron, screw in ferrule which covers the end of the conduit inside and out, insulated throat, approved for grounding. Provide with gland nut with integral ground lug for connectors to motors rated 10 horsepower and larger. O-Z/Gedney Type 4Q series, or approved equal.

2.2 RIGID NONMETALLIC CONDUIT (RNC)

- A. Rigid nonmetallic conduit (RNC) includes PVC and RTRC per NEC Article 352 (Rigid Polyvinyl Chloride Conduit: Type PVC) and NEC Article 355 (Reinforced thermosetting Resin Conduit: Type RTRC) and as follows:
 - 1. PVC:
 - a. NEMA TC 2, Schedule 40 or 80 PVC.
 - b. Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

2. RTRC:
 - a. NEMA TC 14
 - b. UL 1684

2.3 OUTLET AND DEVICE BOXES

- A. Concealed in dry indoor locations, flush mounted in walls: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1, and with plaster or extension rings to suit construction and application.
- B. Exposed dry locations which are not hazardous or are not in process areas: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1. Boxes 6"x6"x4" or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication. Covers shall be of the same material and finish as the device box.
- C. Exposed outdoors, below grade, wet locations, or exposed in indoor locations in process areas which are not hazardous: galvanized, cast iron alloy box, one piece, with threaded holes or hubs, integral mounting lugs and with neoprene gaskets and galvanized cast iron alloy cover (covers shall be of the same material and finish as the device box).
- D. Exposed corrosive locations: PVC coated cast iron or stainless steel boxes with threaded hubs, integral mounting lugs and PVC coated covers. Covers shall be of the same material and finish as the device box.
- E. Exposed hazardous locations (whether dry, wet, or corrosive): explosion proof, galvanized, cast iron alloy box, one piece, with threaded holes or hubs, integral mounting lugs and with neoprene gaskets and galvanized cast iron alloy cover. Covers shall be of the same material and finish as the device box.
- F. Masonry boxes where installed per the requirements of the specifications, are not required to be drawn one piece.

2.4 PULL AND JUNCTION BOXES

- A. Concealed in dry indoor locations, flush mounted in walls: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1, and with plaster or extension rings to suit construction and application.

- B. Exposed dry locations which are not hazardous or are not process areas: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1. Boxes 6"x6"x4" or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication. Covers shall be of the same material and finish as the device box.
- C. Masonry boxes where installed per the requirements of the specifications, are not required to be drawn one piece.
- D. Exposed outdoors, below grade, wet locations, or exposed in indoor locations in process areas which are not hazardous: Cast-Metal Boxes meeting NEMA FB 1, with gasketed screw down cover. Boxes 6"x6"x4" or larger may be code gauge fabricated stainless steel continuously welded at seams and with rubber gasketed covers. Hoffman or equal. Covers shall be of the same material and finish as the device box. Device boxes associated with control stations shall be the same material as the disconnect and control station enclosure.
- E. Exposed corrosive locations: PVC coated cast iron or stainless steel boxes with threaded hubs, integral mounting lugs and PVC coated covers.
- F. Exposed hazardous Locations: locations (whether dry, wet, or corrosive): explosion proof, galvanized, cast iron alloy box, one piece, with threaded holes or hubs, integral mounting lugs and with neoprene gaskets and galvanized cast iron alloy cover. Covers shall be of the same material and finish as the device box.
- G. Underground circuits: In accordance with the Washington State Department of Transportation's Standard Plan No. J-40.10-03.
- H. Communication circuits: Conduit bodies are not permitted. Junction boxes shall be sized as follows:

Maximum Trade Size of Conduit	Box Size			For Each Additional Conduit Increase Width
	Width	Length	Depth	
1"	4"	16"	3"	2"
1-3/4"	6"	20"	3"	3"
1-1/2"	8"	27"	4"	4"
2"	8"	36"	4"	5"

2.5 MAINTENANCE/PULL HOLES

- A. Precast concrete structures with preformed knockout holes for conduit entrance.
1. One-piece, reinforced cast cement concrete with minimum compressive strength of 6,000 psi and suitable reinforcing for the size and construction.
 2. Minimum wall thickness 3 inches.
 3. Access provided by cast iron round covers traffic rated for H20 loading.

2.6 MISCELLANEOUS FITTINGS

1. NEMA FB 1; compatible with conduit/tubing materials.
2. Deep socket PVC coupling for connecting RTRC to PVC conduit runs.
3. Conduit bodies shall be cast or malleable iron, hot dipped galvanized. Covers shall be of the same material and finish as the fitting. Appleton, Crouse Hinds, OZ Gedney, or equal.
4. Conduit bushings shall be malleable iron. Locknuts and sealing locknuts in sizes smaller than 2 ½” shall be steel. Locknuts and sealing locknuts in sizes 2 ½” and larger shall be malleable iron. Appleton, Cooper Crouse Hinds, OZ Gedney, Thomas Betts or equal.
5. Conduit sealing bushings shall be OZ Gedney Type CSM series. Cabinet sealing bushing shall be OZ Gedney Type GRK.
6. Conduit sealing fittings, drains and breathers shall be OZ Gedney Type EY and DB, or equal Appleton or Crouse Hinds.
7. Through wall and floor seals shall be OZ Gedney FS and WS series.
8. Cord grip connectors shall be OZ Gedney CGA, or equal Appleton or Crouse Hinds.
9. External Cable Grip (Kellum’s Grip): Woven wire mesh type made of high-strength galvanized or stainless steel wire strand and matched to cable diameter and with attachment provision designed for the corresponding connector.
10. Conduit spacers for direct buried or encased in concrete raceways shall be Underground Devices, Inc. “Wunpeece Spacers” or equal.

PART 3 — EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

- A. Install RMC or PRMC unless other raceways are shown on the Contract Documents, are required by Code, or are permitted under these specifications.
- B. Where the manufacturer of equipment provided by the Contractor recommends or requires RMC for circuits associated with the equipment, provide RMC or PRMC for the entire circuit, even if other conduit types would otherwise be permitted under these specifications.
- C. Indoors: Use the following wiring methods:
 - 1. Exposed raceway runs in non-process areas which are dry and above grade: EMT or RMC.
 - 2. Exposed in process areas: RMC or PRMC.
 - 3. Exposed in corrosive areas: PRMC
 - 4. Exposed Wet or below grade Locations: RMC or PRMC.
 - 5. Concealed:
 - a. in wood frame walls: EMT or RMC.
 - b. in masonry walls: RNC or RMC.
 - c. In dry accessible building spaces (i.e. above dropped ceilings): EMT or RMC.
 - d. in concrete slab floors, walls or ceilings surrounded by dry areas or in slabs above basements which are not corrosive: PRMC, RMC, or RNC.
 - e. in concrete slab floors, walls or ceilings in contact with earth, water containing tank walls or corrosive areas: PRMC or RNC.
 - f. below slab-on-grade floors: PRMC, RMC or RNC.
 - 1) Use PRMC for underslab circuits where metal conduit is called out on plans. RMC may be used for indoor underslab circuits only where specifically noted on the Plans.

- 2) At stub up locations or other locations where the raceway changes from buried to exposed conditions, transition conduit as described in paragraph 3.3:
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except where RMC (or PRMC) is used, use LFMC. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to equipment. See below for further requirements for the installation of raceway terminations and connections using flexible connections.
- D. Outdoors: Use the following wiring methods:
1. Exposed: RMC or PRMC.
 2. Exposed in corrosive locations: PRMC
 3. Concealed in concrete slab: RNC or PRMC
 4. Below slab-on-grade, or in earth (backfill): RNC or PRMC.
 - a. Use PRMC where metal conduit is indicated on the Plans for underground circuits. It is not permissible to use RMC in outdoor, below grade locations.
 - b. At stub up locations and at entrances to buildings or other locations where the raceway changes from buried to exposed conditions, transition conduit as described in paragraph 3.3:
 5. Connection to Vibrating Equipment: LFMC. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to equipment. See below for further requirements for the installation of raceway terminations and connections using flexible connections.
- E. Concrete encased ductbank: RNC, or PRMC.
- F. Comply with additional requirements of Section 16740 Paragraph 3.3 for installation of raceways for communications circuits.

3.3 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions. Provide a raceway for each circuit indicated. Do not gang raceway into wireways, pullboxes, junction boxes, etc., without specific approval. Do not group home runs or circuits without approval of the Owner.
- B. Minimum Raceway Size: 1 inch trade size for underground or imbedded circuits, 1 inch trade size for communications circuits, 3/4 inch trade size for other circuits.

- C. Provide PRMC or RTRC elbows for all RNC runs where conduit transitions horizontally or vertically. Where RTRC is used in PVC runs, provide elbows with factory attached socket PVC couplings. Coordinate the radius of all conduit bends, whether factory elbows or bends, or field bends, with the manufacturer's minimum bend radius for the installed cable or conductor.
- D. Provide long radius elbows (sweeps) for conduit runs containing multi-conductor VFD cables (sweeps shall also meet minimum bend radius requirements of VFD cables as described in Section 16120). Bend radius for conduits containing VFD cable shall not be less than the larger of (1) 12 times the nominal conduit size or (2) 10% greater than the VFD cable manufacturer's minimum bend radius for the installed cable.
- E. Install conduit as a complete, continuous system without wires, mechanically secure and electrically connected to all metal boxes, fittings and equipment. Blank off all unused openings using factory made knockout seals.
- F. Install conduit exposed unless shown otherwise on the Plans.
- G. Do not install raceway in the slab or below grade/slab unless specifically shown on the Plans as being installed in the slab or below grade/slab.
- H. Run parallel or banked raceways together, on common supports where practical. Use factory elbows where elbows can be installed parallel; otherwise, provide field bends for banked raceways. Make bends in parallel or banked runs from same centerline to make bends parallel.
- I. Wherever practical, route conduit with adjacent ductwork or piping and support on common racks. Base required strength of racks, hangers, and anchors on combined weights of conduit and piping.
- J. Exposed Conduit Installation:
 - 1. Install exposed raceways in lines parallel or perpendicular to the building or structural members or the structure lines except where the structure is not level. Follow the surface contours as much as practical. Do not install crossovers or offsets that can be avoided by installing the raceway in a different sequence or a uniform line. Provide adequate headroom.
 - 2. Where several circuits follow a common route, stagger pullboxes or fittings, or if shown grouped in one box, individually fireproof each conduit.

3. Support exposed raceways as specified in Section 16050.
 - a. Provide anchors, hangers, supports, clamps, etc. to support the raceways from the structures in or on which they are installed. Do not space supports further apart than ten feet.
 - b. Provide sufficient clearance to allow conduit to be added to racks, hangers etc. in the future.
 - c. Support raceway within three feet of every outlet box, junction box, gutter, panel, fitting, etc.
 - d. Raceway in "wet" areas shall have clamp backs (spacers) or other appropriate spacers to hold them a minimum of ½ inch off the surface. Horizontal runs on the roof surface shall be blocked at every 5 feet to hold them a minimum of 2 inches above roof surface.
- K. Raceway concealed above ceilings, in furred spaces, under slab, embedded in slab etc., which are normally inaccessible may be run at angles not parallel to the building lines.
- L. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above 40° C (104° Fahrenheit). Install horizontal raceway runs above water and steam piping.
- M. Where conduits cross building or structure expansion joints, use suitable sliding or offsetting expansion fittings. Unless specifically approved for bonding, use a suitable bonding jumper. For sizes one inch and smaller, a half-loop of flexible conduit between boxes or fittings may be used.
- N. Install concealed raceway in wall or ceiling construction and/or place below the slab in a shallow trench. Do not install conduit in slab unless shown to be installed in slab on Contract Document drawings. The top of conduits installed in the shallow trench shall be at least 3 inches below the bottom of the slab. Do not run conduit just below the slab or at the edge of the slab. Embed raceway in masonry in the hollow core. Horizontal runs in the joint are not permitted.
- O. Where conduit is shown on the plans or called for to be embedded or run in concrete walls or slabs, embed conduit in concrete walls or slabs a minimum of two inches from the exterior of the concrete and between steel reinforcing mats or to the center of the concrete with respect to the concrete. It is not permissible for conduit to be in direct contact with reinforcing mats.
 1. Do not place conduit in concrete less than five inches thick.

2. Sizes larger than one inch are not permitted embedded in concrete unless shown otherwise on the plans.
3. Conduit embedded in concrete may run at angles to the structure or slab line.
4. Crossovers in concrete are not permitted unless otherwise noted on the Plans.

P. Underground raceway runs

1. Run as straight as practicable. Make changes in direction and/or grade of sufficient length to allow a gradual change (three foot radius minimum). Make slight offsets with five degree couplings.
2. Run trench true, and clear of stones or soft spots. Place three inches of fine sand in the trench bottom and tamp into place. Provide preformed plastic spacers on top of sand spaced five feet on center where more than one conduit is placed in a trench. After the raceway is placed in the trench, backfill to six inches above top of conduits with sand, then with native earth backfill passing a No. 8 sieve, free of stones. Do not tamp on top of the conduit until the final backfill is placed. Tamp or water settle the final backfill to finish grade. Compact the backfill as specified under Division 2.
3. Mark direct buried conduit by an underground line warning tape as described in Section 16050.
4. Clean underground and embedded conduit two-inch size and above with a wire brush or swab, followed by a mandrel not less than twelve inches long and approximately one-quarter inch smaller in diameter than the conduit internal diameter.
5. Where raceway exits from grade or concrete, provide the following:
 - a. For runs exiting from grade, slabs or encasement, transition to one of the following for a minimum of 24" inches of raceway (including elbows) before exiting and for vertical runs, a minimum of 3" beyond the exiting point:
 - a) PRMC
 - b) RMC taped with a half lapped wrap of Scotchrap No. 51 plastic tape (40 mil total thickness). The conduit shall be wrapped a minimum of 3" above the exiting point and at least 24" of raceway below the exiting point (at a minimum, the rigid steel elbow and conduit located at/above the exiting point shall be fully wrapped).
 - c) RMC coated with Kopper's Bitumastic No. 505.

- d) RTRC (use for elbow only for PVC conduit runs)
 - b. Do not extend plastic conduit (PVC or RTRC) into the slab, above grade, into buildings or into equipment.
 - c. For equipment to be moved into place at a later date, install a coupling flush with the floor slab and a threaded flush plug.
- Q. Under slab raceway runs
1. Install conduits under the slab in a trench. Place three inches of fine sand in the trench bottom and tamp into place. After the raceway is placed in the trench, backfill to three inches above top of conduits with sand, then with compacted backfill up to the compacted top course. Provide compacted top course per structural requirements. Do not tamp on top of the conduit until the final backfill is placed. Compact the backfill as specified under Division 2.
 2. Where raceway exits from under slab runs, provide the following:
 - a. For runs exiting from under slab, transition to one of the following (including elbows) before exiting and for vertical runs, up to a minimum of 3" beyond the top of the exiting point:
 - a) PRMC
 - b) RMC taped with a half lapped wrap of Scotchrap No. 51 plastic tape (40 mil total thickness). The conduit shall be wrapped to a minimum of 3" above the exiting point and at a minimum, the rigid steel elbow and vertical conduit located below/above the exiting point shall be fully wrapped.
 - c) RMC coated with Kopper's Bitumastic No. 505.
 - d) RTRC (use for elbow only for PVC conduit runs)
 - b. Do not extend plastic conduit (PVC or RTRC) into the slab, above grade, into buildings or into equipment.
 - c. Arrange conduit so that no curved portion of conduit bends are installed in the slab. All conduit bends including elbows shall be installed below the slab.
 - d. For equipment to be moved into place at a later date, install a coupling flush with the floor slab and a threaded flush plug.

- R. Stub-ups into switchgear, motor control centers, floor standing switchboards, and similar open bottom equipment:
1. Coordinate conduit stub up locations with approved equipment shop drawing submittals prior to locating conduit stub ups in the slab. Locate conduit stub ups per equipment manufacturer's recommendations and the requirements of the Plans and Specifications.
 2. Do not extend the conduit, including end fittings, more than 3 inches above the bottom of the enclosure. Stub conduits to a uniform height (plus or minus 1/8 inch) and align conduits within plus or minus 1/4 inch in rows parallel or perpendicular to the building structure. Terminate conduit with an insulating, grounding type bushing bonded to the ground bus of the equipment.
 3. Locate stub-ups directly under the enclosure access point or section gutter into which the conductors they contain are to be routed.
 4. Arrange stub-ups so that no curved portion of conduit bends are installed in the finished slab. All conduit bends including elbows shall be installed below the finished slab.
 5. Protect stub-ups from damage where conduits rise through slabs or out of wall by installing a steel bushing or coupling on the threaded end before slab is poured.
- S. Bend and offset metal conduit with hickey or power bender, standard elbows, conduit fittings or pull boxes. Bending of PVC shall be by hot box bender and, for PVC two inches in diameter and larger, expanding plugs. Make elbows, offsets and bends uniform and symmetrical. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- T. Support conduit connections to motors or other equipment independently of the motor or equipment. Rise or drop vertically to the nearest practicable point of connection to the unit. Run vertical drops to the floor and fasten with a floor flange. Unsupported drops are not permitted. Horizontal runs on the floor or on equipment are not permitted. Drop or rise at the appropriate closest location. Run conduit on equipment frames or supports to closely follow the contours of the equipment. Locate conduit to maintain access to all equipment services and adjustment points and so as not to interfere with operation of the equipment.
- U. Connect conduit to hubless enclosures, cabinets and boxes with double locknuts and with insulating type bushings. Use grounding type

bushings where connecting to concentric or eccentric knockouts. Connect to enclosures, boxes and devices from below in wet areas. Make conduit connections to enclosures at the nearest practicable point of entry to the enclosure area where the devices are located to which the circuits contained in the conduit will connect.

V. Penetrations for raceways:

1. Do not bore holes in floor and ceiling joists outside center third of member depth or within two feet of bearing points. Holes shall be one inch diameter maximum.
2. Penetrate through building or structure wall or surfaces with a PVC or sheet metal sleeve with at least ¼" greater interior diameter (ID) than conduit exterior diameter (OD), set flush with walls, pack with fiberglass and seal with silicone sealant and cover with escutcheon plate.
3. Penetrate through poured-in-place or below grade walls and free slabs, with a sleeve. Set sleeves flush with forms or edges of slab/wall. Pack around conduit with fiberglass and seal with silicone sealant. For penetrations below exterior grade, provide a floor or wall sealing fitting on the interior of the building wall.
4. Penetrate through roofs with core drill hole ½ inch to 1 inch larger than conduit, flash with neoprene, caulk conduit in place and seal with silicone sealant under flashing. Sleeve roof opening where non-concrete roof construction occurs.

W. Raceway terminations and connections:

1. Join raceways with fittings designed and approved for the purpose and make joints tight.
2. Make threaded connections waterproof and rustproof by application of a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.
3. PRMC: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
4. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
5. Cut ends of conduit square with hand or power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Make conduit threads which are cut in the field to have same effective length and same thread dimensions and taper as specified for factory-cut threads.

6. Flexible Connections: Use maximum of 18 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement, such as motors, transformers, generators or similar equipment or equipment such as instruments which must be removed for service. Install flexible conduit in a straight length. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to fixed equipment such as panels, enclosures or switches. With the Owner's approval, longer lengths of flexible conduit may be used for connection to items of equipment which require longer lengths for installation (i.e. 2" conduits and larger) and removal of the equipment for maintenance or replacement purposes. Recessed and semi-recessed lighting fixtures may use up to 6 feet of flexible conduit, or 11 feet of pre-manufactured lighting "whips". Use liquid-tight flexible metal conduit in wet or damp locations. Do not strap flexible conduit to structures or other equipment.
7. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts. In "wet" areas, use locknuts of the sealing type, use Myers hubs or O-Z/Gedney rain tight conduit hubs.
8. Connect conduits to enclosures at the location of the gutter or device to which the contained conductors will be routed. Route or stub conduits to motors and/or mechanical equipment directly to the connection and locate as close as possible to equipment terminals.
9. Where a device manufacturer requires a device or junction box to permit multiple conduit entries into the device from a single conduit, provide the device or junction box at no additional cost to the Owner.
10. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
11. Place conduits at panelboards in the rear line of knockouts where possible. Install spare conduits from flush-mounted panels up to accessible spaces. Install a minimum of one spare three-quarter inch conduit for every three single-pole spare breakers or spaces, or fraction thereof (three conduits minimum).

- X. Keep conduits clean and dry and close each end left exposed. When blowing through conduits, cover electrical components installed in enclosures to avoid blowing dirt or water into equipment. Use temporary closures to prevent foreign matter from entering raceways.
- Y. Install pull wires in empty raceways and in empty innerduct. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 8 inches of slack at each end of the pull wire.
- Z. Seal interior of raceways around conductors at: (1) hazardous locations, (2) where conduits pass from warm to cold locations, such as the boundaries of air conditioned, heated or refrigerated spaces and where conduits enter or exit buildings from outdoor areas, including underground ducts or conduit runs, and (3) where otherwise required by NFPA 70.
 - 1. Methods used to seal interior of raceways around conductors shall be as follows:
 - a. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations. For hazardous locations, fill them with UL-listed sealing compound. For non-hazardous areas, fill with expansive foam or Ducseal. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Boxes that have electrical devices installed (switches, receptacles etc.) shall not be used in place of a dedicated steel box for installation of the fitting that will house the sealing material.
 - b. Seal conduits using expansive foam or Ducseal where conduits enter through the bottom of motor control centers, switchboards, panelboards and control panels.
 - c. Seal conduits using expansive foam or Ducseal for individual items of equipment where it is not practical to install raceway seal fittings such as building mounted lighting fixtures and convenience receptacles.
 - d. As otherwise required by NFPA 70.
- AA. Device and Outlet Boxes
 - 1. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.

2. Recess boxes in the wall, floor, and ceiling surfaces in finished areas or where noted on the Plans. Set boxes plumb, level, square and flush with finished building surfaces within one-sixteenth inch for each condition. Set boxes so that box openings in building surfaces are within one-eighth inch of edge of material cut-out and fill tight to box with building materials. Boxes shall be backed with box supports (Caddy Model TSGB, SGB, steel or wood stud backers) that span a minimum of two studs or joists to prevent rotation on studs or joists and to prevent twisting or deflection during wall, ceiling, or floor surface material installation. The use of supports that do not span a minimum of two studs are not permitted without permission from the Owner. Provide attachments to withstand a force of one-hundred pounds applied vertically or horizontally.
3. Use gang boxes in indoor areas wherever more than one device is used at one location. In wet, corrosive or hazardous areas, use multiple double gang boxes.
4. Boxes in wet areas shall be surface mounted on channel iron stanchions or set with spacers on walls and shall be attached with clamps or feet (drilling or punching enclosure to mount through side of box or enclosure is not permitted), and they shall have all conduit connections from below arranged to drain moisture away with suitable EYD drains installed at the bottom. It is not permissible to install conduits into the top and side of the boxes at exterior locations unless otherwise noted on Plans.
5. Attach exposed (surface mounted) boxes to building structure with a minimum of two fasteners. Provide attachments to withstand a force of one-hundred pounds applied vertically or horizontally.
6. Set exposed device boxes four feet above the finished floor to top of the box unless otherwise noted on the Plans.
7. Set exposed boxes for lighting switches at 44 inches above the finished floor and within one foot of the door opening on the strike or lock side of the door or on the side closing last.
8. Set recessed boxes at the following heights to the bottom of the box, except where noted otherwise:
 - a. convenience outlet receptacles in finished areas at sixteen inches;
 - b. lighting switches, dimmers, etc. at forty-four inches above floor and within one foot of the door opening on the strike or lock side of the door or on the side closing last.
 - c. wall mounted telephones at sixty inches above floor.

- d. Place boxes for outlets on cabinets, countertops, shelves, and similar electrical boxes located above countertops two inches above the finished surface or two inches above the back splash. Verify size, style, and location with the supplier or installer of these items before installation.
- 9. Arrange boxes used in wet areas to drain moisture away from devices or enclosures for equipment and make conduit connections from below.
- 10. Set floor boxes level and adjust to finished floor surface.
- BB. Install pullboxes for underground raceway systems true to line and grade. Provide a compacted foundation of fine sand or three-eighths minus crushed rock for the bearing surface edges of the pullboxes.
- CC. Install wall or surface mounted enclosures and cabinets plumb. Support at each corner.
- DD. Conduit entrances into communications junction boxes may be made from two parallel sides only. (Conduit entrances in perpendicular sides are not acceptable.) No cable may be routed to exit and enter the same side of the junction box. All cables must be routed from one side of the junction box to the opposite side. Cable routed so that the cable bend radius is less than the minimum bend radius allowed under Specification Section 16740 is not permitted.

3.4 PROTECTION

- A. Provide protection and maintain ambient conditions (in a manner acceptable to manufacturer and Owner) that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

***** END OF SECTION *****

SECTION 16140
WIRING DEVICES

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes various types of receptacles, connectors, switches, and finish plates.

1.3 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For each type of wiring device specified.
 - 1. Specification sheets (cut sheets) of all proposed equipment (indicate the exact devices that are to be supplied).
 - 2. In addition to the requirements of 16010 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.
- C. Operation and Maintenance Manual: At the completion of the project, the operating and maintenance information shall be updated to reflect any changes during the course of construction. The Operation and Maintenance Manual shall include the following:
 - 1. Maintenance and Repair Manuals (specified in Division 1).
 - 2. Product Data

1.4 QUALITY ASSURANCE

- A. Refer to Section 16010 Basic Electrical Requirements 1.7 Quality Assurance.

PART 2 — MATERIALS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:

1. Wiring Devices:
 - a. Cooper Wiring Devices.
 - b. Bryant Electric, Inc.
 - c. Hubbell Inc.
 - d. Killark Electrical Mfg. Co.
 - e. Leviton Mfg. Co., Inc.
 - f. Pass & Seymour/Legrand.
 - g. Crouse-Hinds
 - h. Paragon
 - i. Mulberry
 - j. Square-D

2.2 WIRING DEVICES

- A. Comply with NEMA Standard WD 1 "General Color Requirements for Wiring Devices" and NEMA Standard WD 6, "Wiring Devices – Dimensional Specifications"
- B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.
- C. Color: Ivory except as otherwise indicated or required by Code.
- D. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with Federal Specification W-C-596, UL Standard 498, "Electrical Attachment Plugs and Receptacles". Receptacles shall be heavy duty specification grade. Provide NRTL labeling of devices to verify compliance.
 1. General purpose Convenience Outlets
 - a. Duplex receptacle configuration
 - b. Nylon face
 - c. Staked screw terminals for line, neutral, and ground connections.
 - d. Provisions for split bus
 - e. NEMA 5-15R or 5-20R
 - f. Hubbell HBL 5262 or equal
 2. Special Purpose Receptacles
 - a. Staked screw terminals for line, neutral, and ground connections.
 - b. NEMA configuration as indicated.
- E. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:

1. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters," with integral NEMA 5-20R duplex receptacle arranged to protect only the connected receptacle and no other receptacles connected on the same circuit.
- F. Receptacles, Industrial Heavy-Duty: Conform to NEMA Standard PK 4 "Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type for Industrial Use."
- G. Receptacles in Hazardous (Classified) Locations: Comply with NEMA Standard FB 11 "Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations" and UL Standard 1010 "Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations."
- H. Pendant Cord/Connector Devices: Matching, locking type, plug and plug receptacle body connector, NEMA L5-20P and L5-20R, heavy-duty grade.
1. Bodies: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 2. External Cable Grip: Woven wire mesh type made of high-strength stainless or galvanized-steel wire strand and matched to cable diameter and with attachment provision designed for the corresponding connector.
- I. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.
1. Cord: Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor has green insulation. Ampacity is equipment rating plus 30 percent minimum.
 2. Plug: Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.
- J. Snap Switches: Quiet-type AC switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification W-S-896.
1. Lighting Switches: 120/277V ac only, rated 20 amperes.
 2. Motor rated switches: horsepower rated for application indicated.
- K. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:
1. Color: Matches wiring device except as otherwise indicated.

2. Plate–Securing Screws: Metal with heads colored to match plate finish.
 3. For Architecturally finished areas with concealed electrical construction: Stainless steel, except as otherwise indicated.
 4. For Architecturally finished areas with exposed electrical construction: Stainless steel.
 5. For non-Architecturally finished areas, in process equipment areas, or electrical rooms: Stainless steel.
 6. See Division 16740 for additional requirements for faceplates for communications devices.
- L. Weatherproof exterior receptacle device covers shall be constructed entirely of cast aluminum material. The cover which encloses the cord set shall be opaque gray. Product shall be INTERMATIC Model WP1010MXD or equal.
- M. Device Box Covers: Cast iron to match box to which installed.

PART 3 — EXECUTION

3.1 INSTALLATION

- A. Except as otherwise indicated on Plans, surface mount, with long dimension vertical. Mount with grounding terminal of receptacles on bottom.
- B. Arrangement of Devices:
 1. Group adjacent switches in common boxes under single, multigang cover plates.
 2. See Section 16130 for mounting height of devices.
 3. Verify locations of outlets and switches in cabinetry with cabinet supplier and cabinetry shop drawings prior to installation.
- C. Install switches with the “Off” position down. Install three and four way switches so the load is de-energized when all switch handles are down.
- D. Connect phase, neutral, and grounding wires to devices with full loops around screws installed to tighten with tightening of the screw. The use of push-in terminals are not acceptable. Trim insulation to within one-eighth inch of screw terminal.
- E. Surface mounted devices and wall plates: Install devices and assemblies plumb, level and secure.

- F. Flush mounted devices and wall plates:
 - 1. Provide spacers on device screws to flush yokes or flanges to surface of wall within 1/16 inch where boxes are not flush with the wall surface.
 - 2. Protect devices and assemblies during painting.
 - 3. Install wall plates after painting is complete. Install with an alignment tolerance of 1/16 inch to plumb. Install at flush mounted devices so that all four edges are in continuous contact with finished wall surface without the use of mats or similar devices. Do not use plaster fillings.
- G. Use corrosion resistant devices outdoors.

3.2 GROUNDING

- A. Connect receptacle or switch ground lug to device box.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing:
 - 1. Test wiring devices for proper connections, polarity and ground continuity. Perform this testing with testing equipment designed for testing polarity and connections.
 - 2. Operate each operable device at least 6 times.
 - 3. Test ground-fault circuit interrupter operation with local fault simulations, using a tester designed for such testing, and according to manufacturer recommendations. Testing with integral test switches on the receptacle is not sufficient for this testing.
- B. Replace damaged or defective components, and retest.

3.4 CLEANING

- A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

***** END OF SECTION *****

SECTION 16422
MOTOR CONTROLLERS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes ac motor-control devices rated 600 V and less that are supplied as enclosed units, or as individual units for mounting in existing motor control centers, or equipment specified under other sections.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 16050 for general materials and installation methods.

1.3 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data: For motor controllers and accessories specified in this Section.
 - 1. For variable frequency drives (VFD), submittals shall be custom prepared by the VFD manufacturer for this specific application, and shall include the following:
 - a. Manufacturer's published installation, set-up and configuration, operation, and maintenance manuals.
 - b. Wiring diagrams specific to the application of the drive under this Contract.
 - c. Initial configuration and program parameters specific to the application of the drive under this Contract, including all parameters that will be set to other than manufacturer's default values, and that demonstrate the drive is capable of operating in the manner intended by the project design.
- C. Shop Drawings:
 - 1. Submit complete Elementary Wiring Diagrams and One Line Diagrams of control and power wiring, specific to the actual motor

- or item to be controlled, which clearly indicate and differentiate field wiring and field wired devices, and wiring provided as part of the manufacturer's assembled unit.
2. For units which are stand alone mounted include dimensioned plans (showing available conduit entry locations), sections, and elevations. Enclosures which will not accept the quantities of conduits as shown on the Contract Plans will be rejected.
 3. Lug configuration showing quantities and sizes of conductors the equipment can accept. Lugs or connections for motor control equipment which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.
- D. Field Test Reports: Indicate and interpret test results for compliance with manufacturer's published standards and performance requirements. (see Section 3.7 for further information)
- E. Operations and Maintenance Manual: Shall include the following:
1. Field Testing Results (must be approved prior to energization of the system)
 2. Maintenance Data
 3. Shop Drawings
 4. Wiring Diagrams
 5. Product Data
 6. Provide listing of motor controller settings after motors have been approved, sent to the job site and pictures of the motor nameplates are available, but prior to or with the Shop Test Notification (described in section 16940 3.5).
 7. Load-Current and Overload-Relay Heater List: Include the nameplate full load amperes and locked rotor amperes for the motor.
 8. Over-current Device settings list: Include the nameplate full load Amperes and locked rotor Amperes for the motor. Include configured settings for motor circuit protectors or circuit breakers. Include the communications settings; if the overload is shown connected to an Ethernet switch, provide the IP address (or addresses), subnet mask and default gateway of the overload relay or communications adapter module.
 9. VFD configuration parameters summary: Document the settings of configuration parameters and switch settings for each VFD. Clearly indicate settings of each parameter and/or switch as of the time the driven equipment is placed in service. Marking the setting as "default" is not acceptable. Actual settings must be documented.

1.4 QUALITY ASSURANCE

- A. Refer to Section 16010 paragraph 1.7.
- B. Source Limitations: Obtain similar motor–control devices through one source from a single manufacturer.
- C. Product Selection for Restricted Space: Space for installation of motor controllers is limited. The Plans indicate typical physical sizes or dimensions for motor controllers, including clearances between motor controllers and adjacent surfaces and items. Motor controllers with larger dimensions may be acceptable, but it is the responsibility of the Contractor to submit detailed drawings showing the required revisions to the structural, process, mechanical, electrical, and other plans to accommodate units with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the motor controllers with the available space and shall verify that the proposed motor controllers are capable of being installed in the available space prior to making a submittal. Motor controllers of dimensions larger than the available space shall not be submitted, and if submitted shall be rejected. The decision of the Owner as to the acceptability of motor controllers with larger dimensions than as shown on the Plans will be final. If the larger equipment is deemed acceptable, it is the Contractor’s responsibility to provide any required revisions to the structural, process, mechanical, electrical, and other designs without additional cost to the Owner.
- D. Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with motor controller access locations from approved shop drawings. Do not place conduits in slabs prior to the receipt of approved shop drawings. Any relocation of conduits that are required because of incorrectly placed conduits prior to receipt of approved shop drawings shall be completed at the Contractor’s expense.

1.5 COORDINATION

- A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

1.6 EXTRA MATERIALS

- A. Furnish extra materials including spare parts described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Spare Fuses and Indicating Lamps: Furnish 1 spare for every 5 installed units, but not less than 1 set of 3 of each kind.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site.
- C.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with additional requirements of the Contract, manufacturers offering motor controller products that may be incorporated into the Work include the following:
 - 1. Square D Co.
- B. Motor controllers and variable frequency drives must be of the same manufacturer as the existing motor control centers (i.e. Square D)..

2.2 MANUAL MOTOR CONTROLLERS

- A. With overload protection: NEMA ICS 2, general purpose, Class A with toggle handle and overload element. Listed for group fusing with Class K fuses.
- B. Lugs or connections for manual motor control equipment shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.
- C. Without overload protection: heavy duty with toggle handle, Hubbell 7810UD, or equal.

2.3 MAGNETIC MOTOR CONTROLLERS

- A. Description: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, unless otherwise indicated. Minimum size NEMA 1. IEC rated devices are not allowed.
- B. Control Circuit: 120 V; obtained from integral control power transformer, unless otherwise indicated. Include a control power

transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 50 percent spare capacity.

- C. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.
- D. Lugs or connections for magnetic motor control equipment shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.
- E. Overload Protection: Solid state electronic type configurable to provide Class 10 or 20 protection for the actual motor furnished. Units shall be manual reset type with an external reset mechanism provided in the starter enclosure front.
 - 1. For non-networked overload protection, provide two separate auxiliary contacts with each overload protection unit.
 - a. One normally closed for use in the motor starting circuit.
 - b. One normally open for signaling overloads to plant control system.
 - 2. For networked overload protection within a motor control center, provide one normally closed contact with each overload protection unit for use in the motor starting circuit.
 - a. Provide all accessories and wiring required to allow the PLC to communicate with the overload protection and to allow the PLC to retrieve the overload status and the motor current.
 - b. The overload protection unit shall include at least two discrete inputs with the input status available over the network.
 - c. The overload protection unit shall include at least one discrete output where the output can be controlled over the network. The overload protection unit will include features to open the output when communications have not occurred within a configurable time span.

2.4 VARIABLE FREQUENCY CONTROLLERS

- A. Variable Frequency Drives (VFDs) shall have the following features:
 - 1. The VFD shall be rated for 480 VAC. The VFD shall provide microprocessor-based control for three-phase induction motors.
 - 2. The VFD shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage to a variable voltage and

- frequency output via a two-step operation. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section.
3. The VFD shall maintain the line side displacement power factor at no less than 0.95 regardless of speed and load.
 4. The VFD shall have a one (1) minute overload current rating of 150% and a two (2) second overload current rating of 250% for constant torque drives. The VFD shall have a one (1) minute overload current rating of 110% for variable torque drives.
 5. The VFD shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VFD.
 6. The VFD shall include a LCD type display with a keypad. The display shall be capable of remote mounting on the exterior of a Motor Control Center or an electrical enclosure containing the VFD.
 7. Electronic circuits and circuit boards shall be conformally coated to resist degradation by hydrogen sulfide and other chemically corrosive agents which may be present in a wastewater treatment facility environment.
 8. Lugs or connections for variable frequency controllers shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.

B. Control Functions

1. It shall be possible to configure all of the parameters for the VFD via the keypad on the LCD type display.
2. The VFD shall be capable of being controlled locally at the keypad, via discrete or analog inputs, or remotely via a communications bus.
3. The VFD shall have at least two analog inputs as follows:
 - a. A current loop analog input suitable for use with a 4-20 ma current loop.
 - b. A voltage loop analog input suitable for use with a potentiometer.
4. The VFD shall have discrete inputs suitable for wiring to dry contacts. The following functions shall be assignable to the discrete inputs:
 - a. Enable — This function may not be overridden when operating via the keypad or via a communications bus.
 - b. External Fault — This function may not be overridden when operating via the keypad or via a communications bus. It

must be possible to automatically clear faults associated with power outages without clearing faults associated with the external fault. (A magnetically or mechanically held relay may be used to provide functionality if necessary.)

- c. Force Local — This input will cause the VFD to ignore start and run signals from the keypad or a communications bus. This function may not be overridden when operating via the keypad or via a communications bus.
 - d. Start (3-wire)
 - e. Stop (3-wire)
 - f. Run (2-wire) — This function will be level triggered rather than edge triggered. If the VFD is ready and this input is asserted, the VFD will be called. It is not acceptable if the VFD is only called when this input transitions from de-asserted to asserted while the VFD is ready.
 - g. Reset Faults
 - h. Setpoint Selection — One or more discrete inputs allowing the selection of the setpoint from among the following sources:
 - 1) Fixed speed
 - 2) current loop analog input
 - 3) voltage loop analog input
 - 4) Keypad
 - 5) Communications Bus
5. The VFD shall have provisions for control via the communications bus.
- a. The communications bus shall be capable of sending the following signals:
 - 1) Start
 - 2) Stop
 - 3) Reset Fault
 - 4) Speed Setpoint
 - b. It shall be possible to configure the VFD so that if the communications bus fails, the VFD will stop if and only if current control is via the communications bus. Units which stop the drive and/or lockout other control methods on bus communications failure are not acceptable.
 - c. While controlling the VFD, the communications bus shall be able to override the value of the Run (2-wire) discrete input.

C. Outputs and monitoring

1. A minimum of three (3) discrete programmable digital outputs shall be provided with the following function selectable:
 - a. Fault
 - b. Run
 - c. Ready
 - d. At speed
2. The VFD display shall be a LCD type capable of displaying at least the following status information:
 - a. Run
 - b. Stop
 - c. Ready
 - d. Alarm
 - e. Fault
 - f. Keypad
 - g. Bus/Communication
 - h. Local (LED)
 - i. Remote (LED)
 - j. Fault (LED)
 - k. Output frequency
 - l. Frequency reference
 - m. Motor speed
 - n. Motor current
 - o. Motor torque
 - p. Motor power
 - q. Motor voltage
 - r. DC-bus voltage
 - s. Voltage level of analog input
 - t. Current level of analog input
 - u. Discrete inputs status
 - v. Fault codes and fault descriptions
3. All numerical status information available via the keypad shall be available via the communications bus.

D. Communications Bus

1. The communication bus media shall be suitable for Modbus TCP or ethernet IP.
2. The protocol shall be Modbus TCP and shall allow full control of the VFD using only ModbusTCP commands.

E. Harmonic Mitigation

1. The VFD system shall consist of the following components. All components listed including power factor correction / harmonic filter and transformer shall be integral to the VFD lineup, factory wired and tested as a complete system.
 - a. a power factor correction / harmonic filter unit (if required to meet these specifications), consisting of (minimally) 3% input reactor
 - b. output inverter
 - c. control logic section.
2. The variable frequency drive(s) when installed and operating at the Owner's facility, shall not cause excessive voltage and/or current total harmonic distortion (THD) levels greater than allowed by the serving utility on the serving utility's electrical system at the point of common coupling. The point of common coupling for this requirement is defined as the utility's revenue metering equipment.
 - a. The voltage and current total harmonic distortion limits shall be as listed in IEEE 519, unless modified by the serving utility. The serving utility is Pacificorp.
 - b. This item applies for any combination of controllers serving one unit of each type of process equipment (i.e. one influent pump of three, one aeration basin of 3, etc.) operating on the power distribution system, combined with not greater than
 - 1) 100 kVA of linear load (for the case of the treatment plant.
 - c. The drives shall be provided with necessary harmonic mitigation equipment including, but not limited to, line reactors, active or passive filtering components, and/or isolation transformers, as required to meet this specification.
3. The variable frequency drive(s) when installed and operating at the Owner's facility, shall not cause the Owner's generator set which supplies standby power to the drive, or the generator set controls, to exceed voltage regulation of 5% or frequency regulation of 3%, nor cause the generator set to oscillate, hunt, jump or otherwise operate in a manner which damages the generator set, generator set components, or equipment to which the generator set provides power.

- F. Spare Parts: Provide spare parts for each drive consisting of (at a minimum) the manufacturer's recommended spare parts, plus (if not

included in the manufacturer’s recommendations) one spare controller main board for each different type of board, one set of power output semiconductor devices (IGBTs) for each different type of drive, one spare base driver board for each different type of board, one set of power semiconductor devices (diodes, SCRs, or similar) used in the power conduction path (AC to DC conversion), and spare fuses for each type of fuse in the units. If these items are not available on the smaller horsepower drives, provide a spare drive for each size or type of unit when they are not available.

- G. Provide complete documentation of each drive including operation and maintenance manuals, as shipped drawings specific to the drive with non-applicable information clearly marked as non-applicable, and a listing of the configuration/programming parameters as programmed in the drive at the time of project acceptance. The drive parameters shall be in a spreadsheet form as follows and shall be provided prior to programming the drive:

Parameters			
Motor Data:	Maximum Motor Frequency		Hertz
	Minimum Motor Frequency		Hertz
	Acceleration Time		seconds
	Deceleration Time		seconds
	Motor Thermal Current Limit		Amps
	Nominal Motor Voltage		Volts
	Nominal Motor Frequency		Hertz
	Nominal Motor Speed		RPM
	Nominal Motor Current		Amps
	Input Phase Loss Behavior		
Control:	Local Control		
	Remote Control		
	Local Reference		
	Remote Reference		
	Fault Automatic Reset		
	Retry Attempts		
	Retry Delay		Seconds
	Braking Mode		

Parameters (Continued)		
Inputs/Outputs:	Discrete Input 0	
	Discrete Input 1	
	Discrete Input 2	
	Discrete Input 3	
	Discrete Input 4	
	Discrete Input 5	
	Discrete Input 6	
	Discrete Input 7	
	Discrete Input 8	
	Analog Input 0	
	Analog Input 1	
	Discrete Ouptut 0	
	Discrete Ouptut 1	
	Discrete Ouptut 2	
	Discrete Ouptut 3	
	Analog Output 0	
	Analog Output 1	
Communications:	Protocol	
	Node/IP Address	
	Data Rate/Baud Rate	
	Stop Bits	
	Error Correction	
	16/32 Bit Data Registers	
Communications	Readable Data Register 0	
	Readable Data Register 1	
	Readable Data Register 2	
	Readable Data Register 3	
	Readable Data Register 4	
	Readable Data Register 5	
	Readable Data Register 6	
	Readable Data Register 7	
	Writeable Data Register 0	
	Writeable Data Register 1	
	Writeable Data Register 2	
	Writeable Data Register 3	
	Writeable Data Register 4	
	Writeable Data Register 5	
	Writeable Data Register 6	
	Writeable Data Register 7	

- H. Any modifications of the standard drive which are necessary to meet the requirements of this specification shall be provided at the factory. Third party or distributor modifications are not allowed.
- I. The variable frequency drive shall be UL or ETL listed and labeled and shall comply with the latest applicable standards of ANSI, NEMA, IEEE, and the National Electrical Code.

2.5 ENCLOSURES

- A. Description: Surface-mounted enclosures per the application as described in Section 16050 unless the unit is mounted in a motor control center. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.

2.6 ACCESSORIES

- A. Devices are factory installed in controller enclosure, unless otherwise indicated.
- B. Provide auxiliary devices meeting the requirements of Section 16050 .

PART 3 — EXECUTION

3.1 APPLICATION

- A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Use fractional-horsepower manual controllers for single-phase motors, unless otherwise indicated.
- D. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with seal-in auxiliary contact for low-voltage protection.
- E. Hand-Off-Automatic Selector Switches: In covers of manual and magnetic controllers where indicated for motors started and stopped by automatic controls or interlocks with other equipment.

3.2 INSTALLATION

- A. Install independently mounted motor-control devices according to manufacturer's written instructions.
- B. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.

- C. For control equipment at walls, bolt units to wall or mount on structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Section 16050.
- D. Install freestanding equipment on concrete housekeeping bases conforming to Section 03300.
- E. Motor-Controller Fuses: Install indicated fuses in each fusible switch.

3.3 IDENTIFICATION

- A. Identify motor-control components and control wiring according to Section 16050.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between motor-control devices according to Section 16120.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic control devices where available.
 - 1. Unless shown otherwise, connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
 - 2. Unless shown otherwise, connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 CONNECTIONS

- A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 START-UP AND TRAINING SERVICES

- A. Provide the services of the manufacturer's factory authorized representative for start up of variable frequency drives and training of the Owner's personnel for operation and maintenance of the drives for each drive as it is connected, started up and placed in service. Inspect the installation of each drive for conformance with the manufacturer's recommended installation practices. Provide a minimum of 1 day per drive on site start-up services. These days shall be coordinated with the start-up of each VFD unit and/or portion of the plant.

- B. Requirements for setting drive parameters:
1. The following shall be completed by the manufacturer's factory authorized representative at the equipment shop test prior to delivering the drive to the site:
 - a. Program motor parameters such as motor horsepower, voltage, current, code letter, full load amps, and similar items. Program and/or configure each drive to properly operate the actual motor to which it is connected..
 - b. Coordinate with the operational requirements of the process equipment and program drive with equipment parameters such as acceleration/deceleration and maximum/minimum speed ramp times, span and range of analog inputs, and similar items.
 - c. Program communications parameters such as precedence between local and bus communications and protocol settings.
 - d. Verify inputs to and outputs from drive and make appropriate settings or programs for motor overtemperature, seal leaks, motor safeties, switch statuses etc.
 - e. Test and verify drive performance with dummy loads.
 2. Test the operation of each drive at the site after fully programming/
configuring the drive. Verify all settings with actual motor installed, driven equipment with driven equipment supplier and communications settings with actual communications and control equipment installed. Reprogram and/or reconfigure and then retest as required to obtain proper operation of the driven equipment and control of the process. Document the final configuration and programming parameters after successful startup and provide in hard copy and electronic form the documentation to the Owner at the job site.
 3. Provide a minimum of eight hours training to the Owner, at the Owner's facility, prior to start-up or placing into operation the first drives. Training shall cover installation, maintenance, operation, and problem troubleshooting for each type of drive provided, and shall delineate differences between individual drives where configuration, programming, or control functions are different for otherwise similar model drives. Demonstrate use of the drive programming software specified elsewhere in these specifications and train Owner's personnel in its use.

- C. Provide training as follows:
 - 1. Provide a minimum of eight hours additional training, program revisions, and maintenance at the Owner's facility approximately one to three months after completion of the project.
 - 2. Provide a minimum of eight hours additional training, program revisions, and maintenance at the Owner's facility approximately 12 months after completion of the project, but prior to expiration of the warranty.

3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test controllers and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
 - 2. Make insulation-resistance tests of each component and connecting supply or feeder circuit. Megger bus work and circuits phase-to-phase and phase-to-ground disconnecting and reconnecting equipment which cannot be meggered as required. The minimum acceptable steady-state value is 50 megohms. Record ambient temperature and humidity during testing.
- B. Acceptance Testing: After installing motor controllers, before electrical circuitry has been energized, and prior to startup, demonstrate product capability and compliance with requirements.
 - 1. Provide services of a qualified independent testing agency as described in Section 16010 to perform specified testing for motor controllers.
 - 2. Procedures:
 - a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.16.1.1 for motor starters other than variable frequency drives. Certify compliance with test parameters.
 - b. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.17 for variable frequency drives. Certify compliance with test parameters.
 - 3. Remove and replace malfunctioning units with new units, and retest.

3.8 CLEANING

- A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

***** END OF SECTION *****

SECTION 16447
CONTROL STATIONS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes control stations used for motor or other control, but mounted external to motor starters or motor control center.
- B. Related Sections include the following:
 - 1. Section 16050 for additional materials and installation information.

1.3 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- A. Product Data: For each type of control station specified in the section. This includes, but is not limited to:
 - 1. Specification sheets (cut sheets) of all proposed equipment (indicate the exact devices that are to be supplied).
 - 2. Pilot devices
 - 3. Enclosures
 - 4. Auxiliary components.
- B. Operation and Maintenance Manual: Shall include the following:
 - 1. Maintenance Manuals (specified in Division 1).
 - 2. Product Data

1.4 QUALITY ASSURANCE

- A. Refer to Section 16010 paragraph 1.7.
- B. Source Limitations: Obtain similar control station devices through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store equipment per requirements of Section 16010 paragraph 1.11.
- B. Remove equipment protection only after equipment is safe from hazards such as dirt and moisture and damage from construction operations.

Field repair of material or equipment made defective by improper storage or site construction damage by other trades is not acceptable.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with additional requirements of the Contract, provide products by one of the following:
 - 1. Allen–Bradley
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D Co.
 - 4. Eaton Corp.; Cutler-Hammer Products.

2.2 COMPONENTS

- A. Control stations shall consist of selector switches, pushbuttons, pilot lights, potentiometers, and similar devices, individually or group mounted in a single enclosure.
- B. Pilot devices:
 - 1. Selector switches:
 - a. Heavy duty, oiltight type.
 - b. Contact block quantity and arrangement as indicated on wiring diagrams, and required for specified functionality.
 - 1) Dry and indoor locations: standard contact blocks rated for 10 A continuous current.
 - 2) Wet or outdoor locations: Hermetically sealed contact blocks.
 - c. Maintained contact type for selector switches, unless shown otherwise.
 - d. Knob type operators, black in color.
 - e. Legend plate, marked as indicated on the Plans.
 - 2. Pushbuttons
 - a. Heavy duty, oil tight type.
 - b. Contact block quantity and arrangement as indicated on wiring diagrams, and required for specified functionality.
 - 1) Dry and indoor locations: standard contact blocks rated for 10 A continuous current.
 - 2) Wet or outdoor locations: Hermetically sealed contact blocks.

- c. Maintained contact type for selector switches, unless shown otherwise.
 - d. Flush type operators, with half shroud.
 - e. Green colored buttons for START or ON and red color for STOP or OFF. Black in color for other functions, unless otherwise indicated.
 - f. Legend plate, marked as indicated on the Plans.
3. Pilot lights
- a. Heavy duty, oiltight type.
 - b. Lamps
 - 1) LED, or incandescent type.
 - 2) Allows replacement of lamp without removal from enclosure.
 - 3) 120 volt lamp
 - 4) Push to test type.
 - 5) Glass lens
 - 6) Color as indicated on the Plans.
4. Potentiometers
- a. Heavy duty type.
 - b. One turn type, with linear adjustment throughout range, 1% resolution or better.
 - c. 3 wire interface.

C. Enclosures:

- 1. Formed of sheet steel and continuously welded with screw on or clamped covers. Enclosures may be hinged.
 - a. NEMA 1 and 12: Painted Steel.
 - b. NEMA 4X: Stainless Steel.
 - c. NEMA 7: Cast Iron.
- 2. NEMA type per location as stated in Section 16050 “Basic Materials and Methods”, unless indicated otherwise.

2.3 IDENTIFICATION

- A. Provide each control station with an engraved nameplate per the requirements of Section 16050 paragraph 3.3 and as follows:
 - 1. Nameplate is Lamacoid or equal plastic laminate or engraved metal plate. Lettering is white, 3/8”; backgrounds are black. No abbreviations are permitted unless approved by the Owner. Engraving is subject to the Owner’s approval.

2. Provide individual legend plates for each pilot device.
3. Identify conductors at each termination by yellow sleeve wire markers heat-shrink or stretch-on type with indelible black letters and numbers at each termination or splice.

PART 3 — EXECUTION

3.1 INSTALLATION

- A. Mounting: Level, plumb and rigid without distortion of enclosure.
1. Provide bushings on conduits entering from above or at the sides.
 2. Provide metallic, insulating grounding bushings on conduits entering from below.

3.2 GROUNDING

- A. Provide ground continuity to facility electrical ground system.

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing:
1. Test the equipment and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
 2. Test all operating controls for proper operation.
 3. Make continuity tests of each circuit.
 4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

***** END OF SECTION *****

SECTION 16510
INTERIOR LIGHTING

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes interior lighting fixtures (including fixtures normally mounted on the building), lamps, ballasts, emergency lighting units, and accessory materials such as frames, lenses, diffusers, hangers, spacers, stems and canopies, auxiliary junction boxes and other miscellaneous hardware as required for complete installation of all lighting equipment.

1.3 DEFINITIONS

- A. LED luminaire: A complete lighting unit consisting of LED-based light emitting elements and a matched driver together with parts to distribute light, to position and protect the light emitting elements, and to connect the unit to a branch circuit. The LED based light emitting elements may take the form of LED packages (components), LED arrays (modules), LED Light Engine, or LED lamps. The LED luminaire is intended to connect directly to a branch circuit.
- B. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads.
- C. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.
- D. CRI: Color Rendering Index.
- E. CCT: Correlated Color Temperature.
- F. SSL: Solid State Lighting (or LED)

1.4 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data describing fixtures, lamps, drivers, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:
 - 1. Outline drawings indicating dimensions and principal features of fixtures.
 - 2. Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps.
 - 3. Battery and charger data for emergency lighting units.
- C. Provide one of the following sets of data regarding the output of the Luminaire over time:
 - 1. LM-79-08 report at T=0 and at T=6000 hours with a summary table showing the percentage lumen output change and percent input power change.
 - 2. LM-80-08 test data for the LEDs at the three temperatures per LM-80-08. Provide extrapolation data using an exponential decay function to show the output at 50,000 hours. Provide the Ts value from the LM-79-08 ad where the point falls in relation to the LM-80-08 extrapolated data. Interpolate between the LM-80-08 data for the Ts temperature.
- D. Operation and Maintenance Manual: Shall include the following:
 - 1. Maintenance Manuals for the lighting fixtures (specified in Division 1).
 - 2. Field Acceptance Test Reports (see section 3.3 for further information)
 - 3. Product Data

1.5 QUALITY ASSURANCE

- A. Electrical Component Standard: Provide components that comply with NEC and that are listed and labeled by UL.
- B. Refer to Section 16010 paragraph 1.7.
- C. Listing and Labeling: Provide fixtures, emergency lighting units, and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project.
 - 1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, and recessed in combustible construction that are

specifically listed and labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for the specific hazard.

- D. Coordinate fixtures, mounting hardware, and trim with ductwork, insulation, sprinkler system, ceiling system and other items, including work of other trades, required to be mounted on ceiling or in ceiling space.

1.6 EXTRA MATERIALS

- A. Furnish extra materials including spare parts as described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. One spare LED luminaire of each type being provided on the project as described on the lighting fixture schedule.
 - 2. LED Lamps: 10% of each type and rating installed. Furnish at least one of each type.
 - 3. Plastic Diffusers and Lenses: 1% of each type and rating installed. Furnish at least one of each type.
 - 4. LED Drivers: 2% of each type and rating installed. Furnish at least one of each type.
 - 5. Globes and Guards: 5% of each type and rating installed. Furnish at least one of each type.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products specified in the Lighting Fixture Schedule.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. No visible labels, trademarks or monograms on the exterior of the lighting fixtures or on lens or diffusers
- B. Metal Parts: Free from burrs, sharp corners, and edges.
- C. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.

- D. Doors, Frames, and Other Internal Access: Smooth operating without the use of tools, intended for finger operation; free from light leakage at seams, joints or junctions visible in the installed condition under operating conditions; and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Spring loaded latches for frames.
- E. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- F. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.
 - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Lens Thickness: 0.125 inch minimum; except where greater thickness is indicated.
 - 3. Pattern for plastic lenses: K12 prismatic refractors. Pattern No. 12 is not acceptable.
 - 4. Approved manufacturers:
 - a. Holophane
 - b. KSH Plastics
 - c. Carolite Plastics
 - d. Plaskolite, Inc.
- G. Provide gaskets on all trims and housings of "wet" location fixtures. Provide non-corrosive type plaster rings, hangers, trim and hardware in wet locations.
- H. Fixture Supports
 - 1. Provide hook hangers for fixtures where indicated or specified consisting of an integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking type plug.

- I. LED Drivers: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.
 1. Certification by Electrical Testing Laboratory (ETL). Can be UL recognized, but Listed when part of a fixture assembly.
 2. Drivers shall have a minimum efficiency of 85%.
 3. Sound Rating: "A" rating.
 4. Voltage: Match connected circuits.
 5. Starting Temperature: -30 deg. C to 50 deg C.
 6. Minimum Power Factor: 90 percent.
 7. Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.
 8. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
 9. Lamp-Driver connection method does not reduce normal rated life of lamps.

2.3 LAMPS AS PART OF FIXTURE

- A. Provide lamps for each fixture which comply with ANSI C78 series that is applicable to each type of lamp.
- B. Color Temperature and Minimum Color-Rendering Index (CRI): 4000-4100 K and minimum CRI listed on fixture schedule.
- C. LED Lamp Life: Rated average is a minimum of 50,000 operating hours before reaching L70 lumen output degradation point with no catastrophic failures.

2.4 FUSES

- A. Provide fuses in fixtures mounted more than eight feet above floor or operated at 277 volts.
- B. Fast acting, current limiting fuses, coordinated with the ballast and lamp operating characteristics, so as to avoid false tripping, yet provide fault clearing before damage occurs to the fixture. Bussman Type HFL in-line fuse holder and Bussman Type GLR fuse, sized at two-hundred percent of the ballast current rating.

2.5 FINISHES

- A. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

PART 3 — EXECUTION

3.1 INSTALLATION

- A. Coordination with other work.
 - 1. Coordinate lighting fixture size and design, frame requirements, and hanging or mounting devices for project ceiling conditions before ordering lighting fixtures. Refer to the Plans for details of ceiling and wall construction; provide lighting fixtures suitable for the particular type of ceiling or wall at each location.
 - 2. Adjust light fixtures as required - near piping, equipment, etc., to protect from physical damage and provide sufficient clearance to install lamps and to maintain lens, reflectors, ballasts, etc. Where pendant mounted fixtures are in conflict with ducts and piping, coordinate the location and mounting heights of the fixtures to the available space left between the various ducts and piping.
 - 3. Locate fixtures so that doors and other equipment will not damage them at any time.
 - 4. Adjust stem or chain lengths to suit actual field conditions where indicated mounting heights to bottom of fixtures are not possible or conflict with other trades' work. Brace pendants and rods over 48 inches long to limit swinging.
 - 5. Prepare irregular surfaces for mounting.
- B. Fixture support
 - 1. Install fixtures with supports, brackets and trim as recommended by the fixture manufacturer to suit the particular building construction and use. Align each fixture to ceiling structure.
 - 2. Provide clips on fixtures installed in grid type ceiling with exposed T-bar construction to hold fixture to T bars which prevent any relative lateral movement between fixture and the suspension system at any point on the fixture.
 - 3. Provide a minimum of four extra iron wires per fixture, anchored securely to the fixture at each corner and independently anchored to the structural system above, for fixtures mounted in grid type ceilings. Size wires the same as wires which support the ceiling structure.
 - 4. Install surface mounted fixtures tight to the ceiling construction. Provide shims or spacers as required to keep surface mounted fixture from warping or twisting due to uneven surfaces. For suspended fixtures, use stems and chain attachments that cannot be displaced from hangers by an upward force.

5. Provide fixture hangers and attachments on pendant or bracket mounted fixtures in addition to raceway connections. Provide a minimum of two per fixture at the quarter points for fixtures of eight feet or less. Provide a minimum of four per fixture, equally spaced at the ends and on third points for fixtures over eight feet in length. Provide a minimum of one stem or chain per eight feet plus one for fixtures in a continuous row. Maximum spacing of stems not to exceed nominal length of each fixture. Install additional stems or hangers where recommended by the fixture manufacturer.
 6. Secure surface and pendant fixtures to ceiling system, roof structure or slabs with a fastener such as lag screw, lag bolt, toggle bolt, cinch anchor or stud to support the fixture plus one-hundred pounds at each support. Nails or similar fasteners are not approved for lighting fixture support.
 7. Do not support fixtures from ceiling material other than structural or framing material. Provide supports, spacers, channels, etc., necessary to support lighting fixtures where fixtures are located so that they cannot be connected directly to structure members. Provide additional framing to directly support fixtures where construction is such that mounting channels, strongbacks or bridging is required to support fixtures. Provide additional support material which matches the structure material.
 8. Provide outlet boxes or other supports for lighting fixtures which are of sufficient strength to support at least four times the weight of fixture or one-hundred pounds, whichever is greater. Support all fixtures weighing more than fifty pounds independently of outlet box.
 9. Do not support LED fixtures with forty-eight inches or longer lamps from outlet box ears. Provide suitable fixture stud in box for each fixture.
 10. Support all surface mounted fixtures more than eighteen inches wide at or near each corner, in addition to support from outlet box.
 11. For heavy pendant mounted fixtures, where support independent of box is required and where conduit and outlet boxes are installed on surface, use safety swivel hanger with fixture stud. For fixtures suspended indoors from sloping surfaces, provide suitable aligners.
- C. Install fixtures in rows or grids true to line. Install fixtures in a common area at the same level or grade. Install continuous runs of fixtures straight and true with joining straps, couplings, and nipples. Maintain spacing for fixtures as dimensioned or shown on the reflected ceiling

plan and do not arbitrarily change because of ceiling pattern, etc. Symbols on the Plans which are undimensioned show approximate locations and care shall be used to locate fixtures on centers of spaces, at the quarter points, or as indicated. Any changes in fixture layout must be approved in writing by the Owner.

3.2 CONNECTIONS

- A. Ground the lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation.
- C. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
- D. Report results of tests in writing.
- E. Replace fixtures that show evidence of corrosion during Project warranty period.
- F. Provide replacement lamps for all lamps which fail prior to completion of the work.

3.4 ADJUSTING AND CLEANING

- A. Clean fixture lens, diffusers and enclosures on fixtures. Dirty enclosures, lens or diffusers shall be removed, washed and rinsed as recommended by fixture manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

3.5 INTERIOR LIGHTING FIXTURE SCHEDULE

- A. Lighting Fixture Schedule is shown on the Contract Plans.

***** END OF SECTION *****

SECTION 16520
EXTERIOR LIGHTING

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes exterior lighting fixtures, LED drivers, lamps, pole standards, and accessories.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 16510 for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; also for exterior fixtures normally mounted on buildings.

1.3 DEFINITIONS

- A. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads. See also LED luminaire.
- B. Lighting Unit: A fixture or an assembly of fixtures with a common support, including a pole or bracket plus mounting and support accessories.
- C. LED luminaire: A complete lighting unit consisting of LED-based light emitting elements and a matched driver together with parts to distribute light, to position and protect the light emitting elements, and to connect the unit to a branch circuit. The LED-based light emitting elements may take the form of LED packages (components), LED arrays (modules), LED Light Engine, or LED lamps. The LED luminaire is intended to connect directly to a branch circuit.

D. Luminaire: A fixture.

1.4 LM-80 – LUMEN MAINTENANCE DEFINITIONS

- A. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.
- B. CRI: Color Rendering Index.
- C. CCT: Correlated Color Temperature.
- D. SSL: Solid State Lighting (or LED)

1.5 SUBMITTALS

- A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.
- B. Product Data describing fixtures, lamps, drivers, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:
 - 1. Outline drawings indicating dimensions and principal features of fixtures.
 - 2. Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps.
 - 3. Battery and charger data for emergency lighting units.
- C. Provide one of the following sets of data regarding the output of the Luminaire over time:
 - 1. LM-79-08 report at T=0 and at T=6000 hours with a summary table showing the percentage lumen output change and percent input power change.
 - 2. LM-80-08 test data for the LEDs at the three temperatures per LM-80-08. Provide extrapolation data using an exponential decay function to show the output at 50,000 hours. Provide the Ts value from the LM-79-08 ad where the point falls in relation to the LM-80-08 extrapolated data. Interpolate between the LM-80-08 data for the Ts temperature.
- D. Operation and Maintenance Manual: Shall include the following:
 - 1. Maintenance Manuals for the lighting fixtures (specified in Division 1).
 - 2. Field Acceptance Test Reports (see section 3.2 for further information)
 - 3. Product Data

1.6 QUALITY ASSURANCE

- A. Electrical Component Standard: Provide components that comply with NFPA 70.
- B. Refer to Section 16010 paragraph 1.7.

1.7 STORAGE AND HANDLING OF POLES

- A. General: Store poles on decay-resistant treated skids at least 12 inches above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.
- B. Metal Poles: Retain factory-applied pole wrappings until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 EXTRA MATERIALS

- A. Furnish extra materials including spare parts as described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Two spare LED luminaires of each type being provided on the project as described on the lighting fixture schedule.
 - 2. LED Drivers: 10% of each type and rating installed. Furnish at least one of each type.
 - 3. LED Lamps: 10% of each type and rating installed. Furnish at least one of each type.
 - 4. Glass and Plastic Lenses, Covers, and Other Optical Parts: 1% of each type and rating installed. Furnish at least one of each type.
 - 5. Globes and Guards: 5% of each type and rating installed. Furnish at least one of each type.
- B. Extra materials including spare parts shall be provided with the equipment or like materials at the time the equipment or materials arrive on site. It is not acceptable to provide extra materials after the equipment or materials are delivered to the site.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products specified in Lighting Fixture Schedule.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp edges, and corners.

- B. Sheet Metal Components: Corrosion-resistant aluminum, except as otherwise indicated. Form and support to prevent warping and sagging.
- C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed fixtures.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange for door opening to disconnect ballast.
- E. Exposed Hardware Material: Stainless steel.
- F. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- H. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor mounting in fixture doors.
- I. LED Drivers: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.
 - 1. Certification by Electrical Testing Laboratory (ETL). Can be UL recognized, but Listed when part of a fixture assembly.
 - 2. Drivers shall have a minimum efficiency of 85%.
 - 3. Sound Rating: "A" rating.
 - 4. Voltage: Match connected circuits.
 - 5. Starting Temperature: -30 deg. C to 50 deg C.
 - 6. Minimum Power Factor: 90 percent.
 - 7. Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.
 - 8. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
 - 9. Lamp-Driver connection method does not reduce normal rated life of lamps.

2.3 LAMPS AS PART OF FIXTURE

- A. Provide lamps for each fixture which comply with ANSI C78 series that is applicable to each type of lamp.
- B. Color Temperature and Minimum Color-Rendering Index (CRI): 4000-4100 K and minimum CRI listed on fixture schedule.
- C. LED Lamp Life: Rated average is a minimum of 50,000 operating hours before reaching L70 lumen output degradation point with no catastrophic failures.

2.4 FIXTURE SUPPORT COMPONENTS

- A. Pole-Mounted Fixtures: Conform to AASHTO LTS-3.
- B. Wind-load strength of total support assembly, including pole, arms, appurtenances, base, and anchorage, is adequate to carry itself plus fixtures indicated at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 100 mi/h with a gust factor of 1.3.
- C. Arm, Bracket, and Tenon Mount Materials: Match poles' finish.
- D. Mountings, Fastenings, and Appurtenances: Corrosion-resistant items compatible with support components. Use materials that will not cause galvanic action at contact points. Use mountings that correctly position luminaire to provide indicated light distribution.
- E. Pole Bases: Anchor type with galvanized steel hold-down or anchor bolts, leveling nuts, and bolt covers.
- F. Metal Pole Grounding Provisions: Welded 1/2-inch threaded lug, accessible through handhole.
- G. Concrete for Pole Foundations: Comply with Division 3. Use 3000-psi strength, 28-day concrete.

2.5 FINISHES

- A. Metal Parts: Manufacturer's standard finish, except as otherwise indicated, applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and similar defects.
- B. Other Parts: Manufacturer's standard finish, except as otherwise indicated.

PART 3 — EXECUTION

3.1 INSTALLATION

- A. Set units plumb, square, level, and secure according to manufacturer's written instructions and approved Shop Drawings.
- B. Concrete Foundations: Construct according to Division 3.
 - 1. Comply with details and manufacturer's recommendations for reinforcing, anchor bolts, nuts, and washers. Verify anchor-bolt templates by comparing with actual pole bases furnished.
- C. Pole Installation: Use web fabric slings (not chain or cable) to raise and set poles.
- D. Fixture Attachment: Fasten to indicated structural supports.
- E. Lamp fixtures with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.

3.2 FIELD QUALITY CONTROL

- A. Inspect each installed unit for damage. Replace damaged fixtures and components.
- B. Give advance notice of dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests and Observations: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source.
- E. Replace or repair damaged and malfunctioning units, make necessary adjustments, and retest. Repeat procedure until all units operate properly.

3.3 ADJUSTING AND CLEANING

- A. Clean units after installation. Use methods and materials recommended by manufacturer.

3.4 LIGHTING FIXTURE SCHEDULE

- A. Lighting Fixture Schedule is shown on the Contract Plans.

***** END OF SECTION *****

APPENDICES

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APPENDIX 1 – GEOTECHNICAL REPORT

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August 18, 2021
File No. 21-112

Mr. Doug Welch, P.E.
Gray & Osborne, Inc.
1130 Rainier Ave S #300
Seattle, WA 98144

**Subject: Geotechnical Report
Proposed Secondary Clarifier #3
Puyallup Wastewater Treatment Plant, Washington**

Dear Mr. Welch,

As requested, PanGEO, Inc. completed a geotechnical study to assist the project team with the design and construction of the proposed secondary clarifier #3 at Puyallup Wastewater Treatment Plant in Puyallup, Washington. The results of our study and our recommendations are summarized in the attached report.

In summary, from the geotechnical engineering perspective, it is our opinion that the proposed clarifier may be constructed as planned. Our field exploration encountered stone columns previously installed within the footprint of the proposed clarifier. As such, in our opinion, the proposed clarifier can be supported on a structural slab or a mat, with the assumptions that soil below the proposed clarifier has been properly improved.

The proposed excavation will be about 21 feet along the perimeter of the clarifier and sloping to about 33 feet deep in the middle of the structure. The excavation will occur in the proximity of existing utilities and will extend below the site groundwater table. An excavation support system will be needed to protect adjacent utilities and adjacent properties. In addition, control of groundwater will be needed during construction of the project. It is our opinion that secant piles and ground freezing are appropriate options. We rule out the use of sheetpiles due to potential conflicts with existing stone columns.

We appreciate the opportunity to work with you on this project. Please call if there are any questions regarding this report.

Sincerely,



Siew L. Tan, P.E.
Principal Geotechnical Engineer

Encl.: Geotechnical Report

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ATTACHMENTS:

- Figure 1 Vicinity Map
- Figure 2 Site and Exploration Plan
- Figure 3A Generalized Subsurface Profiles A-A'
- Figure 3B Generalized Subsurface Profiles B-B'
- Figure 4 Design Parameters for Uplift Resistance

Appendix A: Summary CPT Data
(CPT-1 through CPT-3, Current Study)

Appendix B: Summary Test Pit Logs
Terms and Symbols for Boring and Test Pit Logs
Figures B-1 through B-3: Summary Logs for TP-1 through TP-3

Appendix C: Geophysical Survey Report

Appendix D: Previous Subsurface Investigations

**GEOTECHNICAL REPORT
PROPOSED SECONDARY CLARIFIER #3
PUYALLUP WASTEWATER TREATMENT PLANT
PUYALLUP, WASHINGTON**

1.0 INTRODUCTION

PanGEO completed a geotechnical study for the proposed secondary clarifier #3 at the Puyallup Wastewater Treatment Plant in Puyallup, Washington. The purpose of our geotechnical study was to evaluate subsurface conditions at the site, verify that stone columns are present within the footprint of the proposed clarifier, and provide geotechnical recommendations pertinent to the design and construction of the proposed secondary clarifier #3.

Our services included conducting a site reconnaissance, reviewing existing geotechnical reports and subsurface information, conducting geophysical surveys including reviewing existing project and subsurface information, advancing three cone penetration tests (CPTs), excavating three test pits, conducting geophysical surveys, and developing the conclusions and recommendations presented in report.

2.0 SITE AND PROJECT DESCRIPTION

The existing Puyallup Wastewater Treatment Plant is located at 1602 18th Street Northwest in Puyallup, Washington (see Figure 1 – Vicinity Map). The proposed secondary clarifier #3 will be located in the northeast portion of the site, near the existing clarifier #2, an existing 60-inch secondary effluent, the primary circuit from the medium voltage switch gear to Unit Substation No. 3, and a concrete fence to the north. The aerial photo of the site is shown in Plate 1 (see page 2). The current condition at the proposed clarifier is shown in Plate 2 (see page 3).

Based on the design drawings (Gray & Osborne, 1997) for the Wastewater Treatment Facilities Improvements project, Sheets S-5 and S-6, the site grades at the proposed clarifier #3 generally range from about Elevation 30 feet (NGVD 29 datum) near the west end of the clarifier and Elevation 34 feet near the east end of the clarifier, with a total elevation relief of about 4 feet. Based on the current topographic survey provided for our review, the existing ground surface is generally between Elevation 32 feet along the east side of

the proposed clarifier, to about Elevation 30 feet along the west side of clarifier (NGVD 29 datum)

Sheet S-5 also shows ground improvements consisting of stone columns were designed to be installed within the area of the existing secondary clarifiers #1 and #2 and the proposed clarifier #3. Our subsurface explorations conducted within the footprint of the proposed clarifier #3 encountered stone columns, which are discussed in Section 4.3 of this report. However, we understand that as-built drawings for the stone columns installation are not available.

As currently planned, the proposed clarifier #3 will be about 110 feet in diameter, similar to the existing secondary clarifiers #1 and #2. It is our understanding that the excavation for the proposed clarifier #3 will be as deep as about 21 feet (perimeter) to 33 feet (center) below the existing grades.



Plate 1. Existing Puyallup Wastewater Treatment Plant (modified based on Google map)



Plate 2. Approx. Location of Proposed Clarifier #3, looking south

3.0 SUBSURFACE EXPLORATIONS

3.1 CONE PENETROMETER TEST

Three cone penetration tests (CPTs) designated CPT-01 through CPT-03 were conducted at the site on May 04, 2021, using a truck-mounted rig operated by ConeTec. The approximate CPT locations are plotted on the attached Figure 2. A CPT consists of pushing an instrumented cone, approximately 1.5-inches in diameter, through the soil from a truck mounted reaction frame. The resistances to continuous penetration encountered by the cone tip and adjacent friction sleeve exhibit high sensitivity to changes in soil type, providing data on soil behavior types and correlated strength parameters. The cones were pushed to maximum depths of about 80½ feet below the ground surface. Geotechnical properties were recorded during cone penetration testing, including tip resistance, friction ratio, and pore pressure. These properties were used to estimate soil behavior type and equivalent Standard Penetration Test (SPT) N-values. Summary CPT logs and the results of a dissipation test are included in Appendix A.

3.2 TEST PIT INVESTIGATIONS

Three test pits (TP-1 through TP-3) were excavated at the site on June 25, 2021. The test pits were excavated to maximum depths of about 3, 15, and 8 feet below the existing ground surface at TP-1, TP-2, and TP-3, respectively. The approximate test pit locations were measured in the field from on-site features and are plotted on Figure 2.

The relative in-situ density of cohesionless soils, or the relative consistency of fine-grained soils, was estimated from the excavating action of the excavator, probing with a ½-inch diameter steel rod, and the stability of the test pit sidewalls. Where soil contacts were gradual or undulating, the average depth of the contact was recorded in the log.

The test pits excavated for this study were backfilled with the excavated soils after the soils were logged. The backfill was tamped with the backhoe bucket and the ground surface leveled. The backfill was not compacted to the requirements of structural fill. During construction of the project, the earthwork contractor should locate the previously excavated test pits, remove the loose backfill, and replace it with properly compacted structural fill.

An engineer from our firm was present to observe the excavations, assist in sampling, and to document the soil samples obtained from the excavations. The soil samples were described in general accordance with the symbols and terms outlined in Figure B-1, and the summary test pit logs are included as Figures B-1 through B-3.

3.3 GEOPHYSICAL SURVEY

Non-destructive geophysical methods including a microgravity survey and ground penetrating radar (GPR) were conducted to locate the existing stone columns at the proposed clarifier location on March 11 through March 22, 2021. The survey was performed by Global GeoPhysics. The gravity data was collected at a grid of about 7 feet by 7 feet.

The results and methodology of the geophysical survey are included in Appendix C.

3.4 PREVIOUS SUBSURFACE INVESTIGATIONS

We reviewed the results of previous soil explorations performed in the project vicinity, including borings B-16 and B-29 (Shannon & Wilson, 1979), borings BH-2, BH-4, and BH-7 (Hong West & Associates, 1996), cone penetration tests CPT-9 to CPT-11 and CPT-15 (Hong West & Associates, 1996). The approximate locations of the previous explorations are presented in Figure 2, and the summary logs are included in Appendix D of this report.

4.0 SUBSURFACE CONDITIONS

4.1 GEOLOGY

According to the geologic map compiled by Troost (in review), the surficial geologic unit at the project site is alluvium (map unit Qal). Alluvium typically consists of clean to silty, sand, silt, and gravel deposited by lowland streams and rivers. The relative density of alluvial deposits ranges from very loose to dense.

4.2 SOIL

The following is a generalized description of the soils observed within the footprint of the and near the proposed clarifier. In addition, we developed two general subsurface profiles to depict the subsurface conditions at the site. These profiles are included as Figures 3A and 3B.

Fill: Fill soils consisting of loose to medium dense, brown, sand with gravel and silt were encountered immediately below the grounds surface. Traces of organics and roots were also found in this unit. The fill extended to about 1½, 5, and 1 foot deep in test pits TP-1, TP-2, and TP-3, respectively. The fill encountered in CPT-1 to CPT-3 and previous boring BH-4 was about 2 feet thick.

Alluvium: Below the fill, the subsurface explorations encountered loose to medium dense, silty sand and medium stiff sandy silt to about 22 to 25 feet below the existing grade, overlying an approximately 15- to 20- foot-thick layer of looser and finer soils (i.e., silt to organic silt and clayey silt). Below a depth of about 40 to 45 feet, the soils generally consist of medium dense to dense/stiff to very stiff interlayers of sand and

silt that extend to the maximum depths of the subsurface explorations (i.e., about 80 to 101½ feet). We interpret this soil unit as that mapped Alluvium.

4.3 EXISTING STONE COLUMNS

We understand that ground improvements consisting of stone columns were completed as part of the 1999 expansion project, which included the area of the proposed secondary clarifier #3. Our test pits TP-1 through TP-3 excavated within the footprint of the proposed clarifier #3 encountered relatively clean ¾-inch crushed gravel columns near the existing ground surface. The observed stone columns are about 12 to 15 inches in diameter and spaced about 8 to 9 feet apart. The top of the stone columns was observed at about 1, 5, and ½-foot below the existing ground surface in test pits TP-1, TP-2, and TP-3, respectively.

In our opinion, we interpreted these columns of crushed rock as the previously installed stone columns. Based on Sheet S-5 (Gray & Osborne, 1997), the stone columns extend to about 44 feet deep, or approximate Elevation -12 feet.

4.4 GROUNDWATER

Groundwater levels and elevations encountered in the subsurface explorations are summarized in Table 1, below:

Table 1. Approx. Groundwater Elevation (NGVD 1939) in Test Borings and CPTs

Location of Subsurface Exploration	Approx. Ground Surface Elevation	Approx. Groundwater Depth	Approx. Groundwater Elevation
CPT-1	34 ft	15 ft	19 ft
CPT-2	34 ft	14½ ft	19½ ft
CPT-3	31 ft	12½ ft	18½ ft
TP-2	31 ft	15 ft	16 ft
BH-2	33 ft	10½ ft	22½ ft
BH-4	33 ft	12½ ft	20½ ft

BH-7	33½ ft	20 ft	13½ ft
B-16	24 ft	8 ft	16 ft
B-29	30½ ft	10 ft	20½ ft

In general, the groundwater levels encountered in the above-referenced subsurface explorations generally ranged from about Elevations 13½ to 22½ feet. However, we understand the water level could rise to about Elevation 30 feet (NGVD29 datum) based on the 100-year Flood Elevation indicated in the FEMA Flood Insurance Rate Map.

It should be noted that the groundwater level could also fluctuate depending on the seasonal precipitations, the water level in the nearby Puyallup River, localized variation in subsurface conditions, and other factors.

5.0 SEISMIC SITE CLASS

We understand that, based on our discussions, it is assumed that the as-built stone columns installed in 1999 are adequate to provide foundation support to proposed secondary clarifier #3 for both static and seismic conditions. Therefore, our scope of work does not include a liquefaction analysis with the current codes.

For structural design of the proposed structures, in our opinion that a Site Class E can be assumed for determining the site coefficients.

6.0 DESIGN RECOMMENDATIONS

6.1 FOUNDATION

Based on our observations of the stone columns in the test pits and our discussions with you, it is assumed that soils below the entire footprint of the proposed clarifier have been improved by the previously installed stone columns and are adequate to support the proposed clarifier in both static and seismic condition.

For design purposes, we recommend that the proposed structure be found on a structural slab or a mat foundation. We anticipate the soils at the proposed foundation subgrade elevation will likely consist of stone columns and native alluvium (primarily sand and silt).

Because the excavation will extend below the groundwater table, we anticipate that the foundation subgrade is likely to be wet and can be easily disturbed. As such, we recommend placing at least 12 inches of properly compacted crushed surfacing base course (CSBC, WSDOT 9-03.9(3), 2021 WSDOT Standard Specification) or approved equivalent below the foundation level to serve as a working surface for mat/slab construction.

Foundation Design Parameters – We recommend a maximum allowable soil bearing pressure of 1,500 pounds per square foot (psf).

For elastic analysis, a modulus of subgrade reaction of 75 pci could be used for mat slab design, assuming the soils immediately below the base of the proposed clarifier has been improved with existing stone columns. The suitability of the subgrade should be evaluated by a geotechnical engineer. Any loose or unsuitable subgrade should be re-compacted or replaced with CSBC.

During construction, the groundwater should be lowered and maintained at a depth of at least 2 feet below the bottom of the excavation to achieve a stable subgrade. The conceptual recommendations for construction dewatering are included in Section 7.3 of this report.

Foundation Performance – Under the static and seismic loading conditions, we anticipate that the proposed secondary clarifier #3 supported on structural slab or mat over the improved ground will perform similarly to the existing nearby second clarifiers #1 and #2. It is our understanding that the existing secondary clarifiers #1 and #2 have performed well without foundation support issues.

6.2 LATERAL EARTH PRESSURES AND LATERAL RESISTANCE

Lateral Earth Pressures – As discussed above, the groundwater may be near the existing ground surface during a 100-year flood event. Therefore, we recommend that the proposed clarifier be designed to resist an at-rest lateral earth pressure 85 pounds per cubic foot (pcf), assuming groundwater near the existing ground surface. The above recommended earth pressures assume level backslope behind the clarifier. In addition, these structures should be designed to resist buoyancy uplift as discussed in Section 6.3 below.

Seismic Condition: For the seismic case, we recommend that an additional uniform pressure of 10H be utilized for all below grade walls, where H is the below grade portion of the wall.

Surcharge Pressure: If the below-grade structures or walls will be subjected to the influence of surcharge loading within a horizontal distance equal to or less than the height of the walls, the walls should be designed for the additional horizontal pressure calculated using a lateral pressure coefficient of 0.4.

Lateral Resistance – Lateral loads on the structures may be resisted by passive earth pressure developed against the embedded portion of the foundation system and by frictional resistance between the bottom of the foundation. We recommend that a frictional coefficient of 0.4 may be used to evaluate sliding resistance developed between the concrete and the compacted CSBC.

Allowable passive resistance in backfill should be computed using an equivalent fluid pressure of 200 pcf, assuming submerged condition.

The above values include a factor of safety of 1.5.

6.3 BUOYANCY AND LIFT

As discussed in Section 4.4, the groundwater levels encountered in the subsurface explorations ranged from about Elevations 13½ and 22½ feet. We also understand the water level could rise to about Elevation 30 feet (NGVD29 datum) based on the 100-year Flood Elevation indicated in the FEMA Flood Insurance Rate Map. In our opinion, as a minimum, the proposed structure should be designed to resist the upward buoyancy forces assuming water level as high as the FEMA flood level.

Structures should be designed to resist this upward force and to prevent possible heave and cracking of the foundation. The weight of the structure and friction along the sides of the structure will resist uplift forces. If needed, the base slabs of the below-grade structures may be extended outside its wall to increase its uplift resistance. Figure 3 provides design parameters for uplift resistance.

6.4 NEW UTILITIES

6.4.1 Trench Excavation

Trench excavations may be accomplished using conventional excavation equipment. All excavations in excess of 4 feet in depth should be sloped in accordance with Washington Administrative Code (WAC) 296-155 or be shored. Trench boxes are likely appropriate for this project. It is the contractor's responsibility to design and maintain the required temporary excavation stability and dewatering to achieve a safe working condition.

We anticipate the trench excavation to encounter a sequence of existing fill and native sand and silt. Trench sidewalls may become unstable, especially when wet conditions are present. Where trench excavation will extend into submerged sand, construction dewatering will be needed to lower the groundwater level prior to trenching to reduce the risks of sidewall caving, and to achieve a stable subgrade. The recommendations for construction dewatering are included in Section 7.3.

In our opinion, if needed, the trench boxes and/or steel plates with hydraulic braces are appropriate for trench excavation support. As a minimum, all shoring systems should be designed to withstand a lateral earth pressure of 45 pcf. Construction equipment, construction material, excavated soil, and vehicular traffic should not be allowed within a horizontal distance equal to half the depth of the excavation measured from the edge of the excavation, unless the shoring system has been designed for the surcharge. A uniform lateral pressure of 80 psf may be used to account for a traffic surcharge.

6.4.2 Pipe Support and Bedding

In general, the existing fill consisting of silty sand (relatively free of organics, debris, and roots) or the native soils are anticipated to provide adequate support for the new pipes.

Where wet subgrade will be present at pipe invert elevation, the subgrade can be easily disturbed and may require over-excavation. If unstable wet subgrade is encountered at pipe invert elevation, we recommend overexcavating the trench by 1-foot, placing a non-woven geotextile fabric at the base of the overexcavation, and backfilling the over-excavation with pipe bedding.

We also recommend that flexible pipe connections be used to reduce the risk of pipe damage due to potential liquefaction-induced ground settlement.

General recommendations relative to pipe bedding are presented below.

- Pipe bedding material, placement, compaction, and shaping should be in accordance with the project specifications and the pipe manufacturer's recommendations. At a minimum, the pipe bedding should meet the gradational requirements for Gravel Backfill for Pipe Zone Bedding, Section 9-03.12(3) of the 2021 WSDOT *Standard Specifications*;
- Pipe bedding should be placed on relatively undisturbed native soils, fill consisting of grave, or compacted imported fill. If the native subgrades are disturbed, the disturbed material should be removed and replaced with compacted bedding material;
- We recommend that a minimum 4-inch thickness of bedding material beneath the pipe be provided. Pipe zone bedding shall be constructed in accordance with Section 7-08.3(1)C of the 2021 WSDOT *Standard Specifications*.
- Pipe bedding material and/or backfill around the pipe should be placed in layers and tamped to obtain complete contact with the pipe. In areas where a trench box is used, the bedding material should be placed before the trench box is advanced.

6.4.3 Trench Backfill

Trench backfill should consist of properly compacted granular fill as outlined in Section 7.1 of this report. The trench backfill should be placed in 8- to 12-inch, loose lifts and compacted to at least 90 percent maximum dry density, as determined using test method ASTM D1557. In paved areas, the upper 2 feet of the backfill should be compacted to at least 95 percent maximum dry density, per ASTM D1557.

If the construction is to occur during drier summer months, the on-site excavated soils consisting of relatively clean sand and free of organics may be re-used as structural backfill, provided that the use of on-site soils as structural backfill is approved by the project

geotechnical engineer and the compaction requirements can be achieved. Otherwise, the use of on-site soils should only be limited to non-structural areas where settlement of trench backfill will not affect the use and operation of the facility.

During placement of the initial lifts, the trench backfill should not be bulldozed into the trench or dropped directly on the pipe. Furthermore, heavy vibratory equipment should not be permitted to operate directly over the pipe until a minimum of 2 feet of backfill has been placed over the pipe. The backfill and compaction shall be in accordance with the pipe manufacturer's recommendations.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 STRUCTURAL FILL AND COMPACTION

We anticipate that the on-site excavated soils will likely consist of silty sand or silt, which can have excessive fines to be used as structural backfill. Imported structural fill, if needed, should consist of Gravel Borrow, as described in Section 9-03.14 (1) of the 2021 WSDOT Standard Specifications.

However, any backfill below the proposed clarifier should consist of imported Crushed Surfacing Base Course (CSBC), as described in Section 6.1 of this report.

All structural fills should be moisture conditioned to near its optimum moisture content, placed in loose, horizontal lifts less than 8 to 12 inches in thickness, and systematically compacted to a dense and relatively unyielding condition and to at least 95 percent of the maximum dry density (per ASTM D 1557), unless otherwise specified.

7.2 TEMPORARY EXCAVATIONS AND SHORING

All temporary excavations should be performed in accordance with Part N of WAC (Washington Administrative Code) 296-155. The contractor is responsible for maintaining safe excavation slopes and/or shoring.

For planning purposes, where space is available, temporary excavations may be sloped no steeper than 1.5H:1V (Horizontal:Vertical) above groundwater level and 2.5H:1V below

groundwater level. However, the maximum allowable slopes should be re-evaluated in the field during construction based on actual observed soil conditions. During wet weather, the cut slopes may also need to be flattened to reduce potential erosion.

Excavation Stabilized using Ground Freezing – Where space is unavailable for the unsupported slope cuts, in our opinion, these excavations can be stabilized using ground freezing as the frozen soils have significant soil strength that can allow over-steepened cuts without shoring walls. Unlike shoring systems such as secant pile or sheetpile walls that requires a continuous wall alignment, the installation of ground freezing pipes (for freezing the adjacent soils) are incontiguous and can be adjusted to avoid conflict with the existing stone columns and utilities.

The other advantage of using ground freezing is that the impermeability of the frozen soils can reduce the required dewatering efforts by partially cutting off the flow of groundwater into the excavation, as discussed in Section 7.3.

Ground freezing installation is typically performed with the industrial refrigeration plant and a series of closed-ended steel pipes circulated with coolant installed along the perimeter of the proposed excavation. The freezing system maintains at temperatures with the range -4°F to -40°F to refrigerate the soils around the pipes to achieve the freezing. The spacing between the pipes and the length of the pipes depend on the scale of the desired frozen soils.

Because the specialty contractor determines the lengths and spacing of pipes, improved soil characteristics, and anticipated ground movement, the specialty contractor is responsible for the ground freezing design and will provide design drawings and calculations stamped by a registered professional engineer.

Lateral Earth Pressure – In our opinion, the lateral earth pressure from the unfrozen portion of the soils can be estimated using an equivalent fluid pressure of 55 pounds per cubic foot (pcf) above Elevation 30 feet (assumed design groundwater level), and 85 pounds per cubic foot (pcf) below Elevation 30 feet. Allowable passive pressure against unfrozen soils can be estimated using an equivalent fluid pressure of 200 pcf (including a factor of safety of 1.5), assume submerged condition below the bottom of the excavation.

Existing Structures and Utilities – If unsupported cuts are used, as a minimum, the top of the excavation slope should be located at least 3 feet horizontally from the springline of the existing pipes or the base of the nearby existing structures. Where ground freezing is not used, any excavation should not extend below 1.5H:1V projection line from the springline of the pipes or the base of the nearby existing structures.

7.3 CONSTRUCTION DEWATERING

We understand the excavation for the proposed clarifier #3 will extend to between about Elevation 12 feet (perimeter) and Elevation -0.5 feet (center), which are below the groundwater table encountered in the subsurface explorations. In our opinion, uncontrolled groundwater flows will likely result in running-sand conditions, and hence erosion and instability of the excavation slopes. The design and implementation of the construction dewatering system should be the responsibility of the contractors.

It should be noted that excessive drawdown of groundwater could lead to undesired level of ground settlement that could extend beyond the property boundaries. In general, the ground water level outside of the clarifier footprint should not be lower than Elevation 12 feet (i.e., 4 feet lower than the lowest recorded groundwater level of Elevation 16 feet, see Table 2, on page 6). We believe that this can only be accomplished with ground freezing or cut-off shoring wall such as secant piles.

It may be beneficial for the proposed construction to occur during dry season, as the groundwater levels typically are the lowest, to reduce the effort for construction dewatering.

As discussed in Section 7.2, if ground freezing will be used to allow over-steepened cuts without shoring walls, in our opinion, ground freezing should also be designed to reduce the required dewatering efforts by partially cutting off the flow of groundwater into the excavation.

7.4 WET WEATHER CONSTRUCTION

Earthwork construction is typically most economical if performed during the drier summer months. If earthwork is accomplished in wet weather, the following best management practices should be considered:

- All footing surfaces should be protected against inclement weather. It is the contractor's responsibility to protect the footing subgrade from disturbance. Alternatively, contractor can place a 2 to 3 inches of lean-mix concrete or 4 to 6 inches of CSBC (WSDOT 9-03.9(3) of the 2021 WSDOT Standard Specification) as soon as the subgrade is exposed.
- Earthwork should be performed in small areas to minimize subgrade exposure to wet weather. Excavation or the removal of unsuitable soil should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- During wet weather, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight based on the portion passing $\frac{3}{4}$ -inch sieve. The fines should be non-plastic.
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water.
- Barriers and pumps shall be used to prevent run-off from entering excavations.
- Bales of straw and/or geotextile silt fences should be strategically located to control surface water and to limit erosion.
- Excavation slopes and soils stockpiled on-site should be covered with plastic sheets during periods of wet weather.

7.5 SURFACE DRAINAGE AND EROSION CONSIDERATIONS

Surface runoff can be controlled during construction by careful grading practices. Typically, this includes the construction of shallow, upgrade perimeter ditches or low earthen berms in conjunction with silt fences to collect runoff and prevent water from entering excavations or to prevent runoff from the construction area from leaving the immediate work site. All collected water should be treated if necessary to comply with water quality standards prior to discharge or conveyance to permanent discharge system.

Permanent control of surface water should be incorporated in the final grading design. Adequate surface gradients and drainage systems should be incorporated into the design such that surface runoff is directed away from the structures.

8.0 LIMITATIONS

We have prepared this report for use by Gray & Osborne and other project team members. Recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project. The study was performed using a mutually agreed-upon scope of work.

Variations in soil conditions may exist between the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, we should be notified immediately to review the applicability of our recommendations. Additionally, we should also be notified to review the applicability of our recommendations if there are any changes in the project scope.

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our work specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances. We are

not mold consultants nor are our recommendations to be interpreted as being preventative of mold development. A mold specialist should be consulted for all mold-related issues.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 24 months from its issuance. PanGEO should be notified if the project is delayed by more than 24 months from the date of this report so that we may review the applicability of our conclusions considering the time lapse.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

Within the limitation of scope, schedule and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time the Report or its contents were prepared. No warranty, express or implied, is made.

We appreciate the opportunity to be of service to you on this project. Please feel free to contact our office with any questions you have regarding our study, this report, or any geotechnical engineering related project issues.

Sincerely,

PanGEO, Inc.



Yi-Hsun William Chao, P.E.
Senior Geotechnical Engineer



Siew L. Tan, P.E.
Principal Geotechnical Engineer

9.0 REFERENCES

- ASTM D422, "Standard Test Method for Particle-Size Analysis of Soils" ASTM International, West Conshohocken, PA, 2012, DOI: 10.1520/D0422-63R07
- ASTM D1557, "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)," ASTM International, West Conshohocken, PA, 2012, DOI: 10.1520/D1557-12
- ASCE (2010/2011). "SEI/ASCE 7-10, Minimum Design Loads for Buildings and Other Structures," American Society of Civil Engineers.
- ASCE (2016). "SEI/ASCE 7-16, Minimum Design Loads for Buildings and Other Structures," American Society of Civil Engineers.
- Hong West Associates, 1997. *Test Boring Logs BH-2,4, and 7, CPT Logs CPT-9, 10, 11, and 15. Geotechnical Report, Wastewater Treatment Facilities Improvements, Puyallup, Washington.*
- International Building Code (IBC), 2015, International Code Council.
- International Building Code (IBC), 2018, International Code Council.
- Shannon & Wilson, Inc. 1979. *Test Boring Logs B-16 and B-29, Geotechnical Report, Wastewater Treatment Facilities, Puyallup, Washington.*
- Troost, K.G., in review, *Geologic Map of the Puyallup 7.5-minute quadrangle, Washington* – U.S. Geological Survey, Miscellaneous Field Investigation, scale 1:24,000.
- Washington State Department of Transportation (WSDOT), 2021, Geotechnical Design Manual, M 46-03-13, Olympia, Washington.



Base Map modified from Seattle City GIS Maps.



21-112 Fig. 1 - Vicinity Map 4/26/21 (1:27:13)



**Proposed Secondary Clarifier #3
Wastewater Treatment Plant
Puyallup, WA 98371**

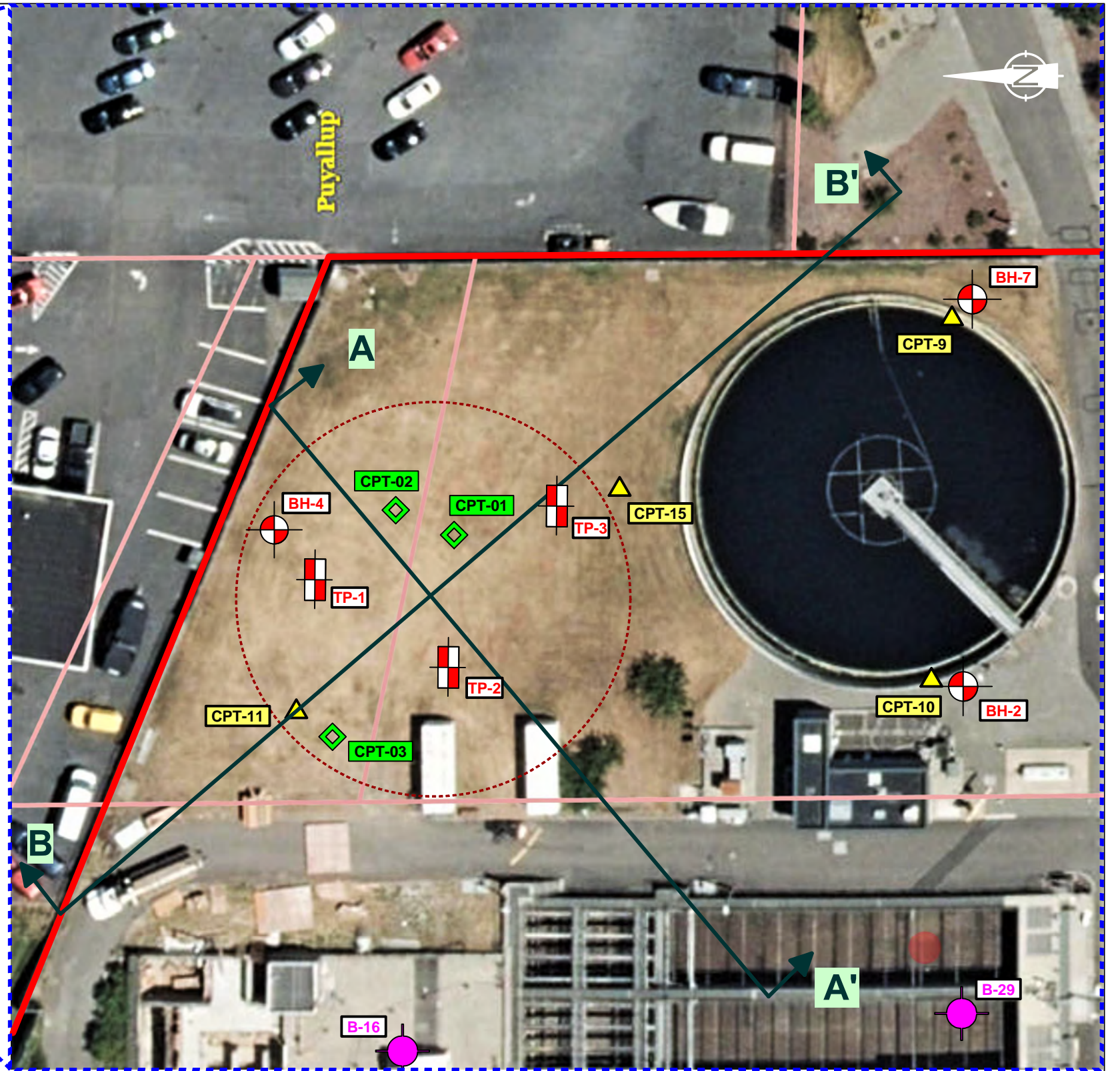
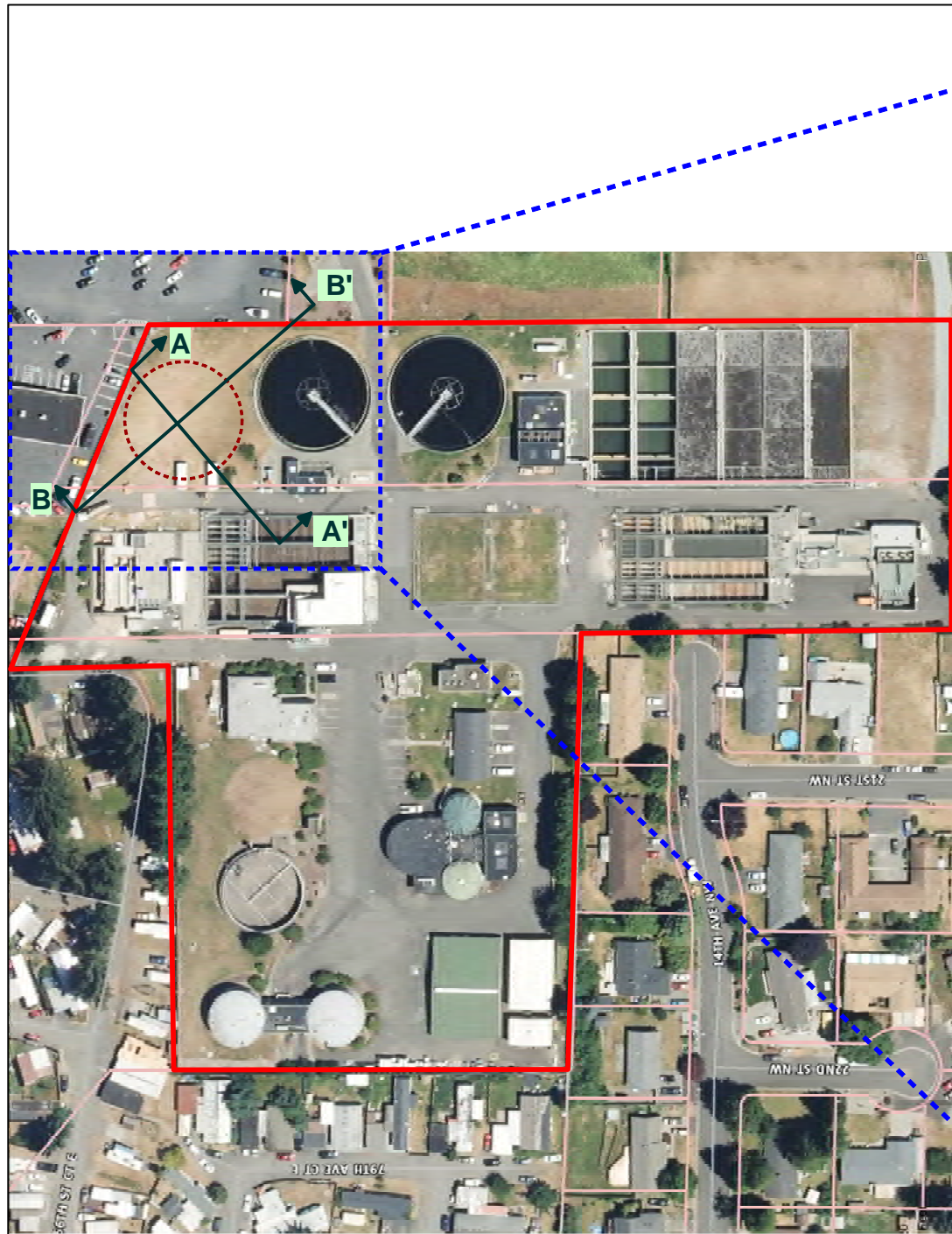
VICINITY MAP

Project No.

21-112








Figure No.

1



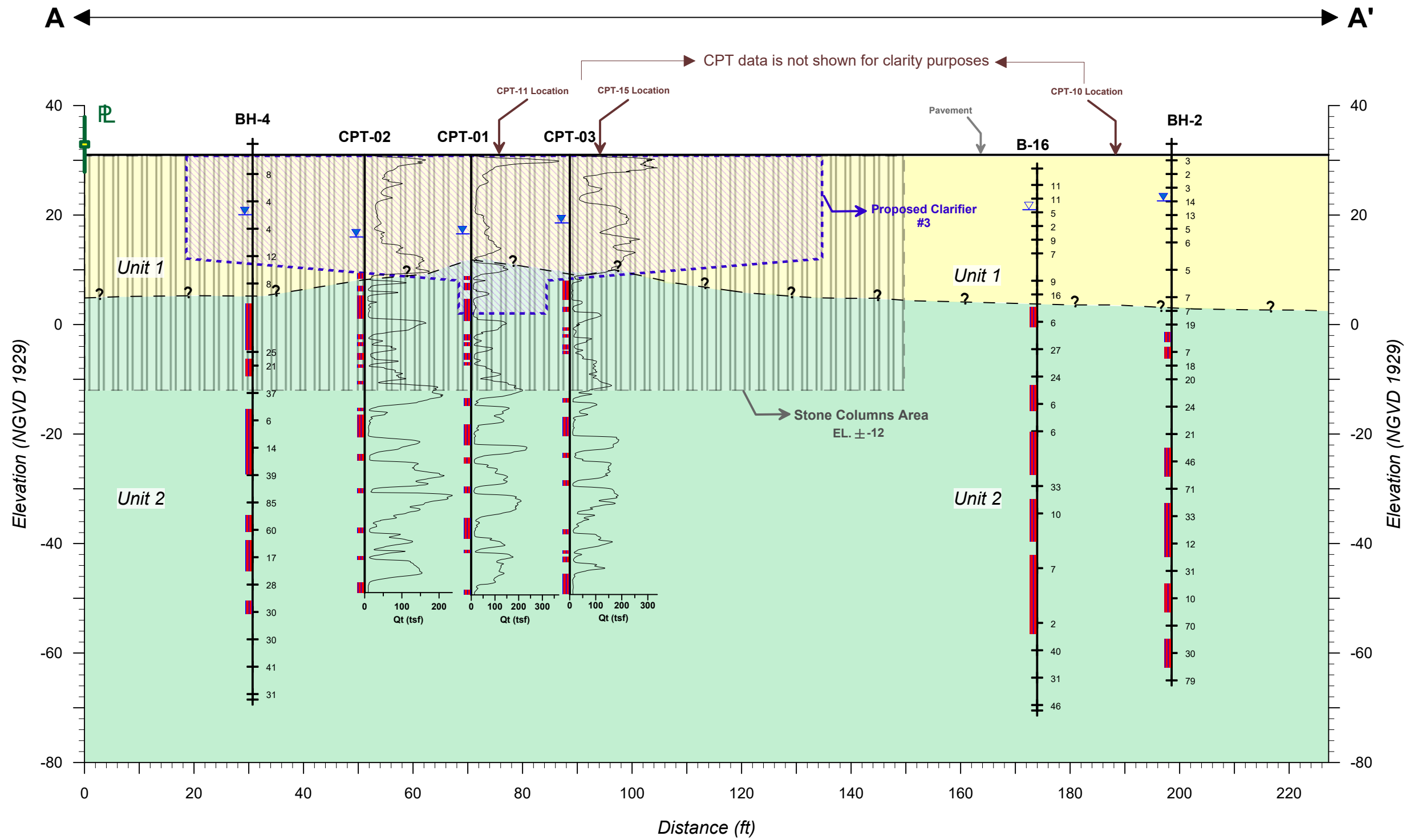
Base maps modified from Pierce County Public GIS webpage Aerial Map.

Legend:

-  Approx. CPT Location (PanGEO Inc., May 2021)
-  Approx. Test Pit Location (PanGEO Inc., June 2021)
-  Approx. Borehole Location (HONG WEST & ASSOCIATES, Inc., July 1996)
-  Approx. Borehole Location (SHANNON & WILSON, Inc., July 1979)
-  Approx. CPT Location (HONG WEST & ASSOCIATES, Inc., July 1996)
-  Approx. Outline of Property
-  Approx. Location of Subsurface Profiles (see Figures 3)

41-112.F119.2- Site and Exploration Plan, 01/02/21 (4.2/1.13)

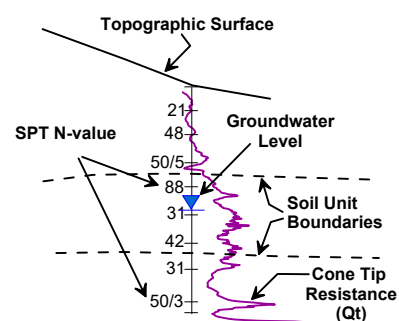
	Proposed Secondary Clarifier #3 Wastewater Treatment Plant Puyallup, WA 98371		SITE AND EXPLORATION PLAN	
	Project No. 21-112	Figure No. 2		



Soil Unit Legend:

- Unit 1: Sand with Silt Interbeds
- Unit 2 : Sand, Silt, & Clay Interbeds
- Silt Interbeds Within Unit 2

Graphics Legend



Notes:

1. Ground surface elevations based on Google Earth.
2. See Figure 2 for location of Section A-A'.
3. See report text for additional discussions on subsurface conditions.
4. The generalized soil profile is based on widely-spaced borings and probes. Soil conditions may vary over a small distance, and the actual subsurface conditions may be different from the generalized soil profile depicted in this figure.

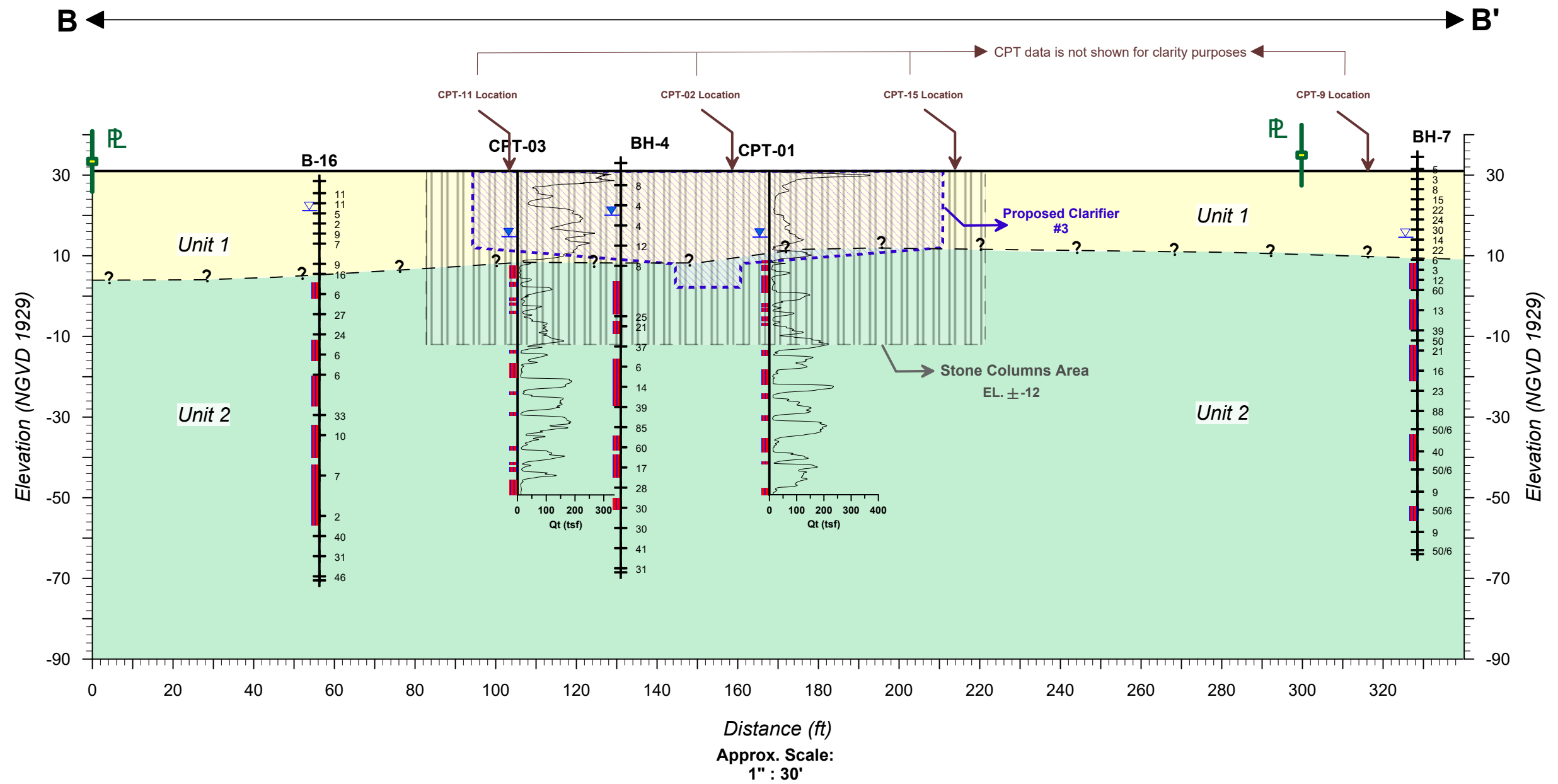
Approx. Scale:
1" : 20'



**Proposed Clarifier # 3
Wastewater Treatment Plant
Puyallup, WA 98371**

**GENERALIZED SUBSURFACE PROFILE
A-A'**

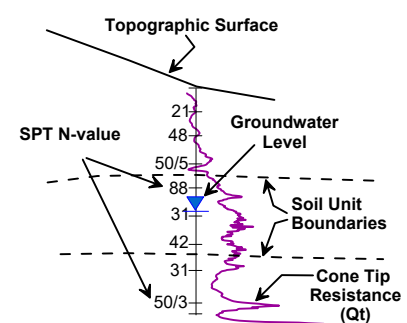
Project No. 21-112	Figure No. 3A
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Soil Unit Legend:

- Unit 1: Sand with Silt Interbeds
- Unit 2 : Sand, Silt, & Clay Interbeds
- Silt Interbeds Within Unit 2

Graphics Legend



Notes:

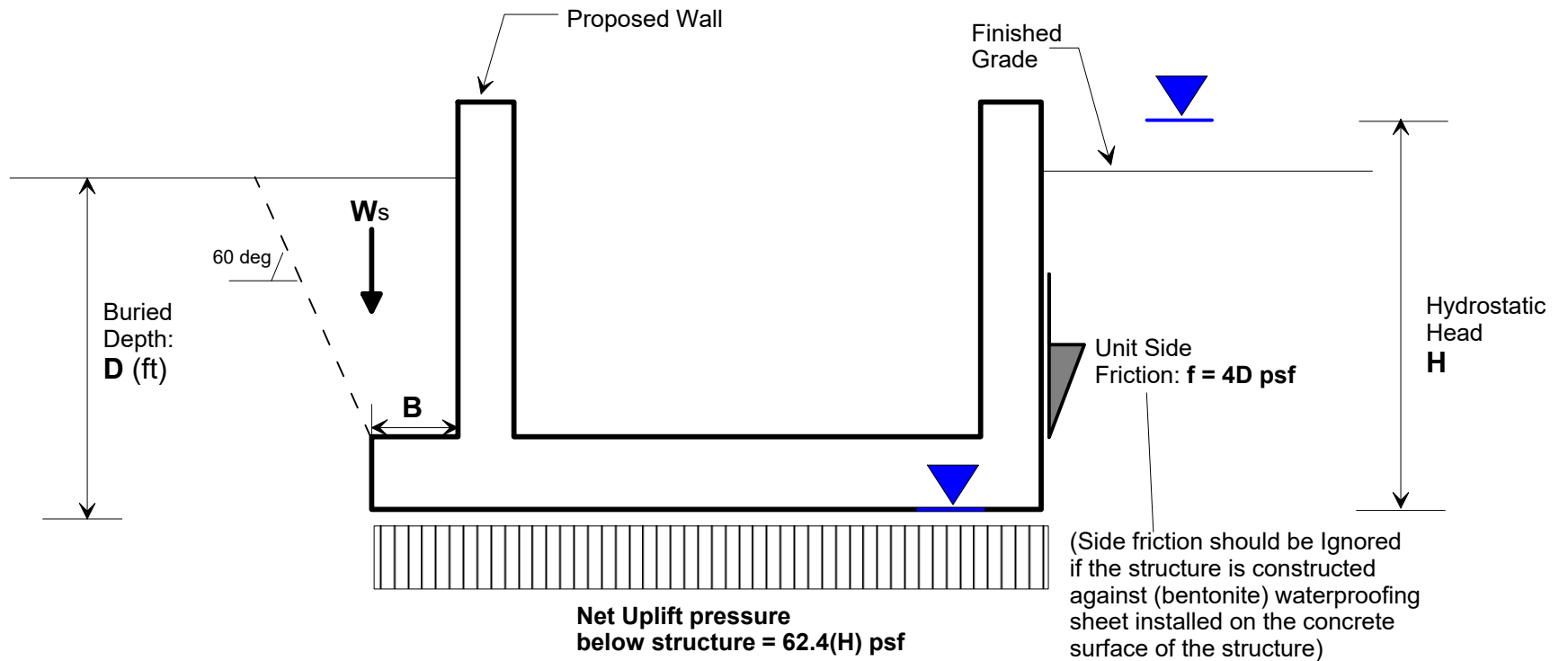
1. Ground surface elevations based on Google Earth.
2. See Figure 2 for location of Section B-B'.
3. See report text for additional discussions on subsurface conditions.
4. The generalized soil profile is based on widely-spaced borings and probes. Soil conditions may vary over a small distance, and the actual subsurface conditions may be different from the generalized soil profile depicted in this figure.



**Proposed Clarifier # 3
Wastewater Treatment Plant
Puyallup, WA 98371**

**GENERALIZED SUBSURFACE PROFILE
B-B'**

Project No. 21-112	Figure No. 3B
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Notes:

(1) Where foundation extends beyond the footprint of the structure (left hand side of the diagram), the uplift resistance should be computed as the sum of the weight of the structure, plus the weight of the soil wedge (**Ws**). **Ws** should be computed using an effective soil unit weight of 60 pcf.

(2) Without the extended foundation lid (right hand side of the diagram), the uplift resistance should be computed as the sum of the weight of the structure, plus the side friction at the soil-structure interface.



Proposed Secondary Clarifier #3
Wastewater Treatment Plant
Puyallup, WA 98371

**DESIGN PARAMETERS FOR
UPLIFT RESISTANCE**

Project No.

21-112

Figure No.

4

APPENDIX A

SUMMARY CPT DATA



Job No: 21-59-22331
Client: PanGEO, Inc.
Project: Puyallup WWTP
Start Date: 04-May-2021
End Date: 04-May-2021

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface (ft)	Final Depth (ft)	Shear Wave Velocity Tests	Latitude ² (deg)	Longitude ² (deg)
CPT-01	21-59-22331_SP01	04-May-2021	EC781	14.4	80.4	24	47.20552	-122.32072
CPT-02	21-59-22331_SP02	04-May-2021	EC781	14.9	80.1	24	47.20558	-122.32068
CPT-03	21-59-22331_SP03	04-May-2021	EC781	12.7	80.3	24	47.20561	-122.32098
Totals	3 soundings				240.7	72		

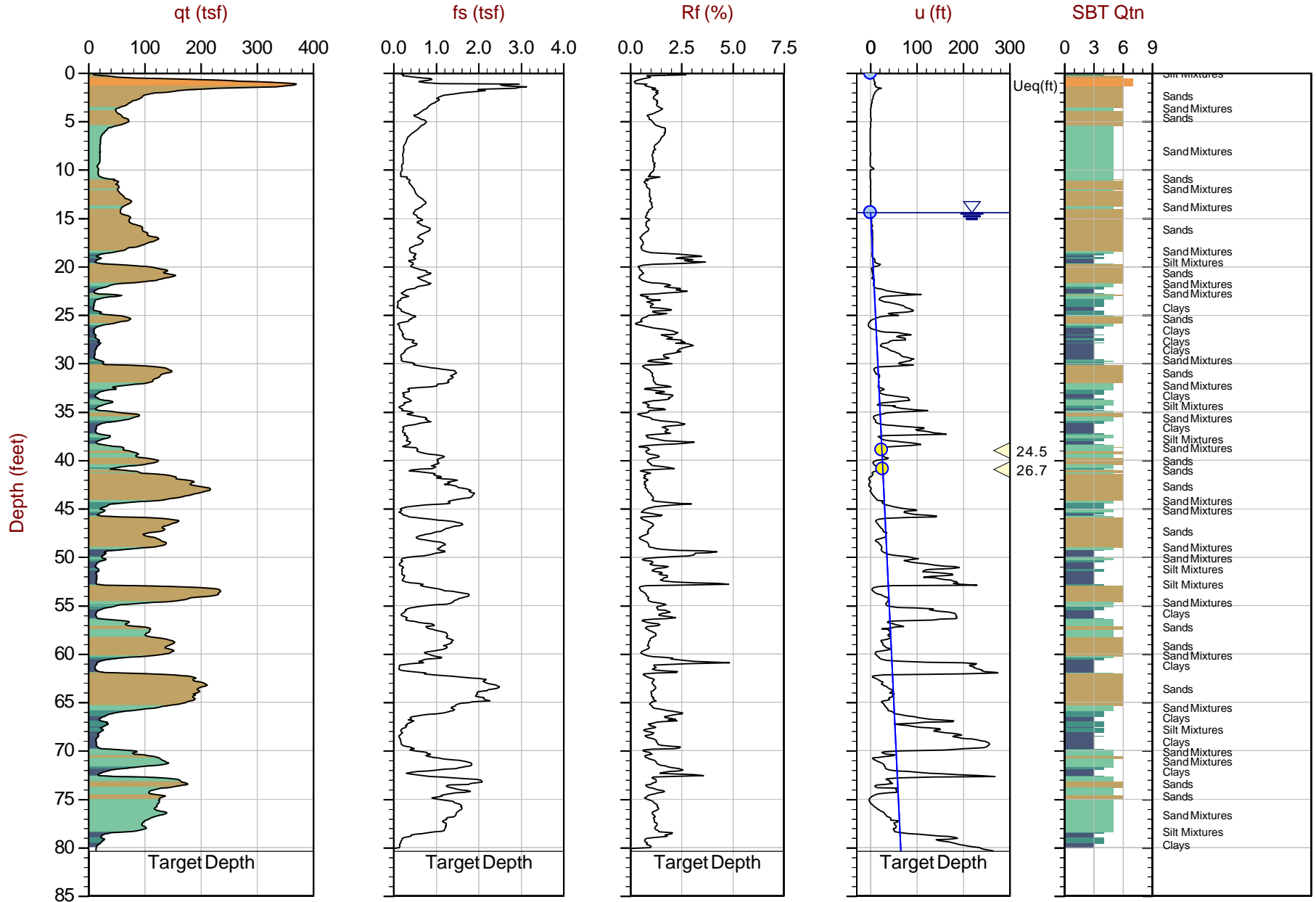
1. Phreatic surface based on pore pressure dissipation test unless otherwise noted. Hydrostatic profile applied to interpretation tables
2. Coordinates were collected using a handheld GPS - WGS 84 Lat/Long



PanGEO

Job No: 21-59-22331
Date: 2021-05-04 10:08
Site: Puyallup WWTP

Sounding: CPT-01
Cone: EC781



Max Depth: 24.500 m / 80.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-22331_SP01.COR
Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.20552 Long: -122.32072

● Equilibrium Pore Pressure (Ueq) ● Assumed Ueq ◁ Dissipation, Ueq achieved ▷ Dissipation, Ueq not achieved — Hydrostatic Line

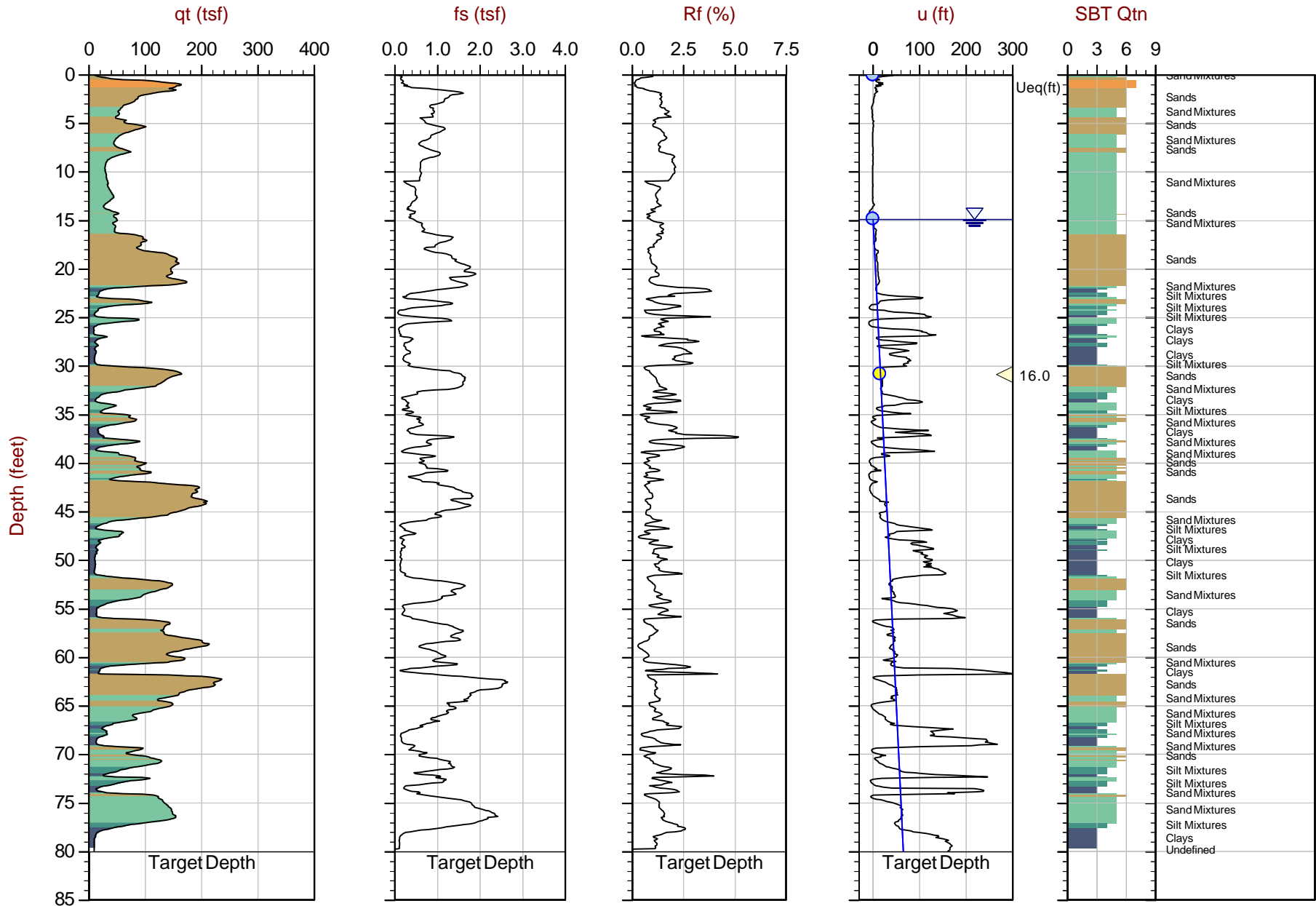
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



PanGEO

Job No: 21-59-22331
Date: 2021-05-04 11:37
Site: Puyallup WWTP

Sounding: CPT-02
Cone: EC781



Max Depth: 24.400 m / 80.05 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-22331_SP02.COR
Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.20558 Long: -122.32068

● Equilibrium Pore Pressure (Ueq)
● Assumed Ueq
◀ Dissipation, Ueq achieved
◀ Dissipation, Ueq not achieved
— Hydrostatic Line

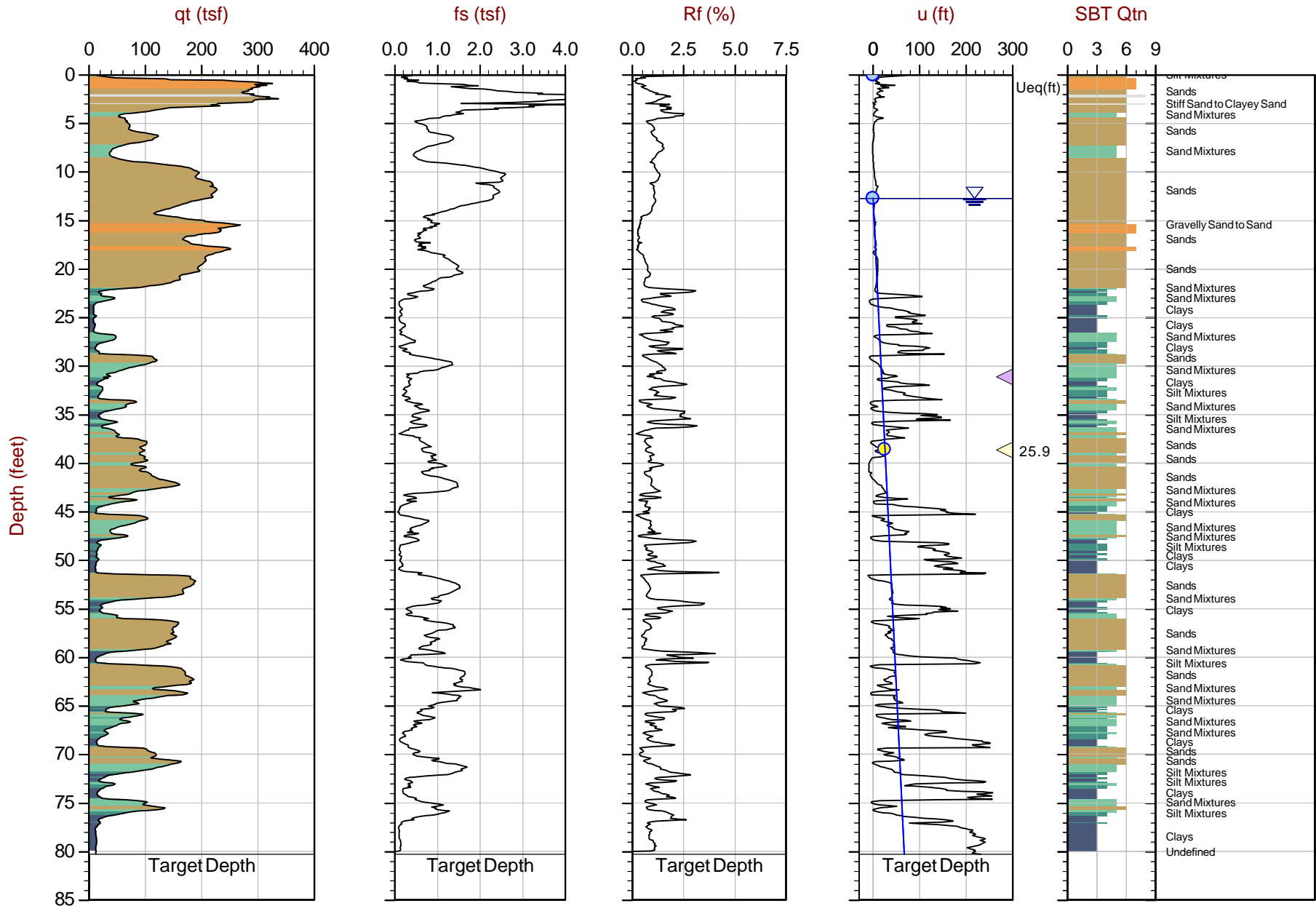
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



PanGEO

Job No: 21-59-22331
 Date: 2021-05-04 01:05
 Site: Puyallup WWTP

Sounding: CPT-03
 Cone: EC781



Max Depth: 24.475 m / 80.30 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-59-22331_SP03.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: Lat: 47.20561 Long: -122.32098

● Equilibrium Pore Pressure (Ueq)
 ● Assumed Ueq
 ◀ Dissipation, Ueq achieved
 ◀ Dissipation, Ueq not achieved
 — Hydrostatic Line
 The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Advanced Cone Penetration Test Plots with I_c , S_u , Φ and $N(60)/N1(60)$

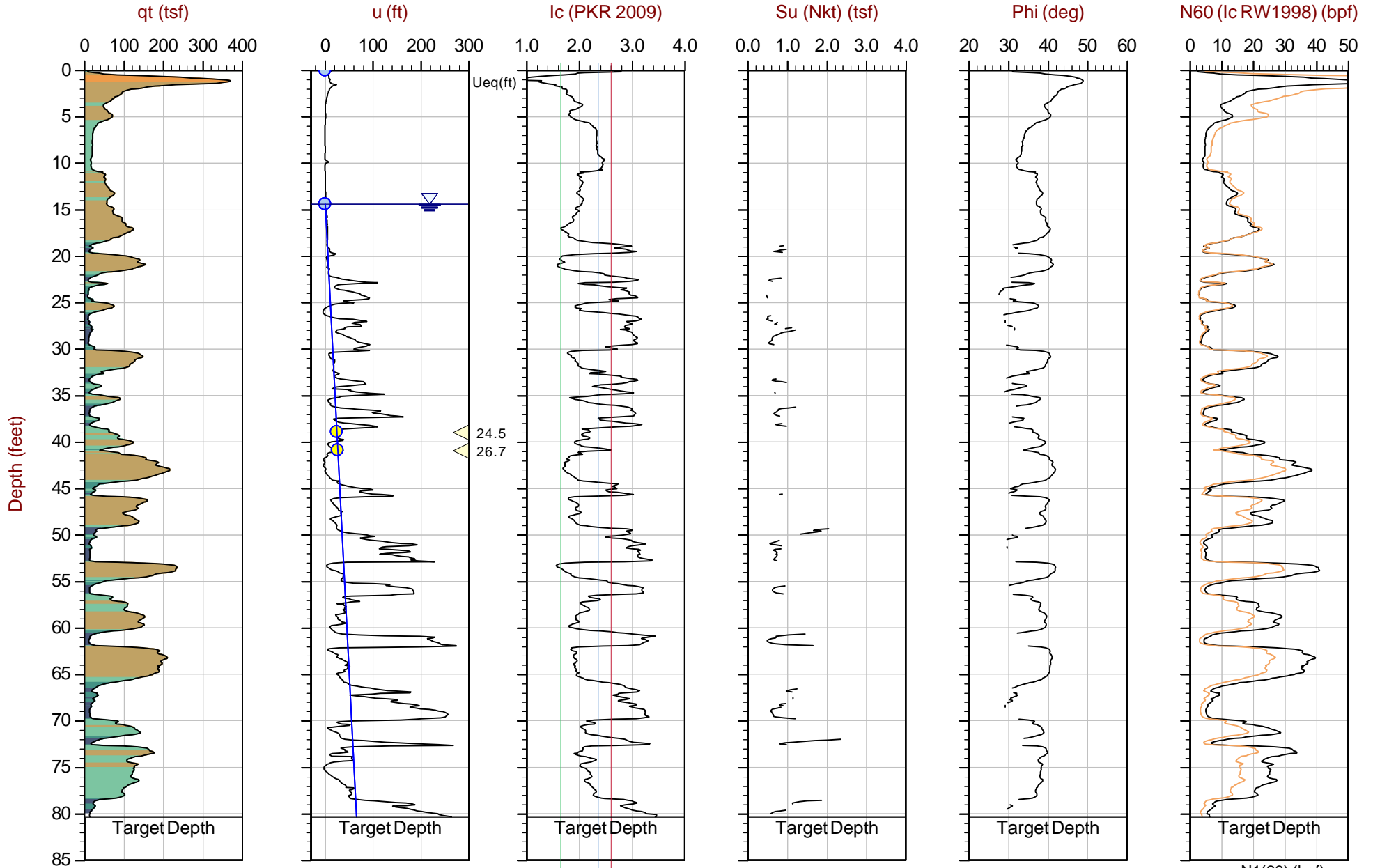




PanGEO

Job No: 21-59-22331
Date: 2021-05-04 10:08
Site: Puyallup WWTP

Sounding: CPT-01
Cone: EC781



Max Depth: 24.500 m / 80.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-22331_SP01.COR
Unit Wt: SBTQtn(PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.20552 Long: -122.32072

● Equilibrium Pore Pressure (Ueq) ● Assumed Ueq ◁ Dissipation, Ueq achieved ▷ Dissipation, Ueq not achieved — Hydrostatic Line

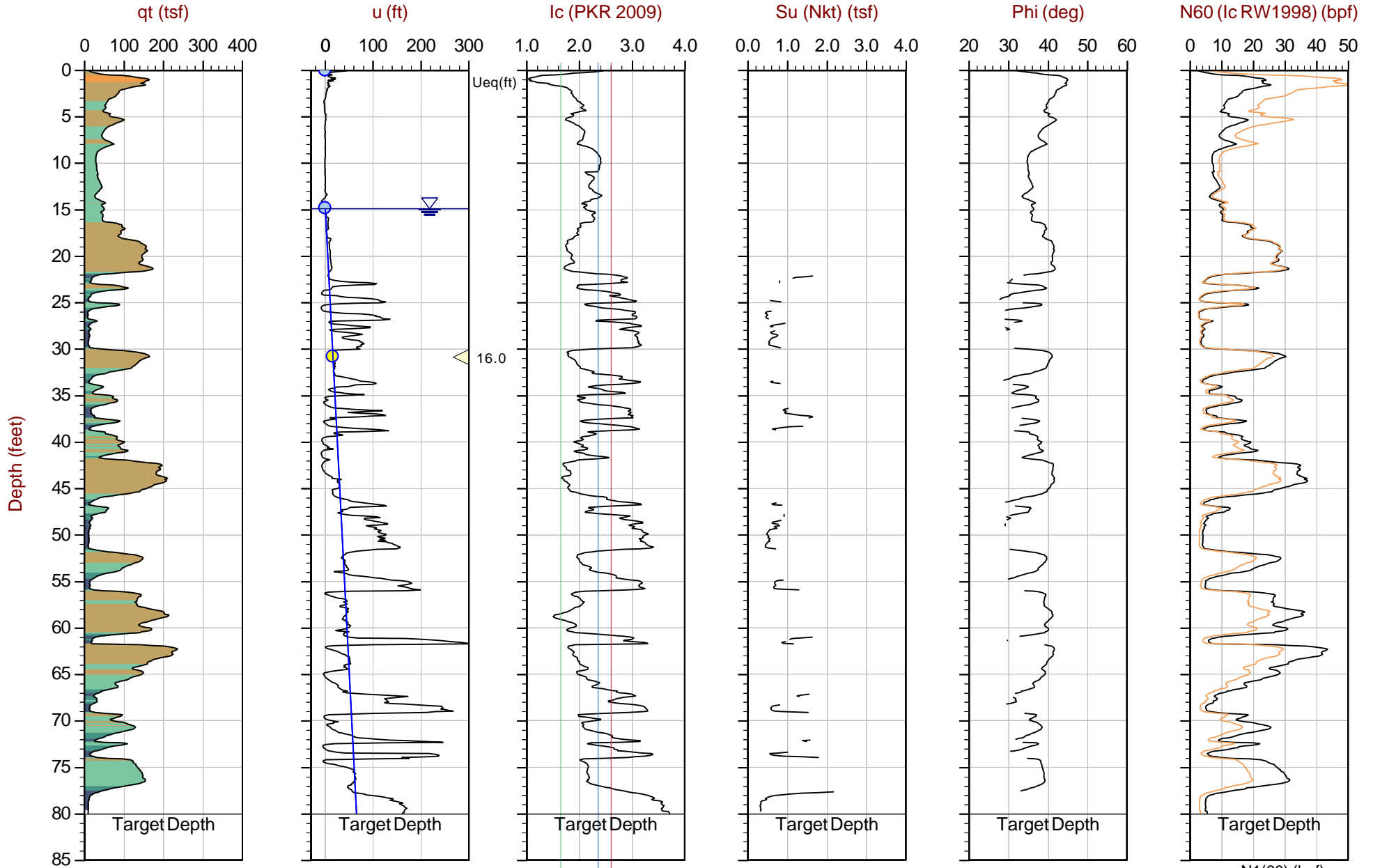
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



PanGEO

Job No: 21-59-22331
Date: 2021-05-04 11:37
Site: Puyallup WWTP

Sounding: CPT-02
Cone: EC781



Max Depth: 24.400 m / 80.05 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-22331_SP02.COR
Unit Wt: SBTQtn(PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.20558 Long: -122.32068

● Equilibrium Pore Pressure (Ueq) ● Assumed Ueq ◁ Dissipation, Ueq achieved ▷ Dissipation, Ueq not achieved — Hydrostatic Line

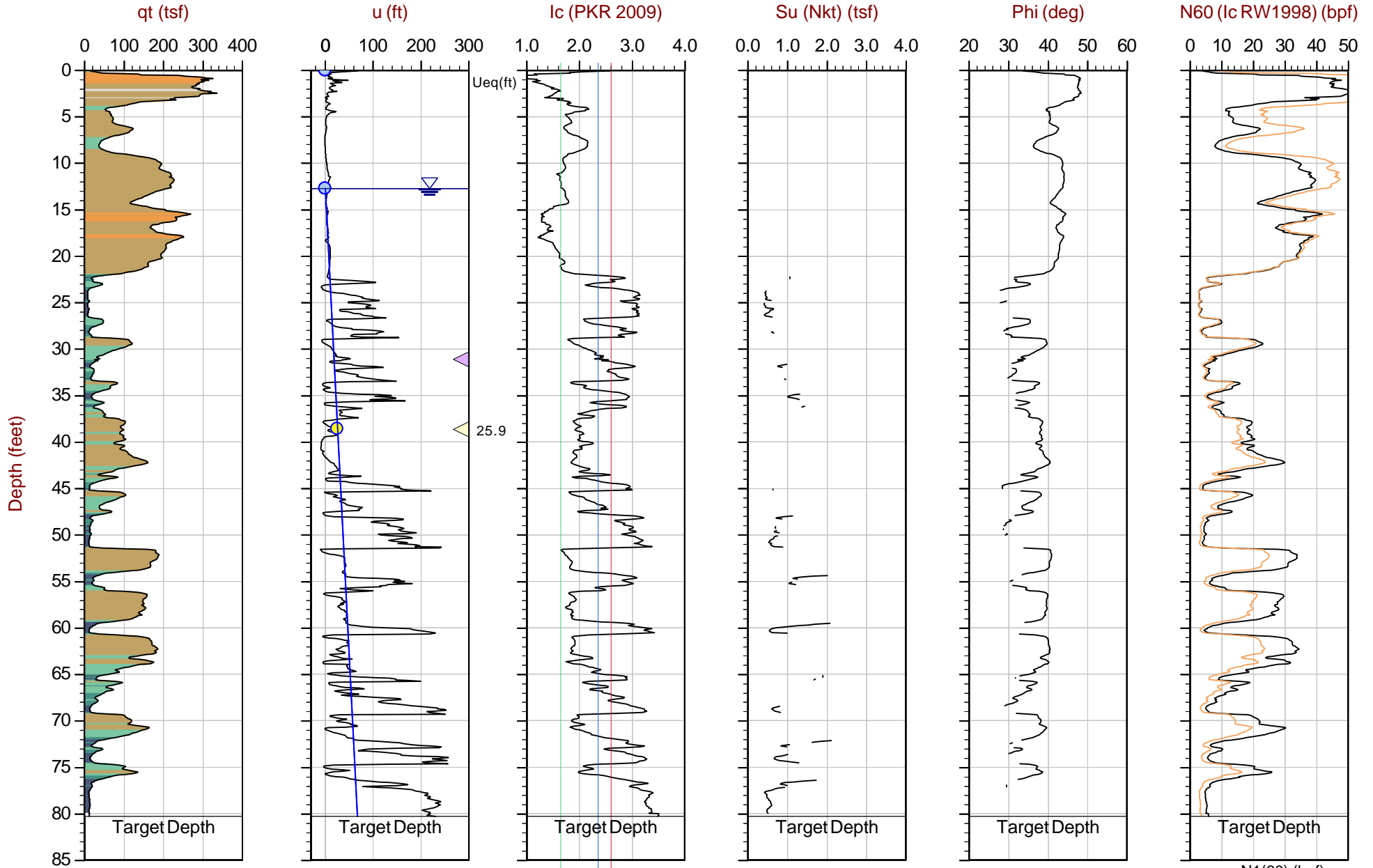
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



PanGEO

Job No: 21-59-22331
Date: 2021-05-04 01:05
Site: Puyallup WWTP

Sounding: CPT-03
Cone: EC781



Max Depth: 24.475 m / 80.30 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-22331_SP03.COR
Unit Wt: SBTQtn(PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.20561 Long: -122.32098

● Equilibrium Pore Pressure (Ueq)
● Assumed Ueq
◀ Dissipation, Ueq achieved
◀ Dissipation, Ueq not achieved
— Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

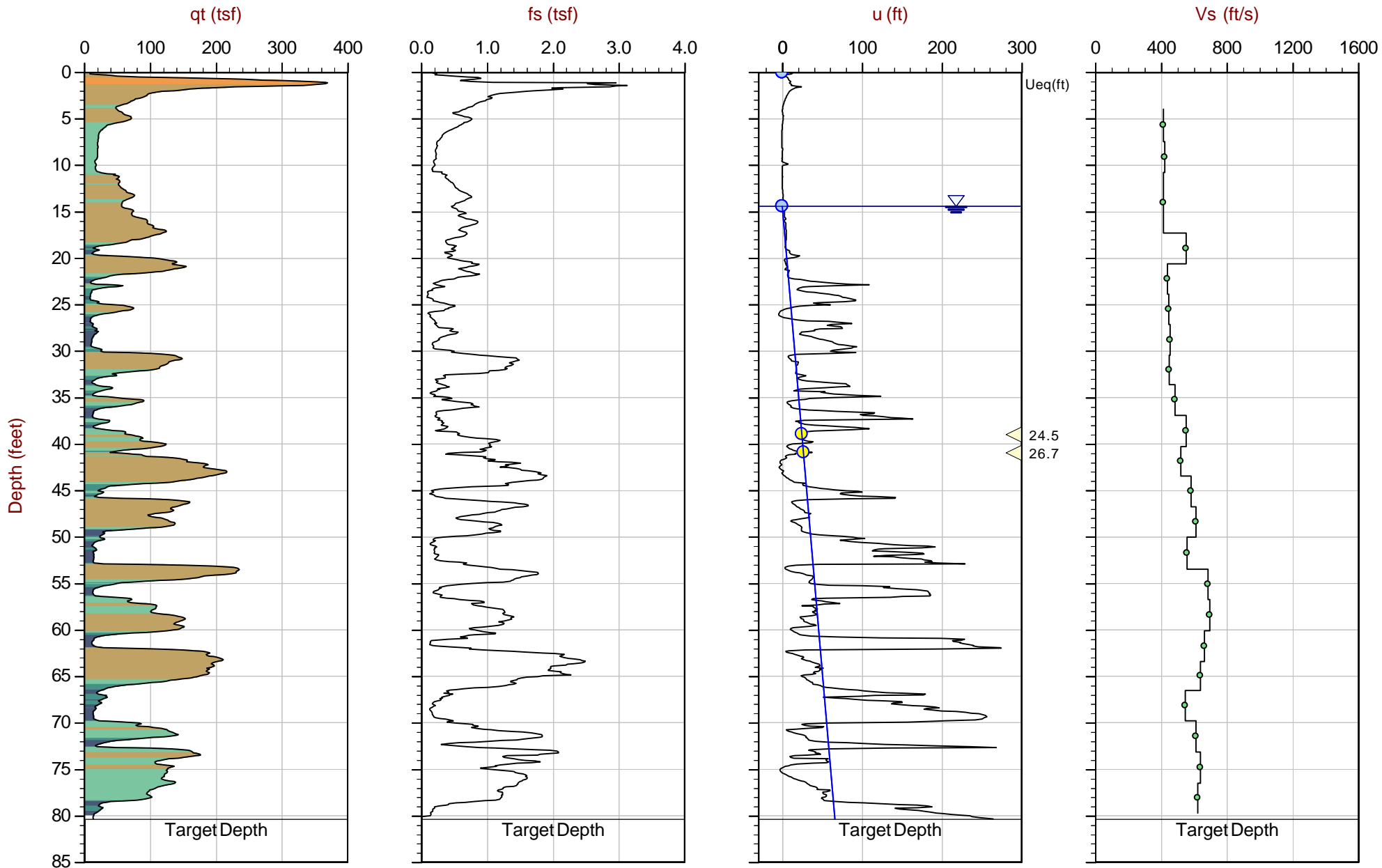
Seismic Cone Penetration Test Plots



PanGEO

Job No: 21-59-22331
Date: 2021-05-04 10:08
Site: Puyallup WWTP

Sounding: CPT-01
Cone: EC781



Max Depth: 24.500 m / 80.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-22331_SP01.COR
Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.20552 Long: -122.32072

● Equilibrium Pore Pressure (Ueq)
 ● Assumed Ueq
 ◁ Dissipation, Ueq achieved
 ◁ Dissipation, Ueq not achieved
 — Hydrostatic Line

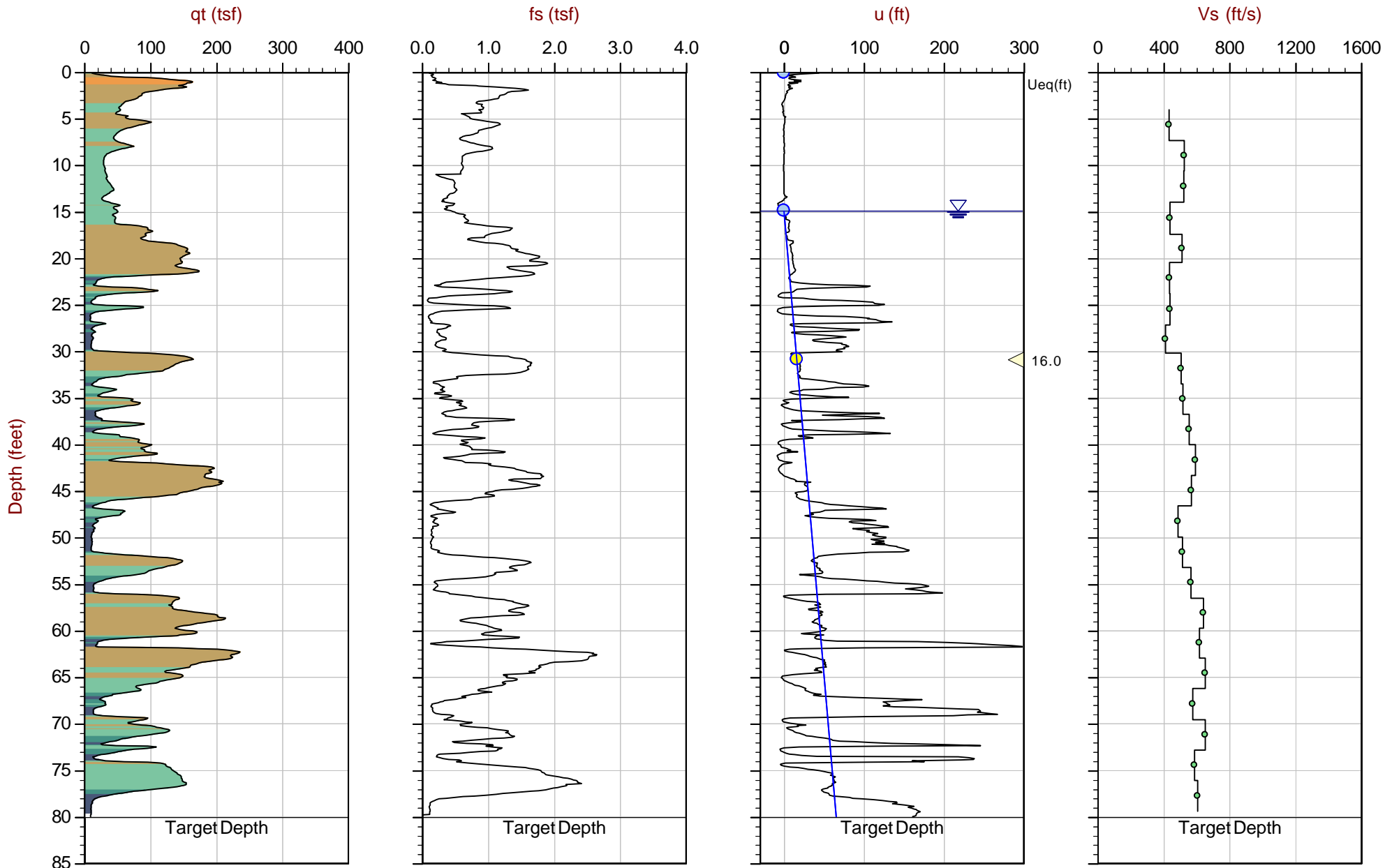
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



PanGEO

Job No: 21-59-22331
Date: 2021-05-04 11:37
Site: Puyallup WWTP

Sounding: CPT-02
Cone: EC781



Max Depth: 24.400 m / 80.05 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-22331_SP02.COR
Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.20558 Long: -122.32068

● Equilibrium Pore Pressure (Ueq)
 ● Assumed Ueq
 ◁ Dissipation, Ueq achieved
 ◁ Dissipation, Ueq not achieved
 — Hydrostatic Line

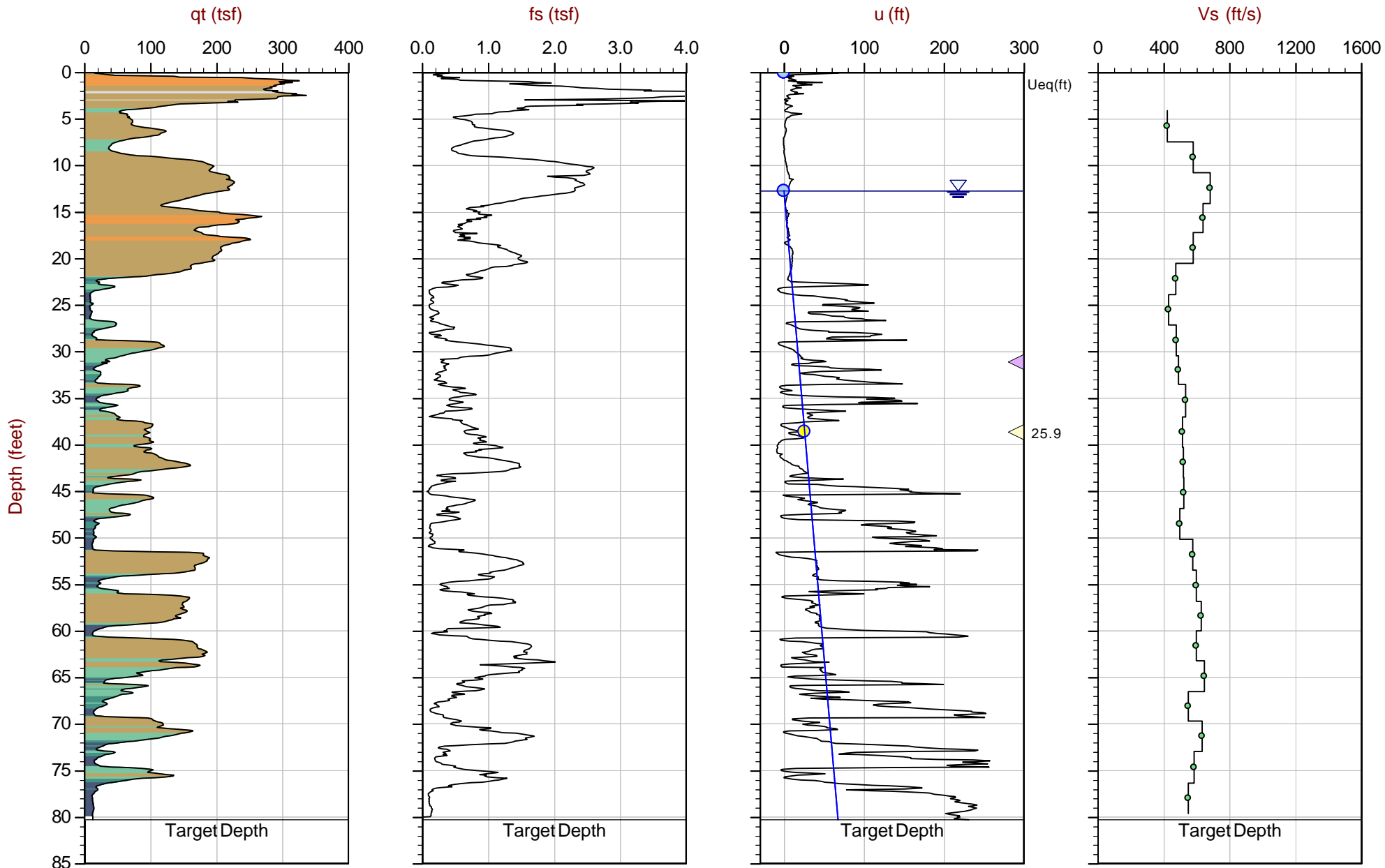
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



PanGEO

Job No: 21-59-22331
Date: 2021-05-04 01:05
Site: Puyallup WWTP

Sounding: CPT-03
Cone: EC781



Max Depth: 24.475 m / 80.30 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-59-22331_SP03.COR
Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.20561 Long: -122.32098

● Equilibrium Pore Pressure (Ueq)
 ● Assumed Ueq
 ◁ Dissipation, Ueq achieved
 ◁ Dissipation, Ueq not achieved
 — Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Shear Wave (V_s) Tabular Results



Job No: 21-59-22331
Client: PanGEO, Inc.
Project: Puyallup WWTP
Sounding ID: CPT-01
Date: 04-May-2021

Seismic Source: Beam
Source Offset (ft): 9.20
Source Depth (ft): 0.00
Geophone Offset (ft): 0.66

SCPT_u SHEAR WAVE VELOCITY TEST RESULTS - V_s

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.59	3.94	10.01			
8.14	7.48	11.86	1.85	4.46	415
11.42	10.76	14.16	2.30	5.46	421
17.98	17.32	19.61	5.46	13.20	413
21.26	20.60	22.56	2.95	5.34	553
24.54	23.88	25.60	3.03	6.92	438
27.82	27.16	28.68	3.09	6.90	447
31.10	30.45	31.81	3.12	6.90	453
34.28	33.63	34.86	3.06	6.83	448
37.57	36.91	38.04	3.17	6.55	485
40.94	40.29	41.33	3.29	5.97	551
44.13	43.47	44.43	3.11	5.97	521
47.41	46.75	47.65	3.21	5.52	582
50.69	50.03	50.87	3.22	5.26	613
54.13	53.48	54.26	3.39	6.09	557
57.41	56.76	57.50	3.24	4.72	685
60.79	60.14	60.84	3.34	4.80	695
64.07	63.42	64.08	3.25	4.89	663
67.19	66.54	67.17	3.09	4.82	640
70.47	69.82	70.42	3.25	5.94	547
73.82	73.16	73.74	3.32	5.44	611
77.17	76.51	77.06	3.32	5.20	639
80.38	79.72	80.25	3.19	5.12	623



Job No: 21-59-22331
Client: PanGEO, Inc.
Project: Puyallup WWTP
Sounding ID: CPT-02
Date: 04-May-2021

Seismic Source: Beam
Source Offset (ft): 9.20
Source Depth (ft): 0.00
Geophone Offset (ft): 0.66

SCPT_u SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.66	4.00	10.03			
7.97	7.32	11.75	1.72	3.98	432
11.22	10.56	14.01	2.25	4.30	524
14.60	13.94	16.70	2.70	5.18	521
18.04	17.39	19.67	2.97	6.78	438
21.10	20.44	22.41	2.74	5.37	510
24.44	23.79	25.50	3.09	7.12	434
27.82	27.16	28.68	3.18	7.26	438
30.84	30.18	31.55	2.87	6.99	411
34.12	33.46	34.71	3.15	6.23	506
37.40	36.75	37.88	3.17	6.15	516
40.68	40.03	41.07	3.19	5.77	553
43.96	43.31	44.27	3.20	5.40	593
47.24	46.59	47.49	3.21	5.67	567
50.59	49.93	50.77	3.29	6.75	487
53.87	53.22	54.00	3.23	6.28	514
57.15	56.50	57.24	3.24	5.72	566
60.37	59.71	60.42	3.18	4.95	641
63.58	62.93	63.60	3.18	5.16	616
66.86	66.21	66.84	3.25	4.98	652
70.21	69.55	70.16	3.32	5.76	576
73.49	72.83	73.41	3.25	4.99	652
76.77	76.12	76.67	3.26	5.54	588
80.05	79.40	79.93	3.26	5.37	606



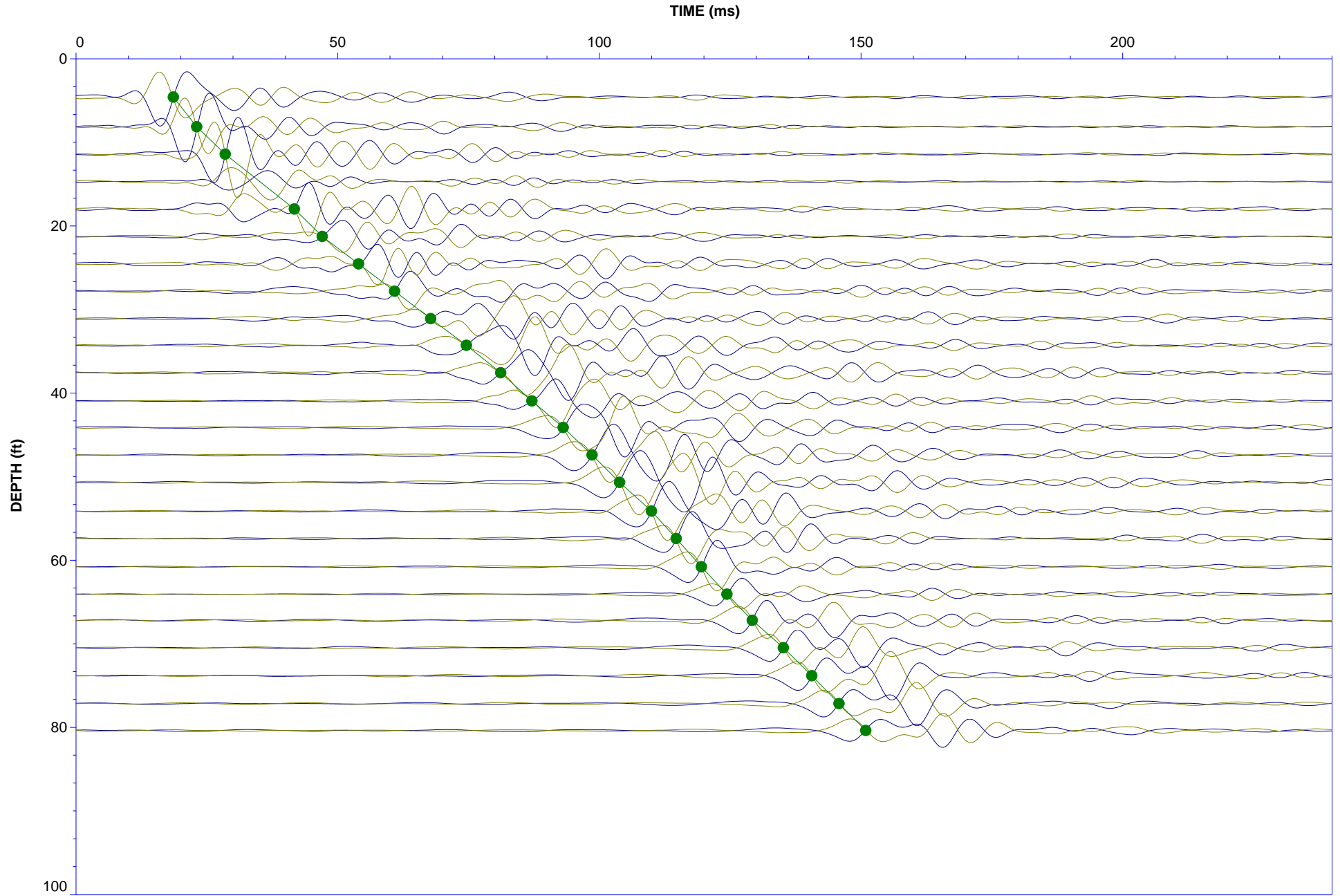
Job No: 21-59-22331
Client: PanGEO, Inc.
Project: Puyallup WWTP
Sounding ID: CPT-03
Date: 04-May-2021

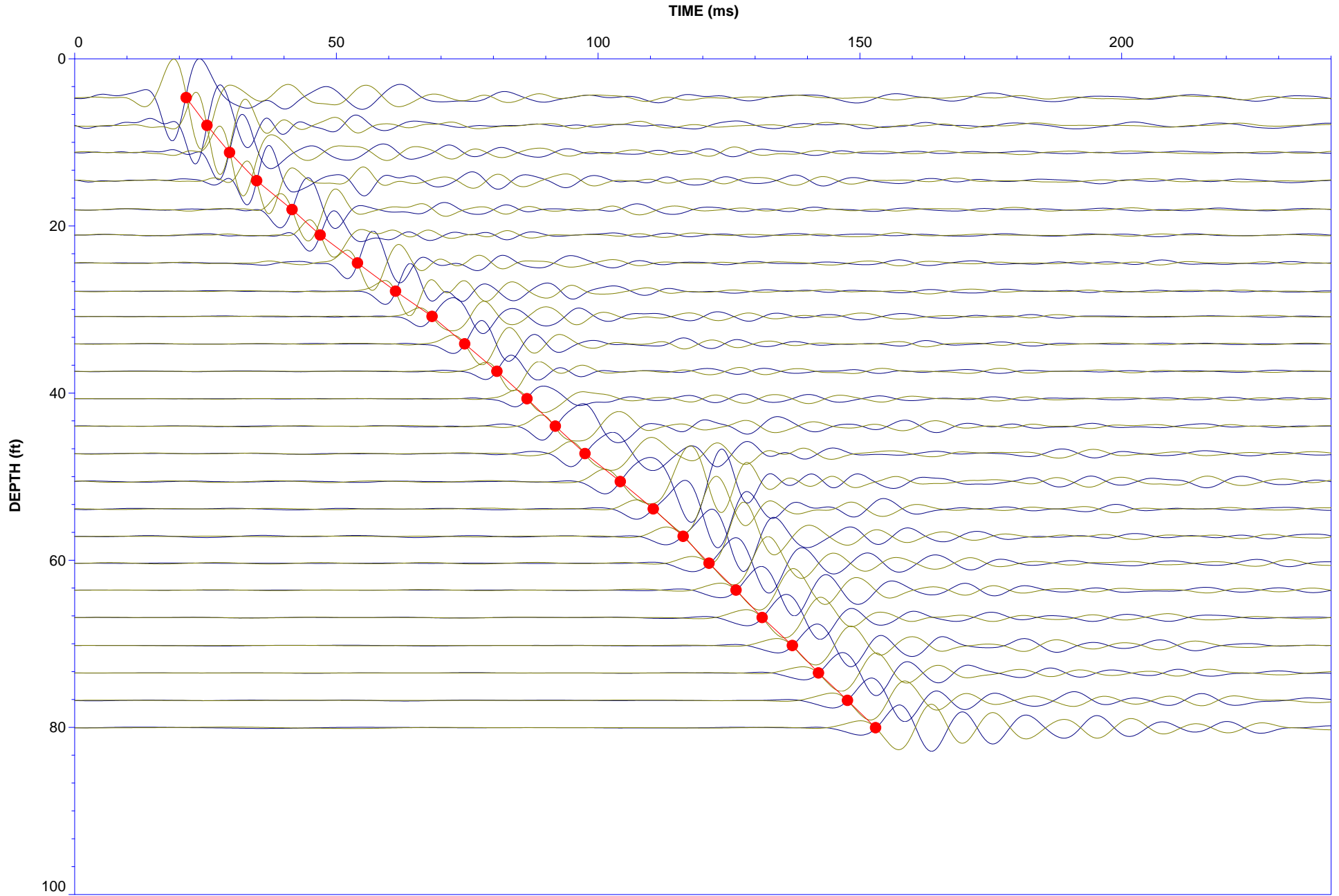
Seismic Source: Beam
Source Offset (ft): 9.20
Source Depth (ft): 0.00
Geophone Offset (ft): 0.66

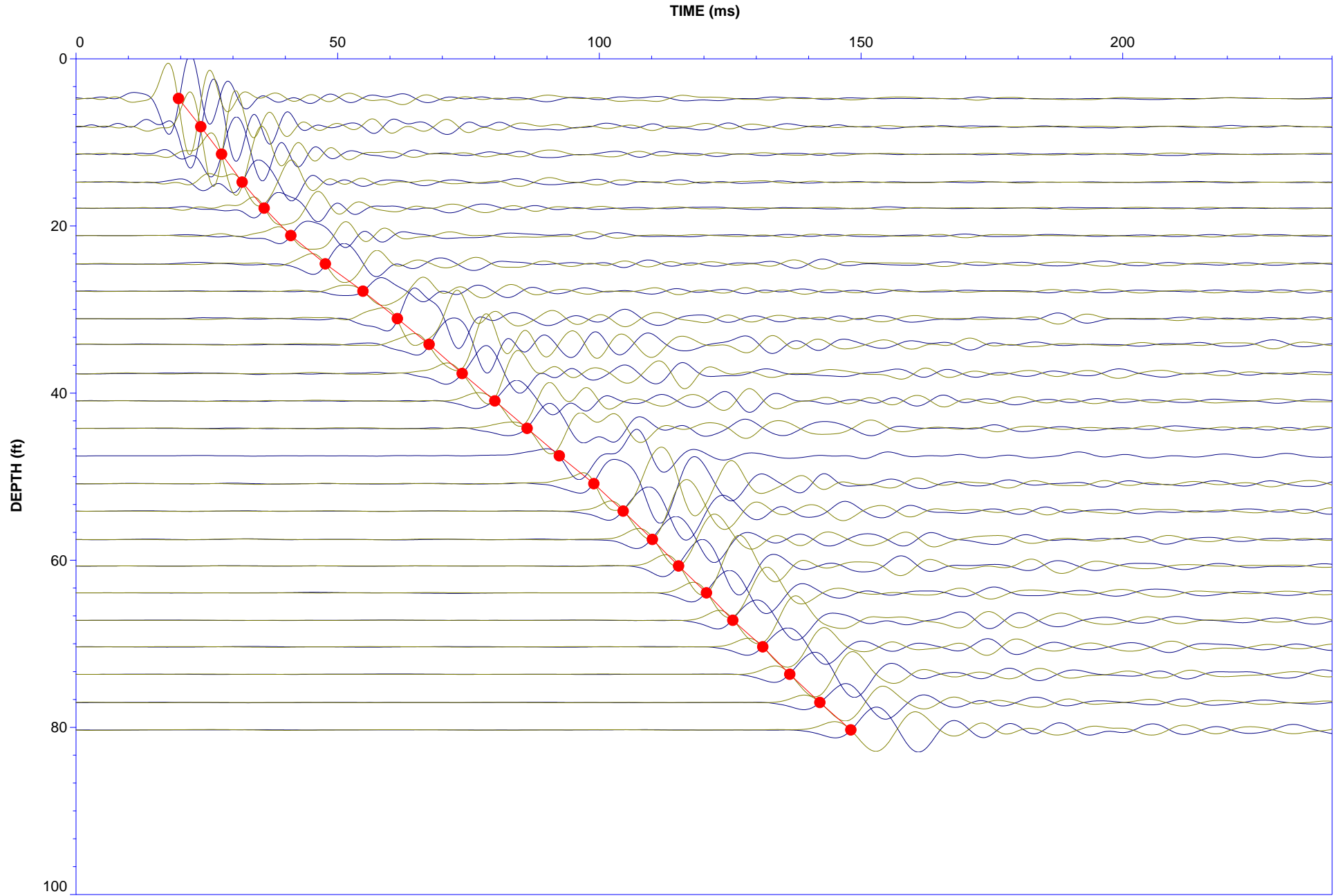
SCPT_u SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.76	4.10	10.07			
8.14	7.48	11.86	1.78	4.24	421
11.42	10.76	14.16	2.30	3.98	578
14.76	14.11	16.84	2.68	3.94	682
17.88	17.22	19.53	2.68	4.21	638
21.16	20.50	22.47	2.95	5.09	580
24.54	23.88	25.60	3.12	6.60	473
27.82	27.16	28.68	3.09	7.18	430
31.10	30.45	31.81	3.12	6.58	475
34.19	33.53	34.77	2.96	6.07	488
37.66	37.01	38.13	3.36	6.32	532
40.94	40.29	41.33	3.19	6.22	513
44.23	43.57	44.53	3.20	6.18	518
47.51	46.85	47.74	3.21	6.15	523
50.85	50.20	51.03	3.29	6.61	498
54.13	53.48	54.26	3.23	5.59	577
57.51	56.86	57.60	3.33	5.58	597
60.70	60.04	60.74	3.14	5.00	628
63.91	63.25	63.92	3.18	5.32	597
67.19	66.54	67.17	3.25	5.03	645
70.37	69.72	70.32	3.15	5.74	550
73.65	73.00	73.58	3.25	5.15	632
77.03	76.38	76.93	3.35	5.75	583
80.31	79.66	80.19	3.26	5.93	549

Seismic Cone Penetration Test Shear Wave (V_s) Traces







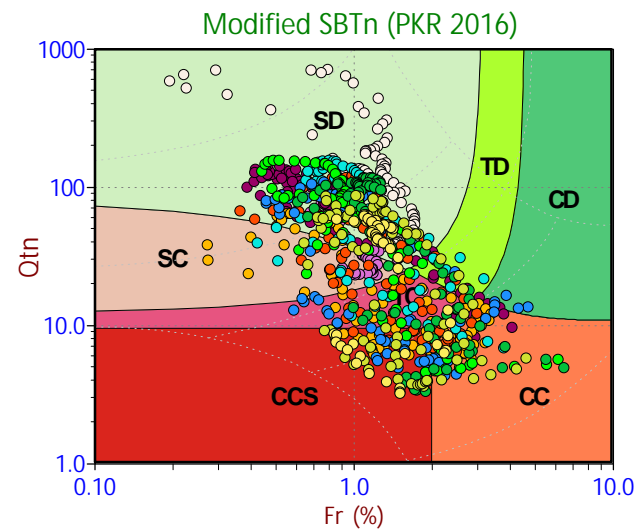
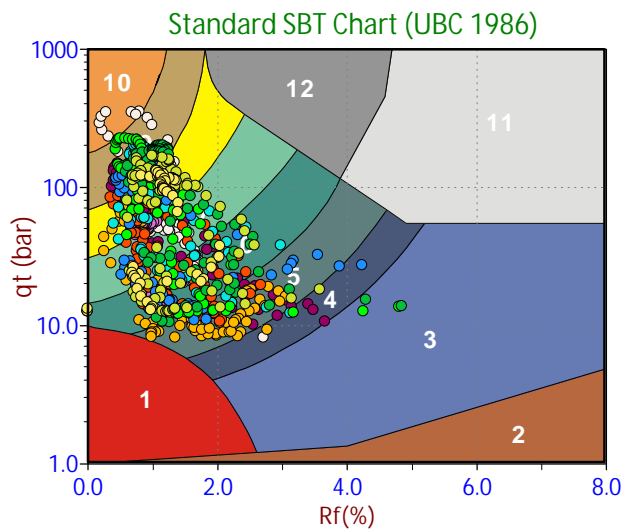
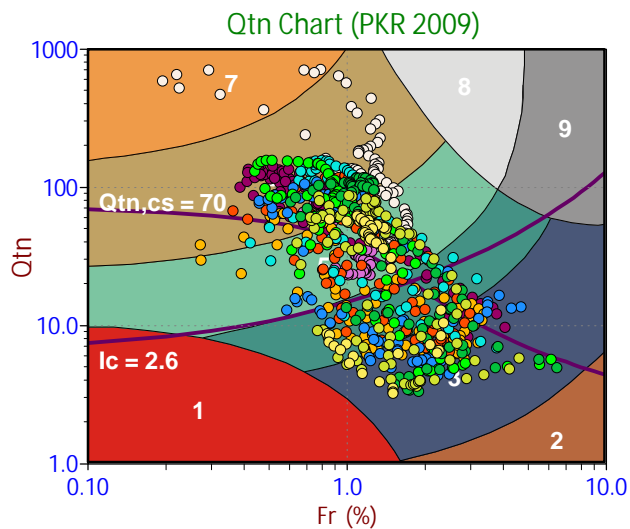
Soil Behavior Type (SBT) Scatter Plots



PanGEO

Job No: 21-59-22331
 Date: 2021-05-04 10:08
 Site: Puyallup WWTP

Sounding: CPT-01
 Cone: EC781



Depth Ranges

- >0.0 to 7.5 ft
- >7.5 to 15.0 ft
- >15.0 to 22.5 ft
- >22.5 to 30.0 ft
- >30.0 to 37.5 ft
- >37.5 to 45.0 ft
- >45.0 to 52.5 ft
- >52.5 to 60.0 ft
- >60.0 to 67.5 ft
- >67.5 to 75.0 ft
- >75.0 ft

Legend

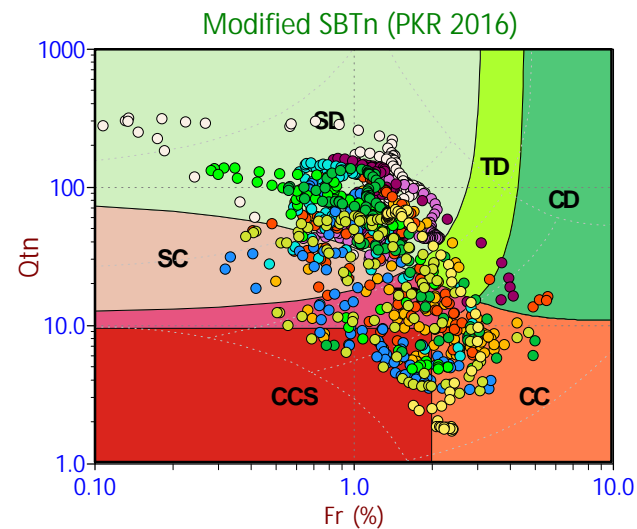
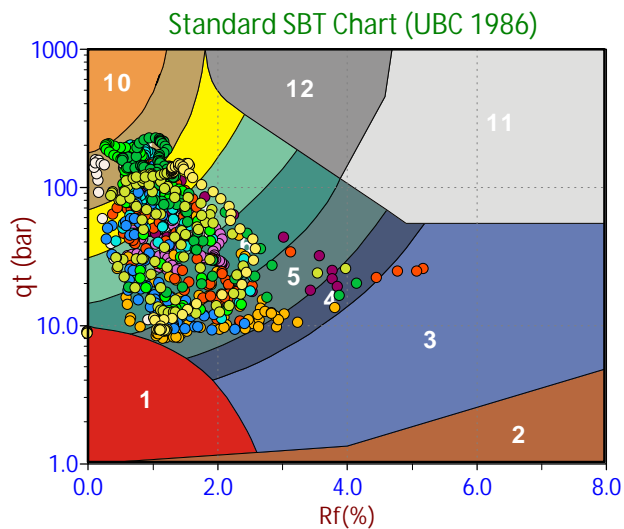
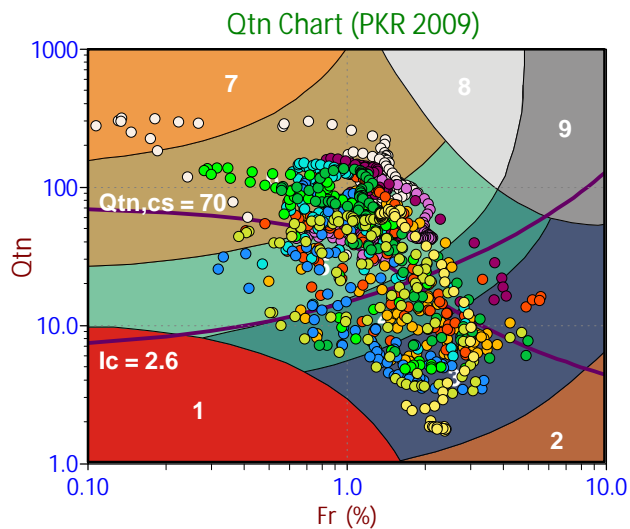
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend

- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Legend

- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)



Depth Ranges

- >0.0 to 7.5 ft
- >7.5 to 15.0 ft
- >15.0 to 22.5 ft
- >22.5 to 30.0 ft
- >30.0 to 37.5 ft
- >37.5 to 45.0 ft
- >45.0 to 52.5 ft
- >52.5 to 60.0 ft
- >60.0 to 67.5 ft
- >67.5 to 75.0 ft
- >75.0 ft

Legend

- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

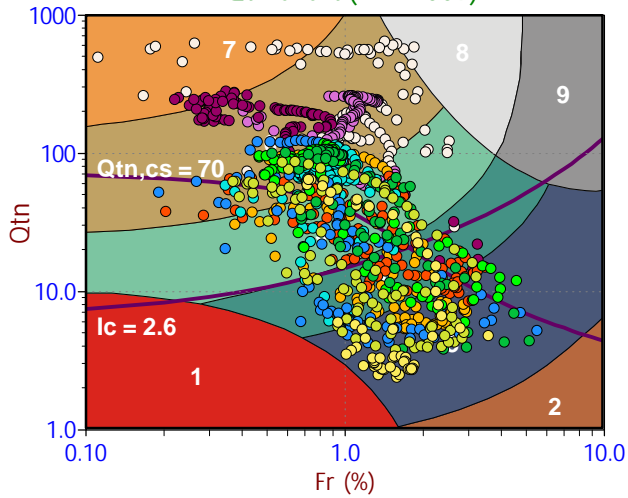
Legend

- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

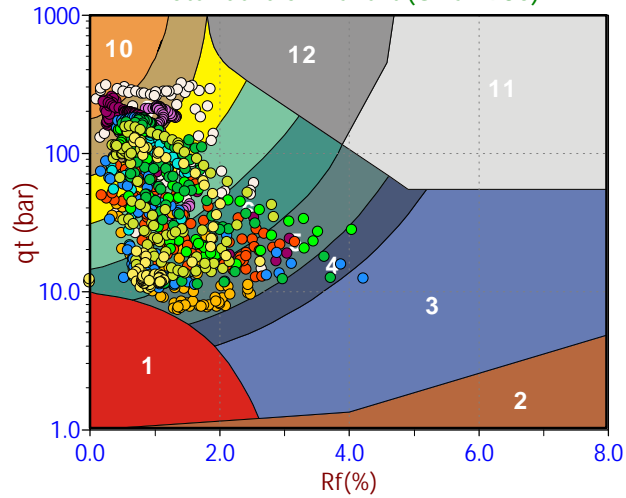
Legend

- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

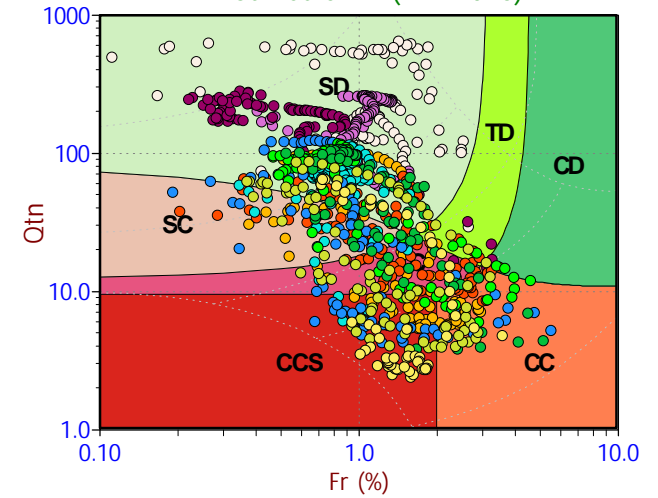
Qtn Chart (PKR 2009)



Standard SBT Chart (UBC 1986)



Modified SBTn (PKR 2016)



Depth Ranges

- >0.0 to 7.5 ft
- >7.5 to 15.0 ft
- >15.0 to 22.5 ft
- >22.5 to 30.0 ft
- >30.0 to 37.5 ft
- >37.5 to 45.0 ft
- >45.0 to 52.5 ft
- >52.5 to 60.0 ft
- >60.0 to 67.5 ft
- >67.5 to 75.0 ft
- >75.0 ft

Legend

- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend

- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Legend

- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots



Job No: 21-59-22331
Client: PanGEO, Inc.
Project: Puyallup WWTP
Start Date: 04-May-2021
End Date: 04-May-2021

CPT_u PORE PRESSURE DISSIPATION SUMMARY

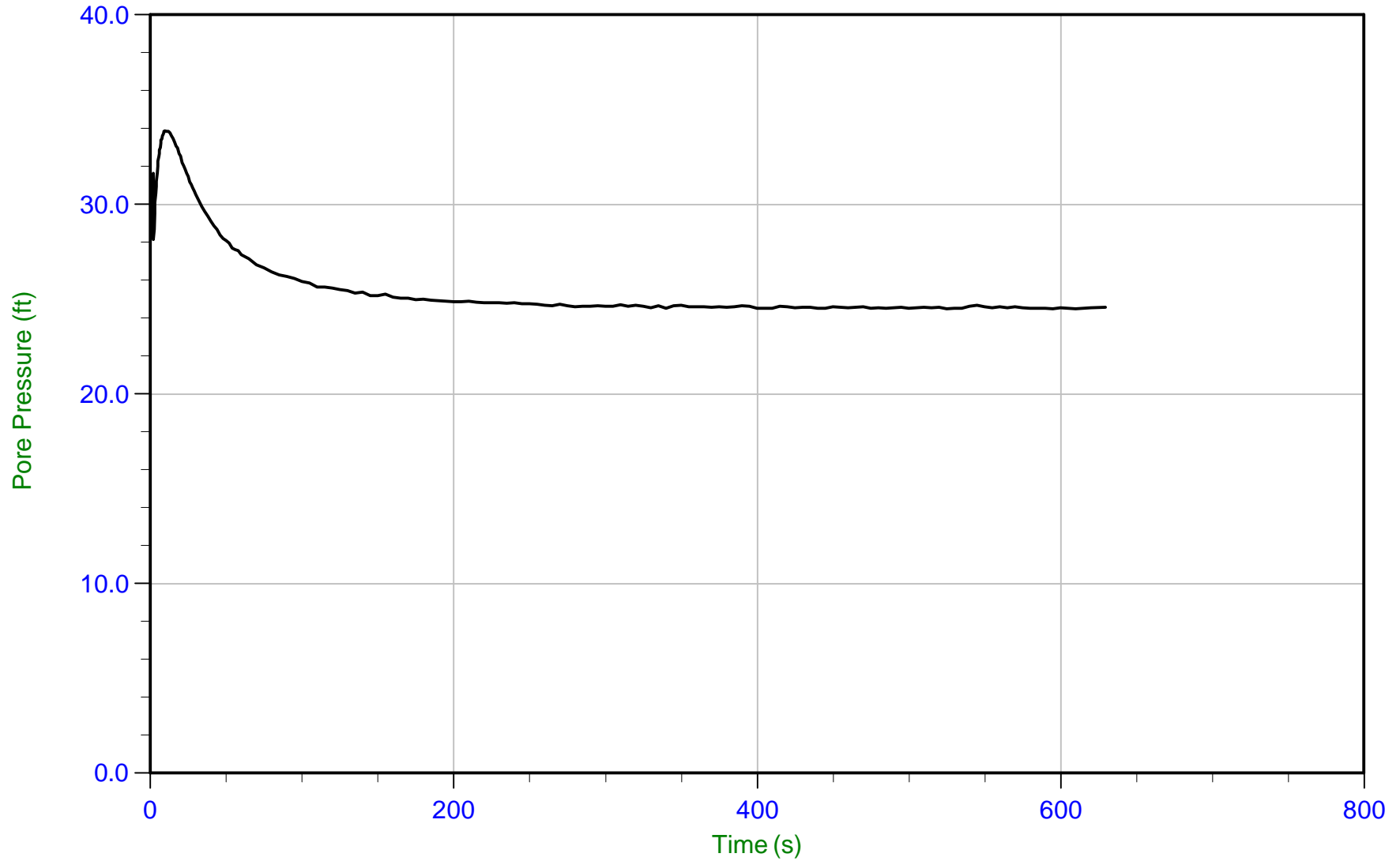
Sounding ID	File Name	Cone Area (cm ²)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U _{eq} (ft)	Calculated Phreatic Surface (ft)
CPT-01	21-59-22331_SP01.ppd2	15	630	39.0	24.5	14.4
CPT-01	21-59-22331_SP01.ppd2	15	465	40.9	26.8	14.2
CPT-02	21-59-22331_SP02.ppd2	15	500	30.8	16.0	14.9
CPT-03	21-59-22331_SP03.ppd2	15	220	31.1		
CPT-03	21-59-22331_SP03.ppd2	15	400	38.6	25.9	12.7
Total Duration			36.9 min			



PanGEO

Job No: 21-59-22331
Date: 05/04/2021 10:08
Site: Puyallup WWTP

Sounding: CPT-01
Cone: EC781 Area=15 cm²



Trace Summary:

Filename: 21-59-22331_SP01.ppd2
Depth: 11.875 m / 38.959 ft
Duration: 629.9 s

u Min: 24.5 ft
u Max: 33.9 ft
u Final: 24.6 ft

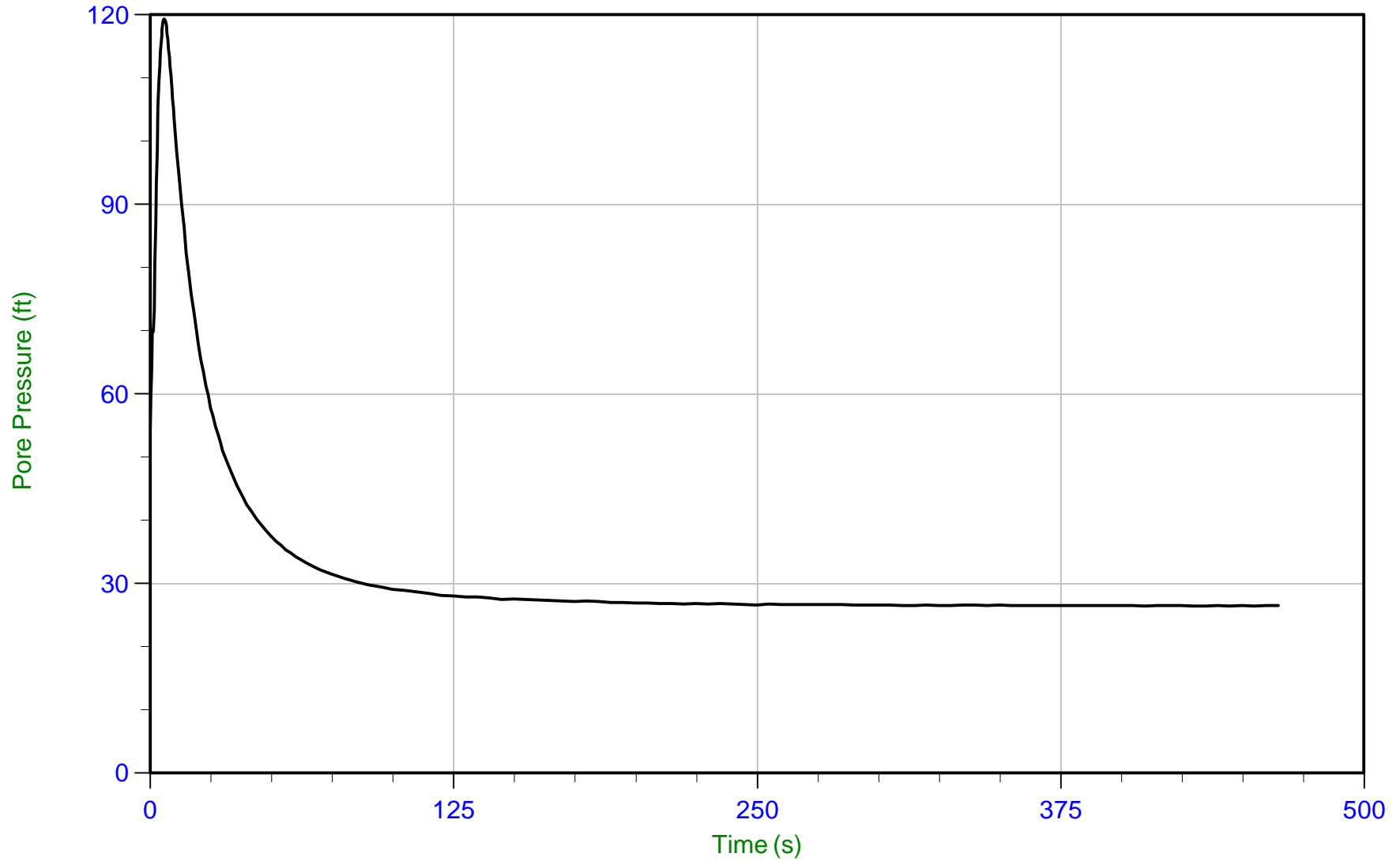
WT: 4.394 m / 14.416 ft
Ueq: 24.5 ft



PanGEO

Job No: 21-59-22331
Date: 05/04/2021 10:08
Site: Puyallup WWTP

Sounding: CPT-01
Cone: EC781 Area=15 cm²



Trace Summary:

Filename: 21-59-22331_SP01.ppd2
Depth: 12.475 m / 40.928 ft
Duration: 465.0 s

u Min: 26.4 ft
u Max: 119.3 ft
u Final: 26.5 ft

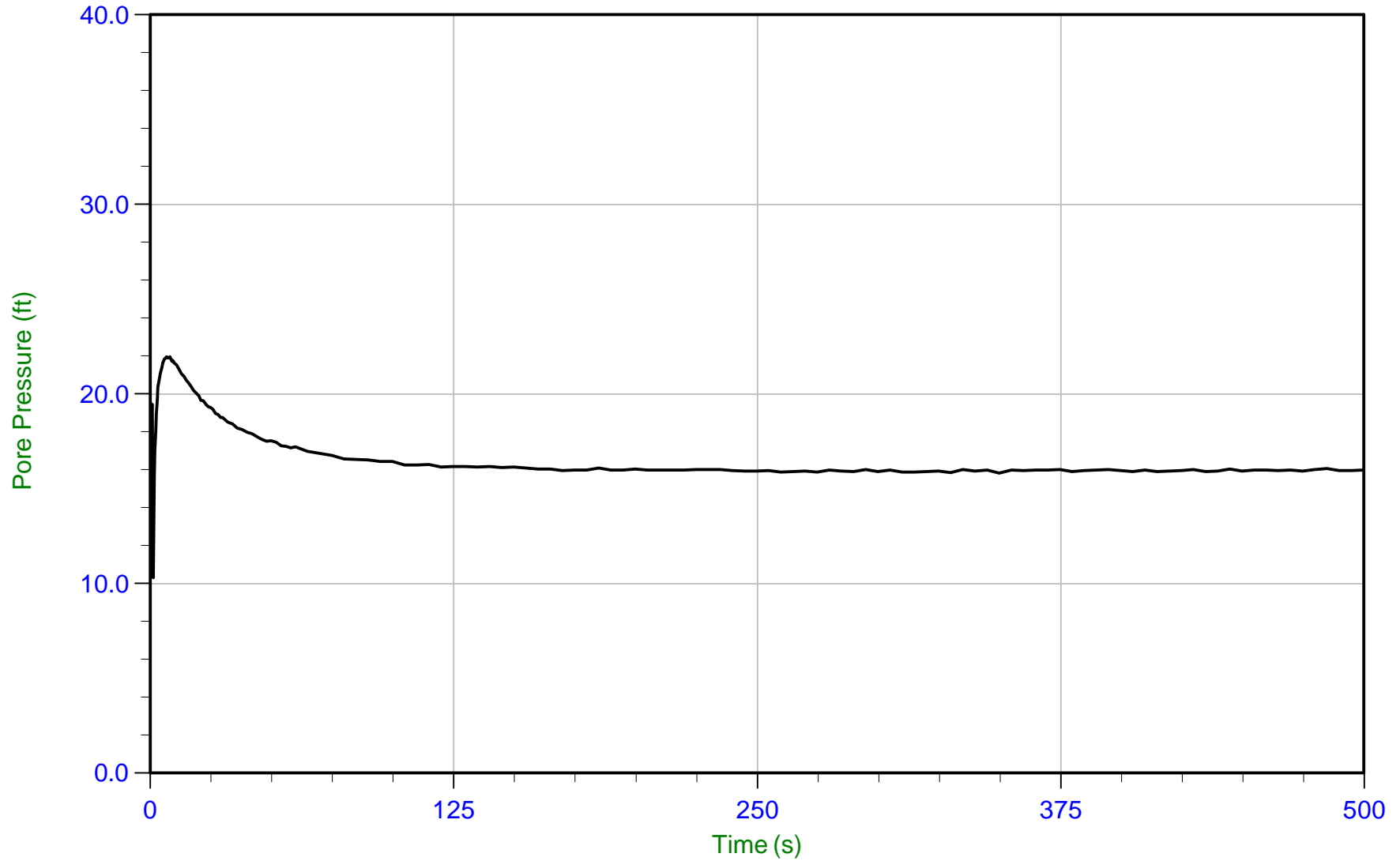
WT: 4.321 m / 14.177 ft
Ueq: 26.8 ft



PanGEO

Job No: 21-59-22331
Date: 05/04/2021 11:37
Site: Puyallup WWTP

Sounding: CPT-02
Cone: EC781 Area=15 cm²



Trace Summary:

Filename: 21-59-22331_SP02.ppd2
Depth: 9.400 m / 30.840 ft
Duration: 500.0 s

u Min: 10.3 ft
u Max: 22.0 ft
u Final: 16.0 ft

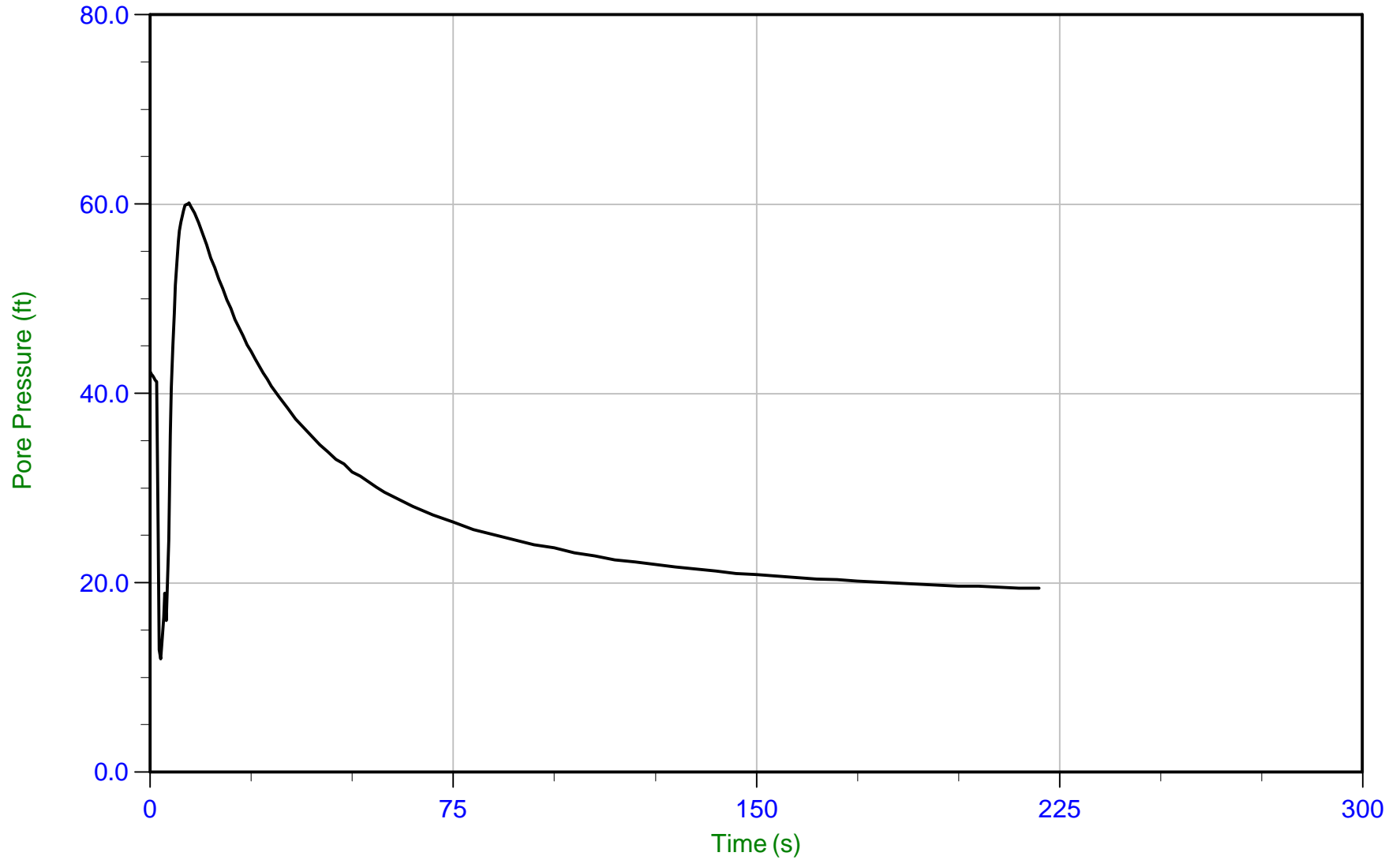
WT: 4.527 m / 14.852 ft
Ueq: 16.0 ft



PanGEO

Job No: 21-59-22331
Date: 05/04/2021 01:05
Site: Puyallup WWTP

Sounding: CPT-03
Cone: EC781 Area=15 cm²



Trace Summary:

Filename: 21-59-22331_SP03.ppd2
Depth: 9.475 m / 31.086 ft
Duration: 220.0 s

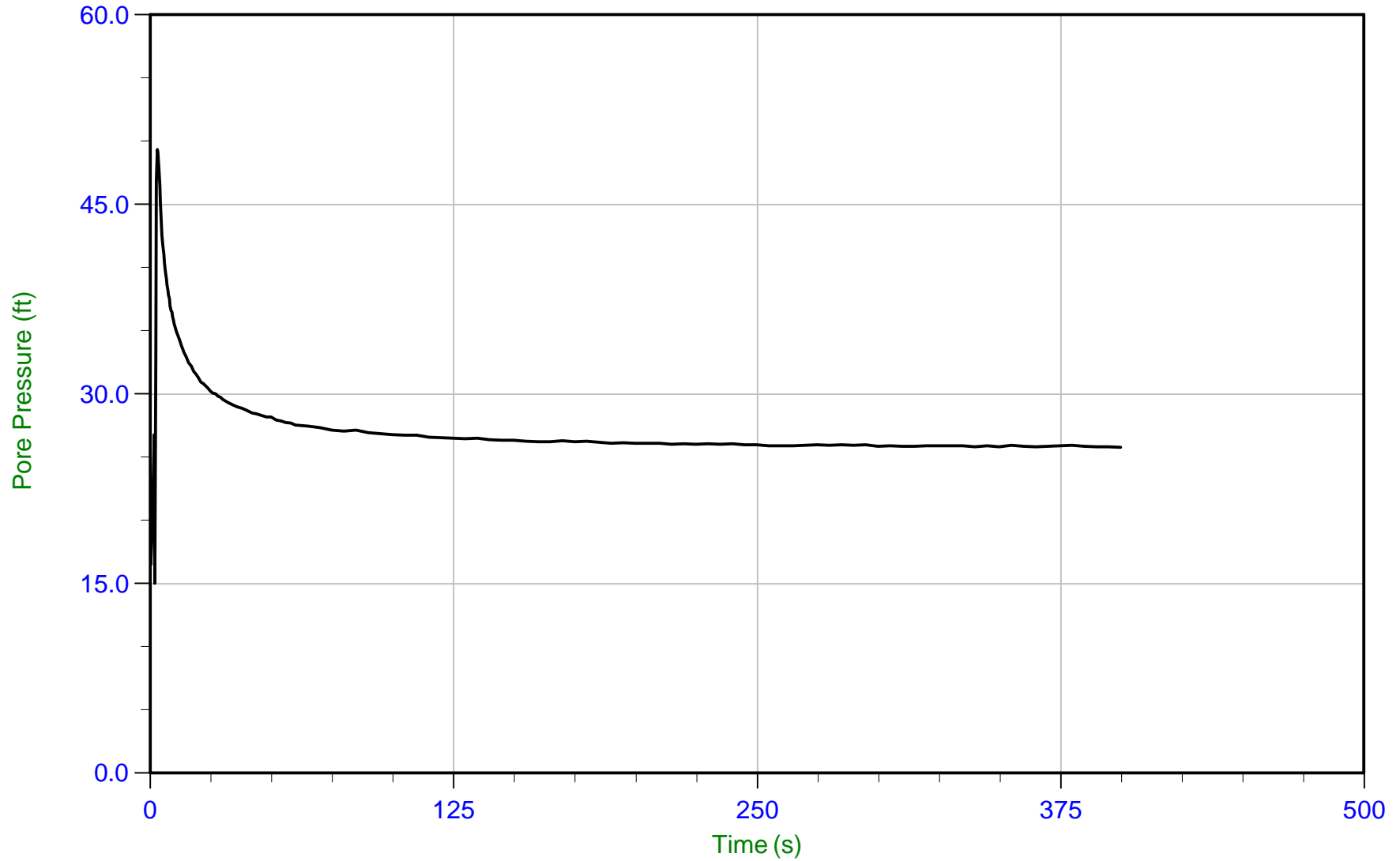
u Min: 12.0 ft
u Max: 60.1 ft
u Final: 19.4 ft



PanGEO

Job No: 21-59-22331
Date: 05/04/2021 01:05
Site: Puyallup WWTP

Sounding: CPT-03
Cone: EC781 Area=15 cm²



Trace Summary:

Filename: 21-59-22331_SP03.ppd2
Depth: 11.775 m / 38.631 ft
Duration: 400.0 s

u Min: 15.0 ft
u Max: 49.4 ft
u Final: 25.8 ft

WT: 3.880 m / 12.729 ft
Ueq: 25.9 ft

APPENDIX B

SUMMARY TEST PIT LOGS

Project No: 21-112
 Project Name: Puyallup Clarifier #3
 Project Location: Puyallup Wastewater Treatment Plant, Puyallup, WA 98371
 Excavated: 6/25/2021

Summary Log of Test Pit No. TP-1

Approx. Location: 47.205602, -122.320741 (Google Earth)
 Approximate ground surface elevation: 32 feet (Google Earth)

<u>Depth (ft)</u>	<u>Material Description</u>
0 – 1½	Loose to medium dense, brown, silty, fine to medium SAND with gravel; organics and rootlets present, no caving observed, moist. - Columns of ¾-inch crushed gravel encountered about 1 foot deep. Gravel column observed to cave into the pit. <div style="text-align: right;">(Fill)</div>
1½ – 3	Medium dense, light brown-gray, poorly-graded, fine SAND with silt; trace gravel, no caving observed, moist. <div style="text-align: right;">(Native Sand)</div>


- Notes:
1. Previous aggregate pier encountered about 5 feet deep and extended to bottom of pit. Spaced about 8 to 9 feet apart in pit.
 2. TP-1 was excavated to approx. 3 feet below ground surface.
 3. Groundwater was not observed within the excavation.



Plate 1. Sidewall view of TP-1. Previous aggregate pier seen about 1 foot below grade.

Test Pit Logged by: B. Townsend

Project No: 21-112
 Project Name: Puyallup Clarifier #3
 Project Location: Puyallup Wastewater Treatment Plant, Puyallup, WA 98371
 Excavated: 6/25/2021

Summary Log of Test Pit No. TP-2	
Approx. Location: 47.205512, -122.320875 (Google Earth) Approximate ground surface elevation: 32 feet (Google Earth)	
<u>Depth (ft)</u>	<u>Material Description</u>
0 – 5	Medium dense to dense, brown, silty, well-graded SAND with large gravel; no caving observed, moist. (Fill)
5 – 15	Medium dense, light brown-gray, poorly-graded, fine SAND with silt; organic odor, no caving observed, moist. <ul style="list-style-type: none"> - Columns of 3/4-inch crushed gravel encountered about 5 foot. Gravel column observed to cave into the pit. - Becomes wet at about 15 feet deep, seepage observed. (Native Sand)
<u>Notes:</u>	<ol style="list-style-type: none"> 1. Previous aggregate pier encountered about 5 feet deep and extended to bottom of pit. Spaced about 8 feet apart. 2. TP-1 was excavated to approx. 15 feet below ground surface. 3. Groundwater seepage observed at about 15 feet deep.
	
<p>Plate 1. View of TP-2. Groundwater in bottom of pit. Caving of gravel column seen in pit sidewall.</p>	

Test Pit Logged by: B. Townsend

Project No: 21-112
 Project Name: Puyallup Clarifier #3
 Project Location: Puyallup Wastewater Treatment Plant, Puyallup, WA 98371
 Excavated: 6/25/2021

Summary Log of Test Pit No. TP-3

Approx. Location: 47.205438, -122.320616 (Google Earth)
 Approximate ground surface elevation: 33 feet (Google Earth)

Depth (ft)	Material Description
0 – 1	Loose to medium dense, brown, silty, well-graded SAND with large gravel; no caving observed, moist, - Column of ¾-inch crushed gravel encountered about 6 inches deep. Gravel column observed to cave into the pit. <div style="text-align: right;">(Fill)</div>
1 – 8	Medium dense, light brown-gray, poorly-graded, fine SAND with silt; no caving observed, moist. <div style="text-align: right;">(Native Sand)</div>
<u>Notes:</u>	<ol style="list-style-type: none"> 1. Previous aggregate pier encountered about 6 inches deep and extended to bottom of pit. 2. TP-1 was excavated to approx. 8 feet below ground surface. 3. Groundwater seepage was not observed in excavation

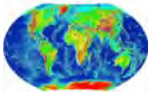


Plate 1. View of TP-3. Caving of gravel column seen in pit sidewall.

Test Pit Logged by: B. Townsend

APPENDIX C

Geophysical Survey Report



April 16, 2021

Our Ref.: 110-1222.000

PanGeo, Inc.
3213 Eastlake Avenue East, Suite B
Seattle, WA 98102

Attention: Mr. Siew Tan

RE: REPORT ON THE MICRO-GRAVITY AND GROUND PENETRATING RADAR SURVEYS FOR LOCATING STONE COLUMNS AT PUYALLUP WASTE WATER TREATMENT PLANT, PUYALLUP, WA

Dear Mr. Tan:

Global Geophysics conducted micro-gravity and ground penetrating radar surveys from March 11th to March 22nd, 2020 at Puyallup Waste Water Treatment Plant located at 1602 18th St NW, Puyallup, WA. The proposed objective of the geophysical investigation is to locate stone columns.

METHODOLOGY AND INSTRUMENTATION

Microgravity and ground penetrating radar were used for this project. Microgravity was the primary method. The following paragraphs describes the methods and their field procedures.

Micro-gravity

The gravity instrument measures the earth's gravitational acceleration. After corrections are made to the gravity measurements for latitude, elevation, tide and terrain of each gravity station, the gravity values represents variations, or excess and differences, in mass of the subsurface geology.

The gravity measurements were made with a Burris digital gravity meter that has a reading resolution of 5 microgal (μgals) and a standard deviation of less than 10 μgals . The latitude, longitude and elevation of stations were obtained by client.

Before taking measurements at the site, the gravity meter was leveled, energized and stabilized for about 4 hours before taken to the site. Thereafter, the instrument was transported to each measurement station, leveled, and stabilized for 20 minutes or longer before taking a set of readings. The gravity meter was returned to a calibration station several times during the day to monitor for signs of instrument drift.

Data were collected at 405 stations on a grid of 7 foot by 7 foot. The data were recorded in the field, input to computer after the survey, and subsequently corrected for latitude, elevation, drift, tide, and terrain. The computer program GravMaster was used to process the gravity data.

Ground Penetrating Radar (GPR)

Ground penetrating radar (GPR) operates on the principle that electromagnetic waves, emitted into the ground by a transmitter (Tx) antenna, are partially reflected at subsurface interfaces or object and subsequently detected by a receiver (Rx). Reflections arise due to contrasts in the dielectric constant and conductivity of subsurface materials. These properties are a function of water content, grain size and mineralogy. The best subsurface penetration is obtained in medium to coarse-grained sediment. Ground penetrating radar will not be effective if the soils at this site are fine-grained (silt and clay).

A subsurface profile is acquired by moving the transmitter and receiver antennas along a traverse and, continuously recording a series of soundings. The resulting reflection data are displayed on a graphic recorder as a continuous profile depicting the subsurface strata and discrete targets.

A GSSI System 200 with a 200 MHz and 80 MHz antennas were used to collect data along the transects spaced at 2.5-foot interval. The data were stored in computer for further processing.

DATA PROCESSING AND RESULTS

Gravity

Gravity readings were taken at 405 stations on a grid of 7 foot by 7 foot. The gravity stations were laid out by us. The positions and elevations of the gravity stations were surveyed by client.

Tide, free-air, latitude, drift, and Bouguer corrections were applied to the gravity readings. The Bouguer gravity data contour plan is presented in Figure 1. After removing the local trends, the residual gravity data is contoured and presented in Figure 1.

Bouguer gravity contour plan shows higher gravity on the south and southwest of the area. This suggest larger mass of higher density materials in that area.

The residual Bouguer gravity contour plan show east-west linear features. Assuming the depth to top of the stone column were relatively similar (same operational practice throughout the installation), the areas with higher gravity readings indicate the locations of stone columns.

Ground Penetrating Radar

The top of the stone column and fill above doesn't appear to have enough dielectric contrast. There are no patterns in the GPR anomalies.

LIMITATIONS OF THE GEOPHYSICAL METHODS

Global geophysics services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. Gravity and GPR are remote sensing geophysical methods that may not detect all subsurface features due to the limitations of the methods, soil conditions.

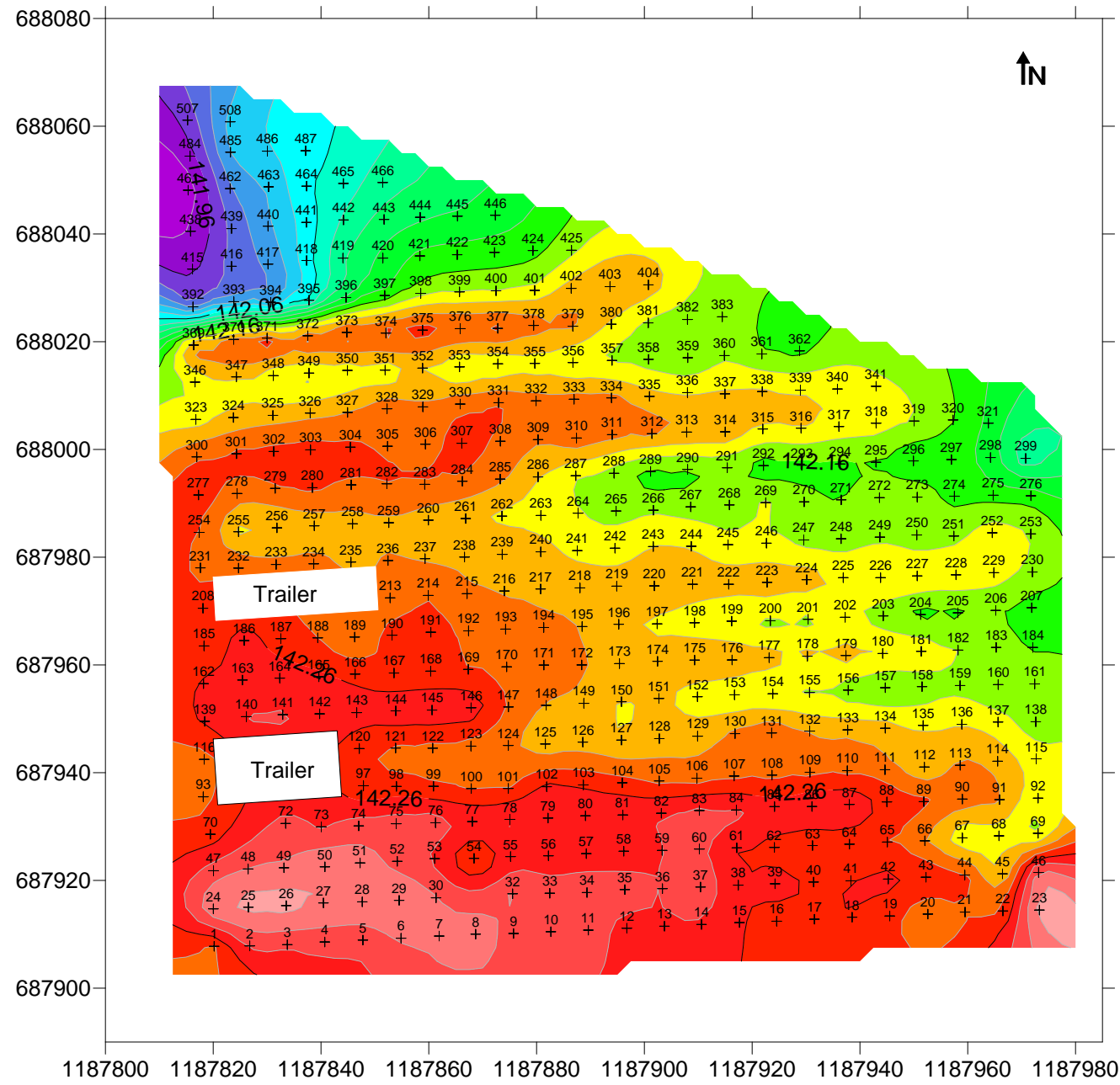
Sincerely,

Global Geophysics

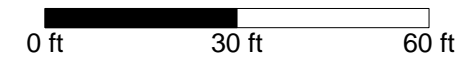
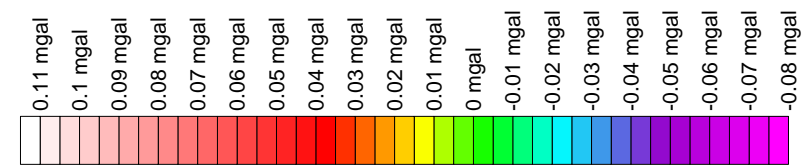
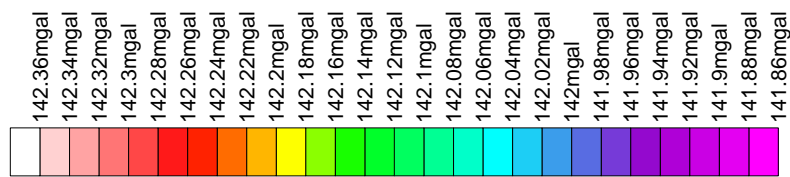
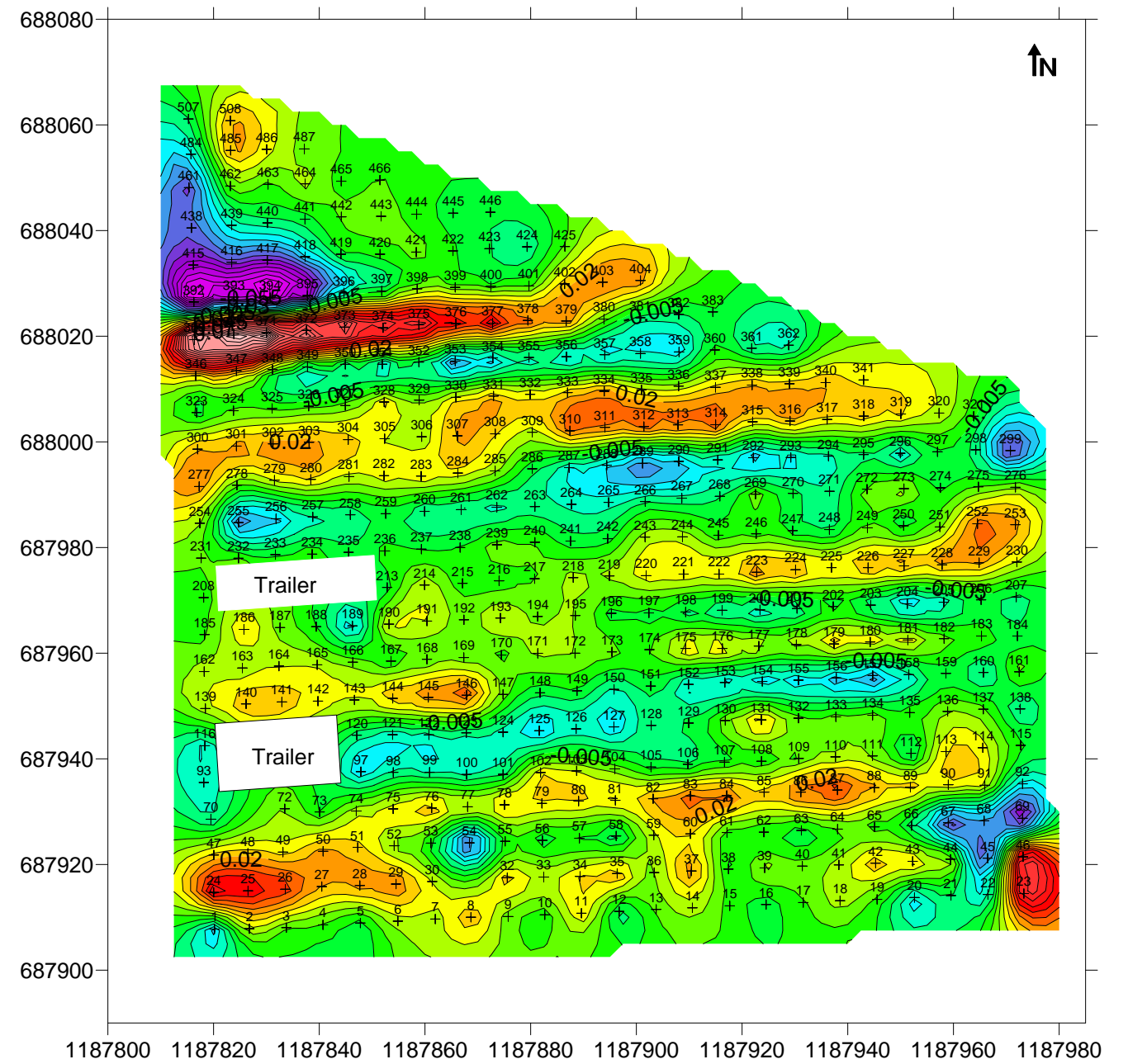


John Liu, Ph.D., R.G.
Principal Geophysicist

Bouguer Gravity Contour Plan



Residual Bouguer Gravity Contour Plan (after local trend removal)



PROJECT	Stone Column Locating At 1602 18th St NW, Puyallup, WA 98371		
TITLE	Gravity Data Contour Plans		
Global Geophysics	Project #: 110-1222.000	FILE No.	
P. O. Box 2229 Redmond, WA 98073-2229 Tel: 425-890-4321	DESIGN --	SCALE AS SHOWN	REV.
	CADD JL		
	CHECK JL		
	REVIEW --		
		FIGURE 1	

APPENDIX D

PREVIOUS SUBSURFACE INVESTIGATIONS

List of Existing Boring Logs

B-16 & B-29 Shannon & Wilson (1979)

BH-2, 4, & 7 Hong West & Associates (1996)

CPT-9 to 11 & CPT-15 Hong West & Associates (1996)

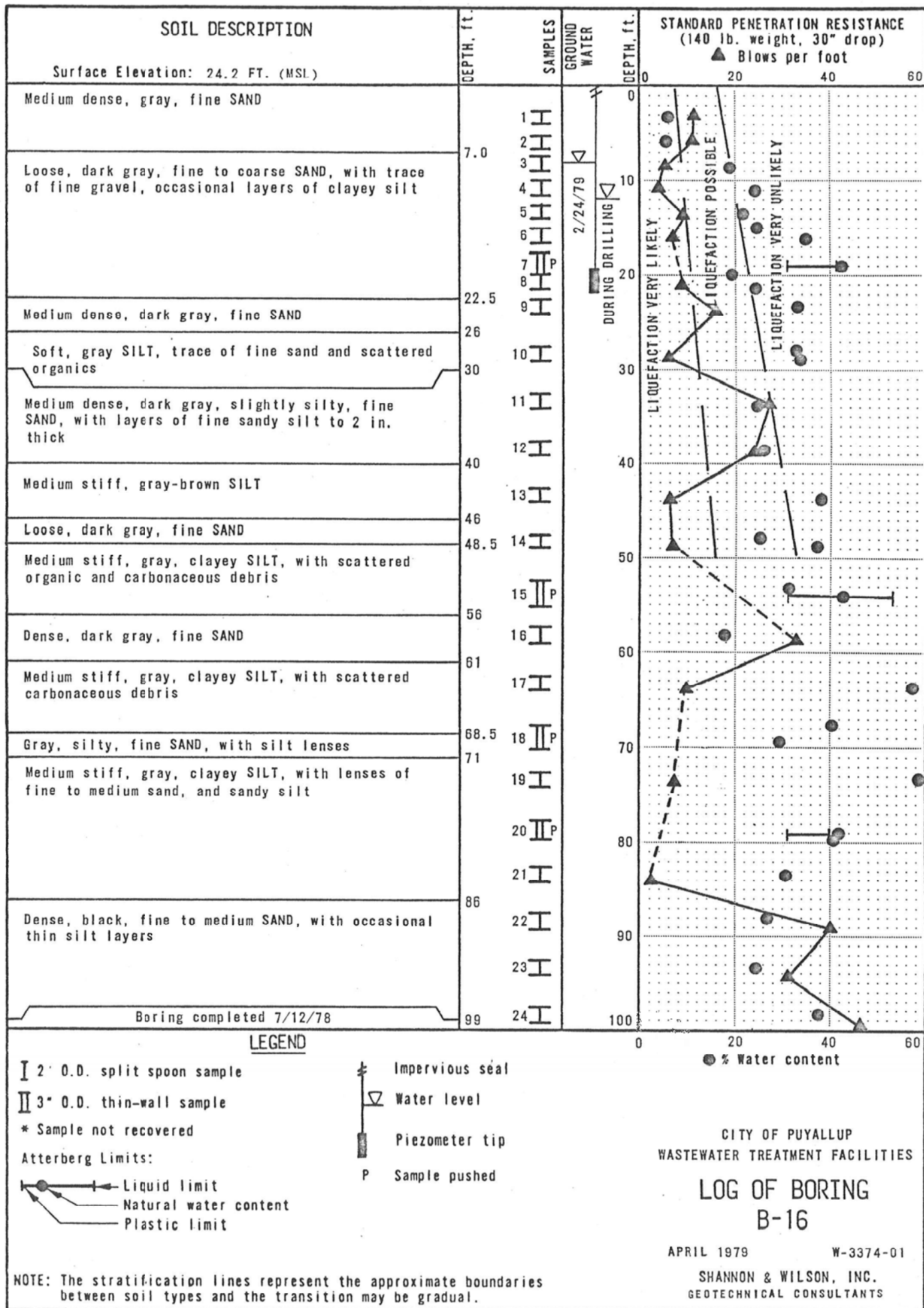


FIG. 7

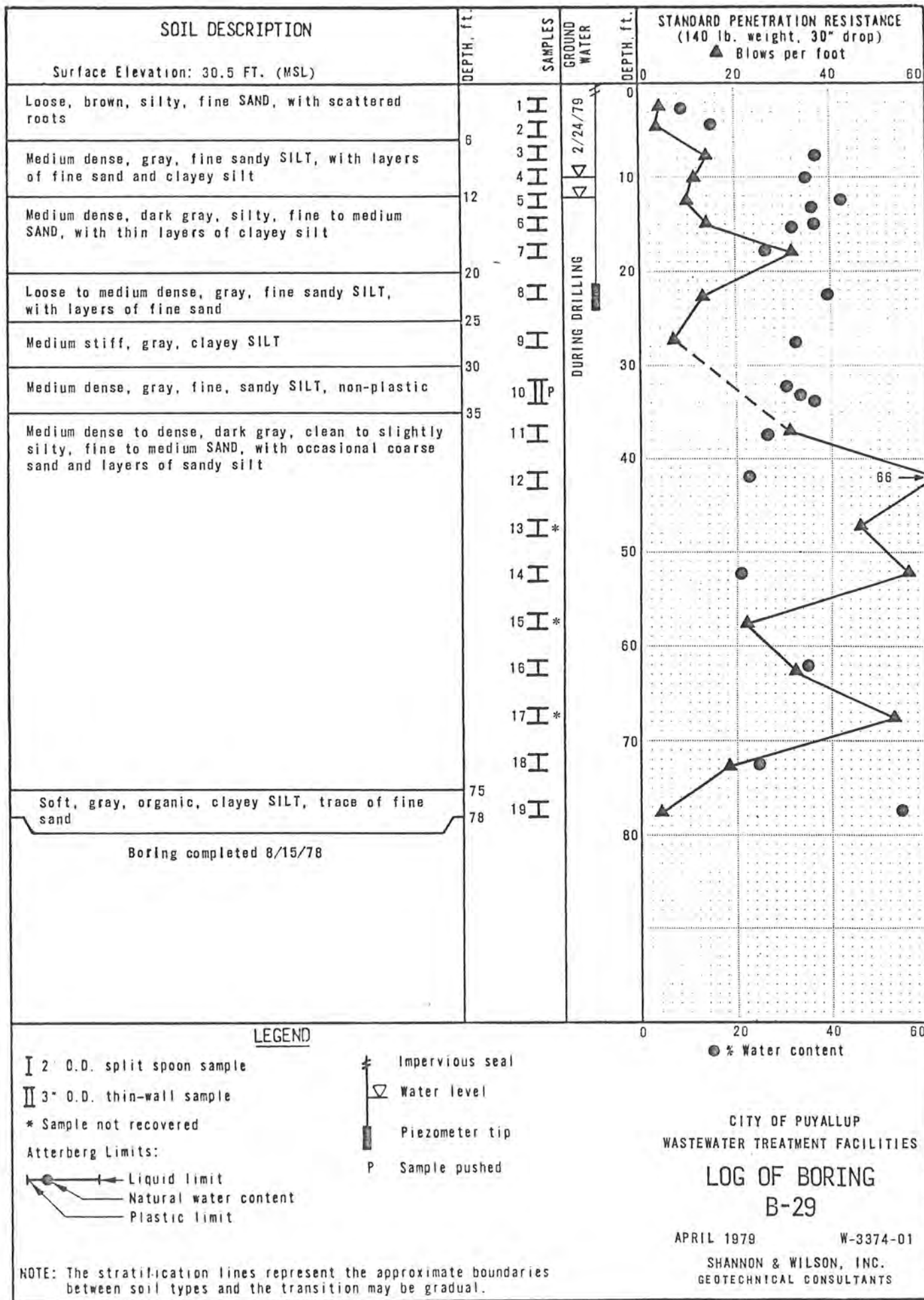


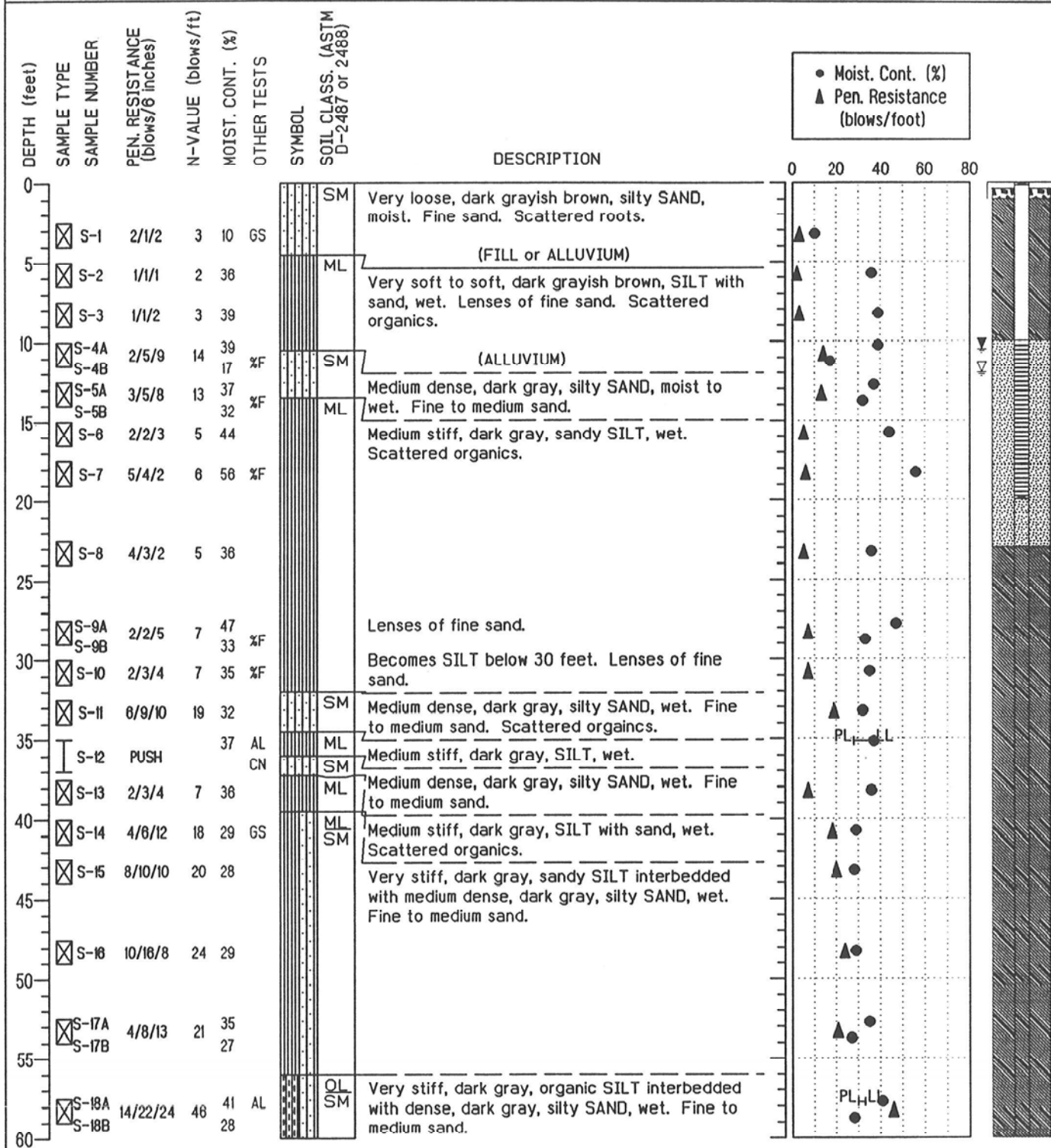
FIG. 16

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Associated Drilling, Inc.
 DRILLING METHOD: Mobile B-61, 3 1/4 in. ID CFHS Auger
 SAMPLING METHOD: SPT, SHELBY

TOTAL DEPTH: 99 Feet
 SURFACE ELEVATION: 33± Feet
 MEASURING POINT EL.: Feet



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

PROJECT: Puyallup Treatment Plant

BORING: BH-2

LOCATION: Splitter Box/Secondary Clarifier No. 2

PROJECT NUMBER: 95024

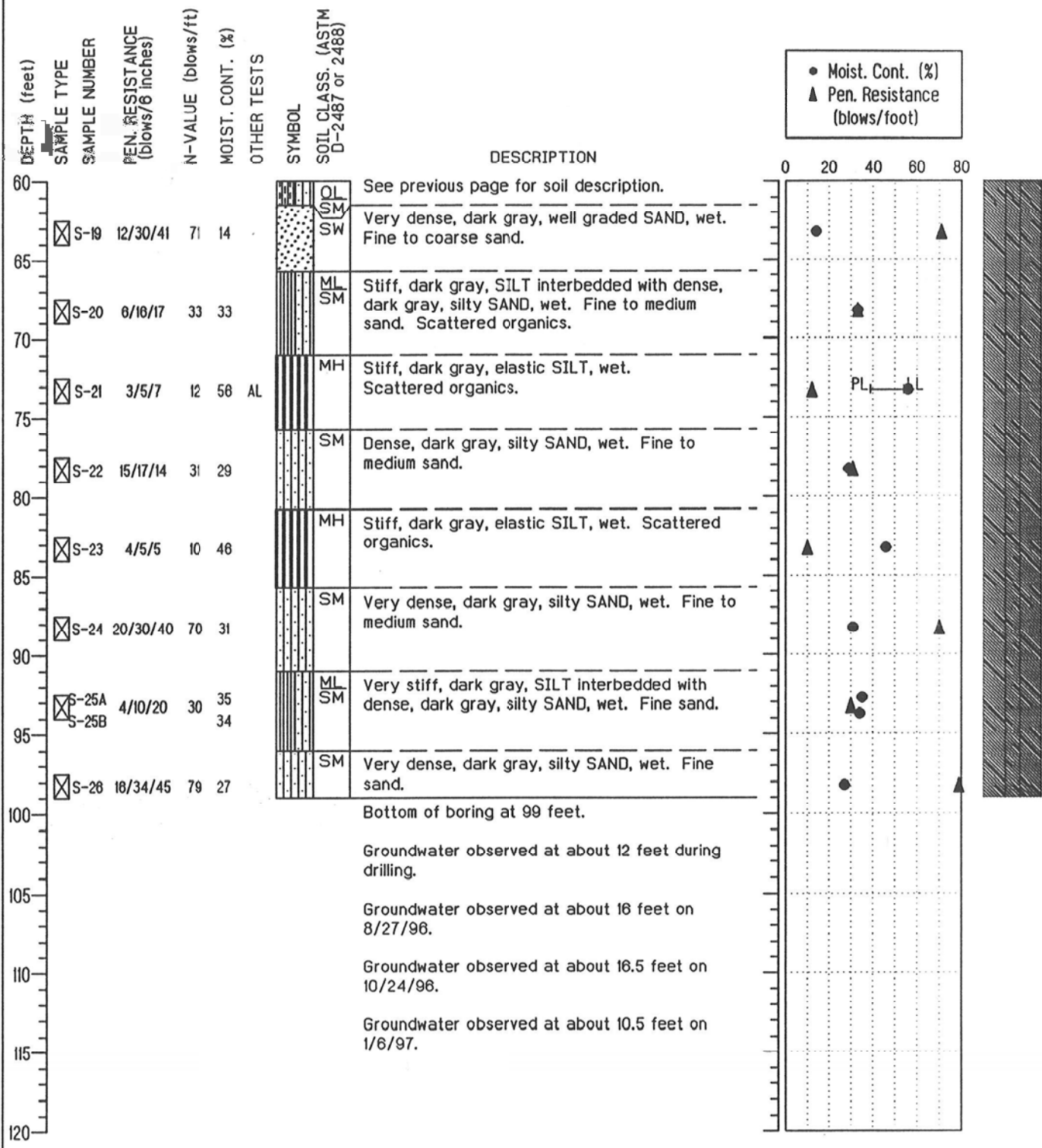
DATE COMPLETED: 7-17-96

LOGGED BY: M. Byers/J. Alexander

PAGE: 1 OF 2

FIGURE: A-2a

HONG WEST & ASSOCIATES, INC. BORING LOG



PROJECT: Puyallup Treatment Plant

BORING: BH-2

LOCATION: Splitter Box/Secondary Clarifier No. 2

PROJECT NUMBER: 95024

DATE COMPLETED: 7-17-96

LOGGED BY: M. Byers/J. Alexander

PAGE: 2 OF 2

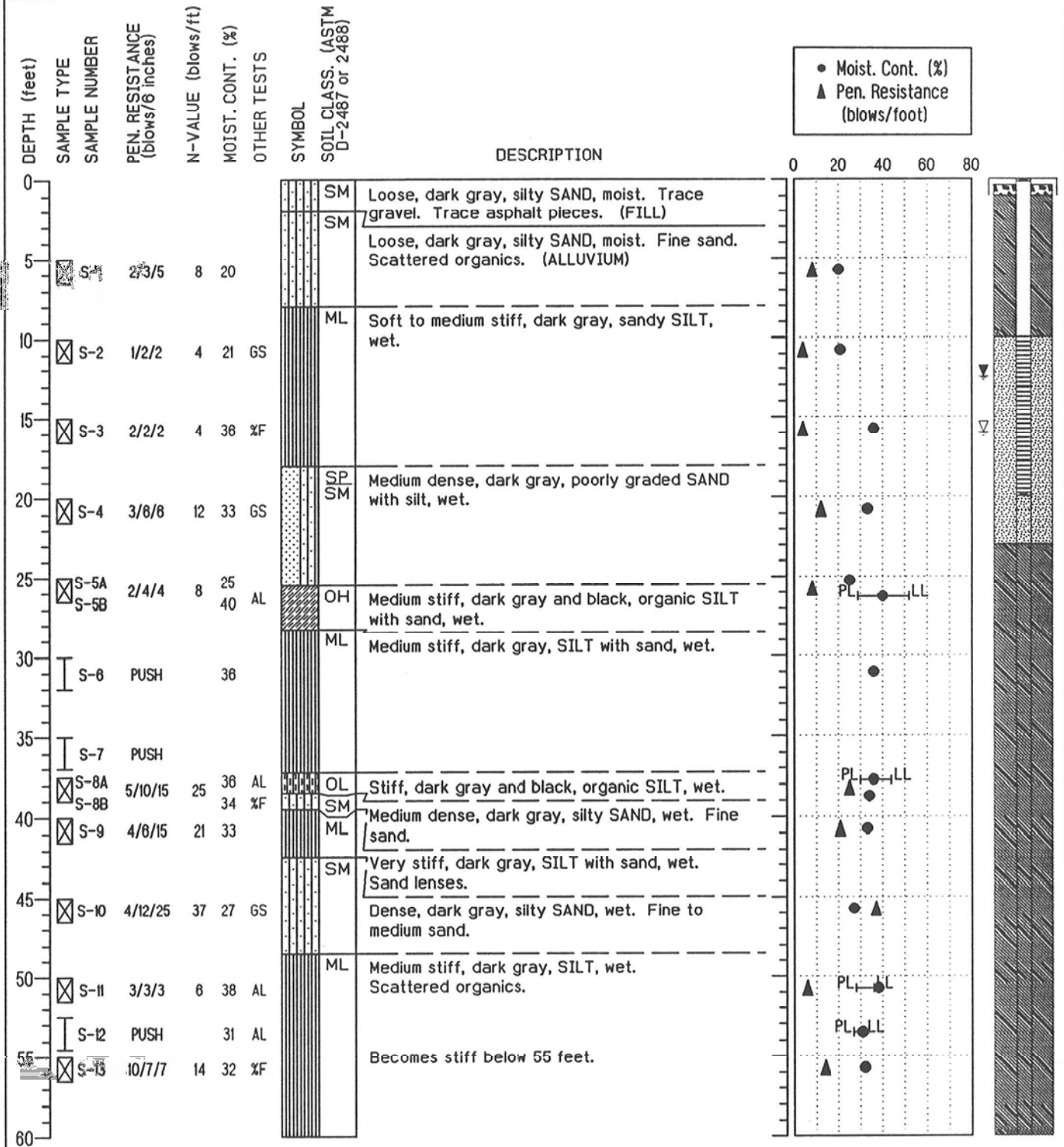
FIGURE: A-2b

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Associated Drilling, Inc.
 DRILLING METHOD: Mobile B-61, 3 1/4 in. ID CFHS Auger
 SAMPLING METHOD: SPT, SHELBY

TOTAL DEPTH: 101.5 Feet
 SURFACE ELEVATION: 33± Feet
 MEASURING POINT EL.: Feet



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

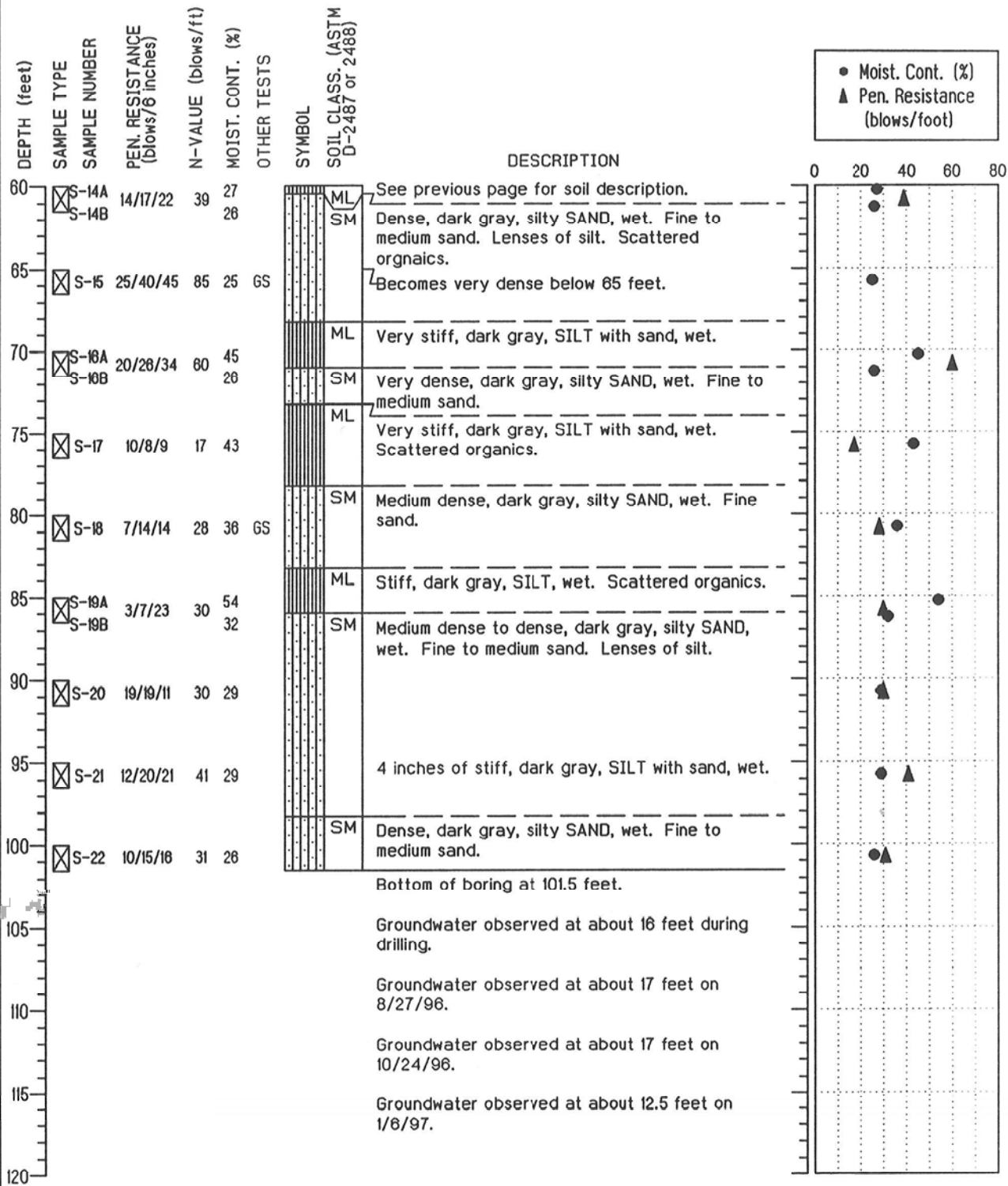
PROJECT: Puyallup Treatment Plant

BORING: BH-4

LOCATION: Secondary Clarifier
 DATE COMPLETED: 7-17-96
 LOGGED BY: Marcus Byers

PROJECT NUMBER: 95024
 PAGE: 1 OF 2

HONG WEST & ASSOCIATES, INC. BORING LOG



PROJECT: Puyallup Treatment Plant

BORING: BH-4

LOCATION: Secondary Clarifier
DATE COMPLETED: 7-17-96
LOGGED BY: Marcus Byers

PROJECT NUMBER: 95024
PAGE: 2 OF 2

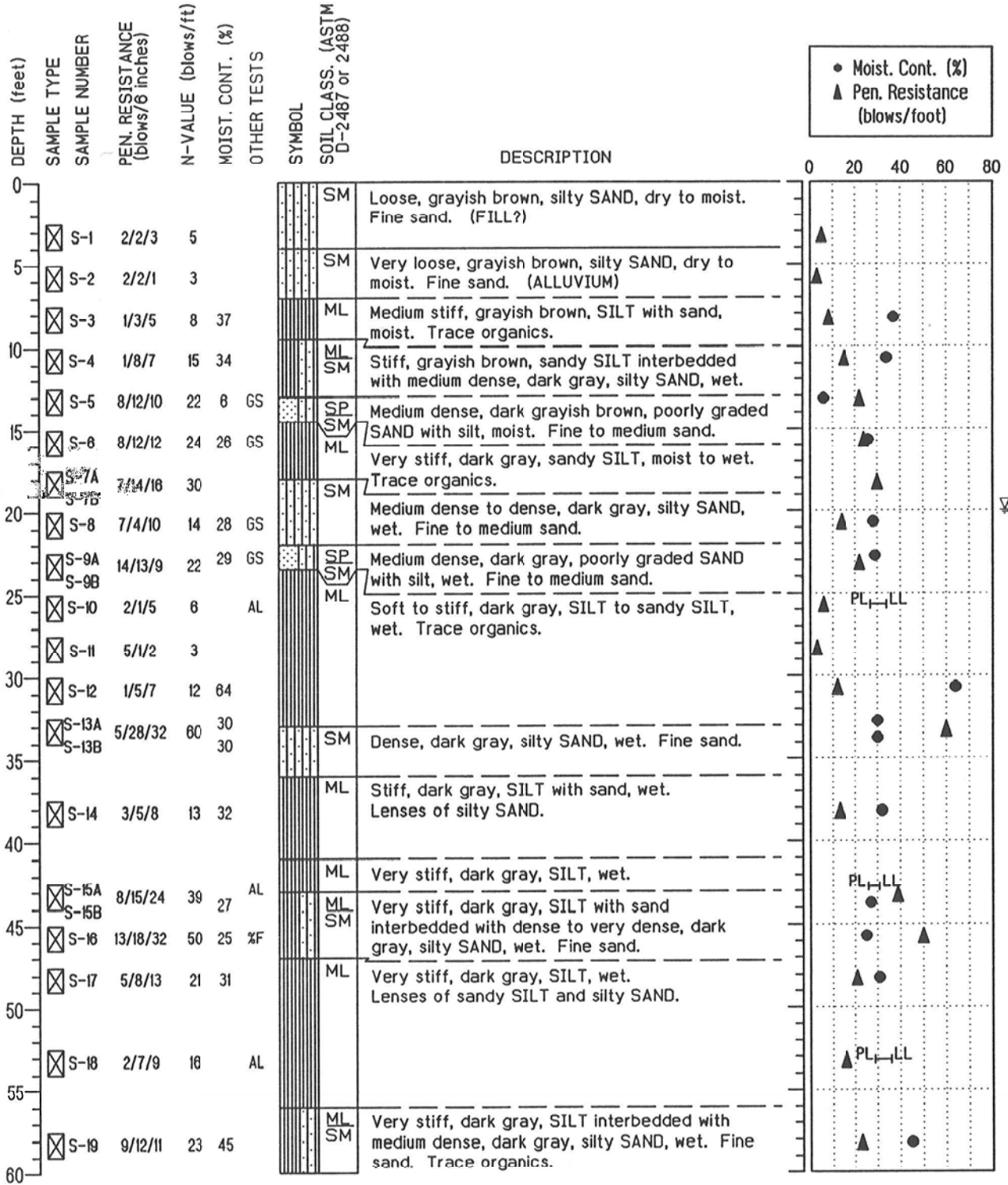
FIGURE: A-4b

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Geoboring & Development, Inc.
 DRILLING METHOD: Aker Environmental Drill, HSA
 SAMPLING METHOD: SPT, SHELBY

TOTAL DEPTH: 98.5 Feet
 SURFACE ELEVATION: 34.5± Feet
 MEASURING POINT EL.: Feet



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

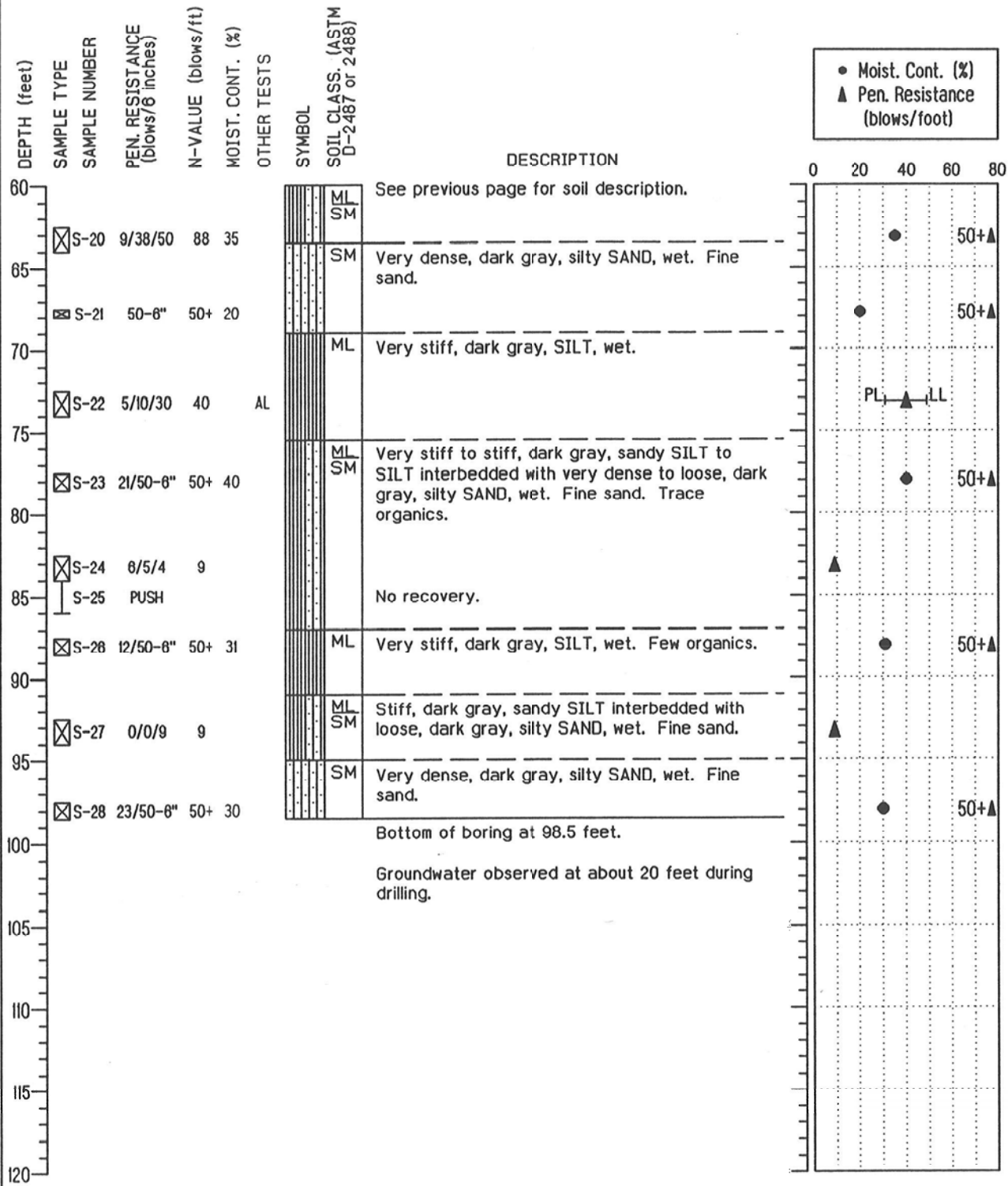
PROJECT: Puyallup Treatment Plant

BORING: BH-7

LOCATION: Secondary Clarifier
 DATE COMPLETED: 8-29-96
 LOGGED BY: Chris Behrens

PROJECT NUMBER: 95024
 PAGE: 1 OF 2

HONG WEST & ASSOCIATES, INC. BORING LOG



PROJECT: Puyallup Treatment Plant

BORING: BH-7

LOCATION: Secondary Clarifier
DATE COMPLETED: 8-29-96
LOGGED BY: Chris Behrens

PROJECT NUMBER: 95024
PAGE: 2 OF 2

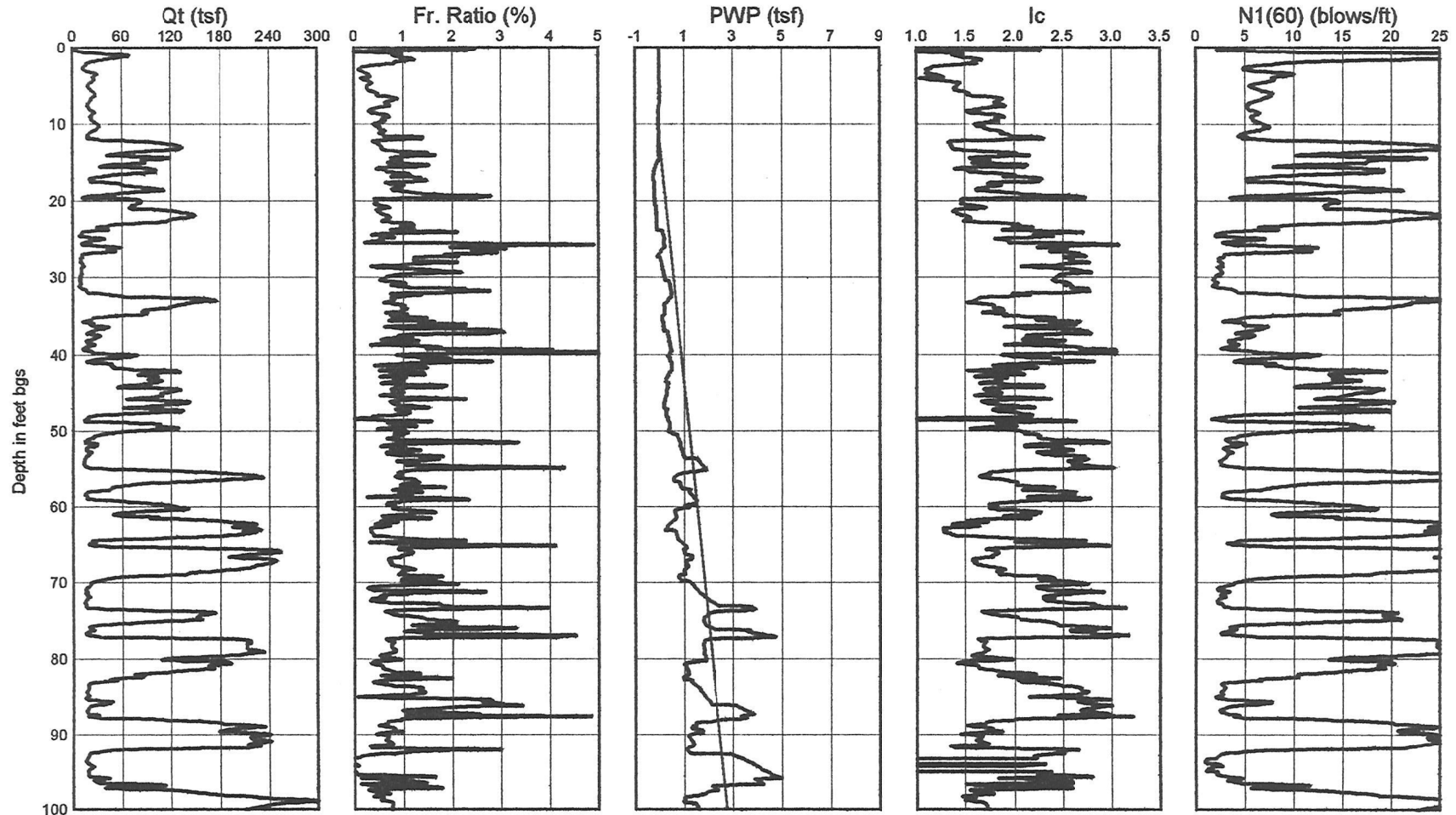
FIGURE: A-7b

Cone Penetration Test - CPT-9

Test Date : Jul 19, 1996
 Location : Puyallup Waste Water Treatment Plant

Operator : Northwest Cone Exploration

Ground Surf. Elev. : 34.50
 Water Table Depth : 12.00



Qt normalized for
 unequal end area effects

Fr Ratio = $100 * F / (Qt * \text{Sigma}_v)$
 Gamma = 110 pcf

After Jefferies and Davies (1991)

- $I_c < 1.25$ - Gravelly sands
- $1.25 < I_c < 1.90$ - Clean to silty sand
- $1.90 < I_c < 2.54$ - Silty sand to sandy silt
- $2.54 < I_c < 2.82$ - Clayey silt to silty clay
- $2.82 < I_c < 3.22$ - Clays

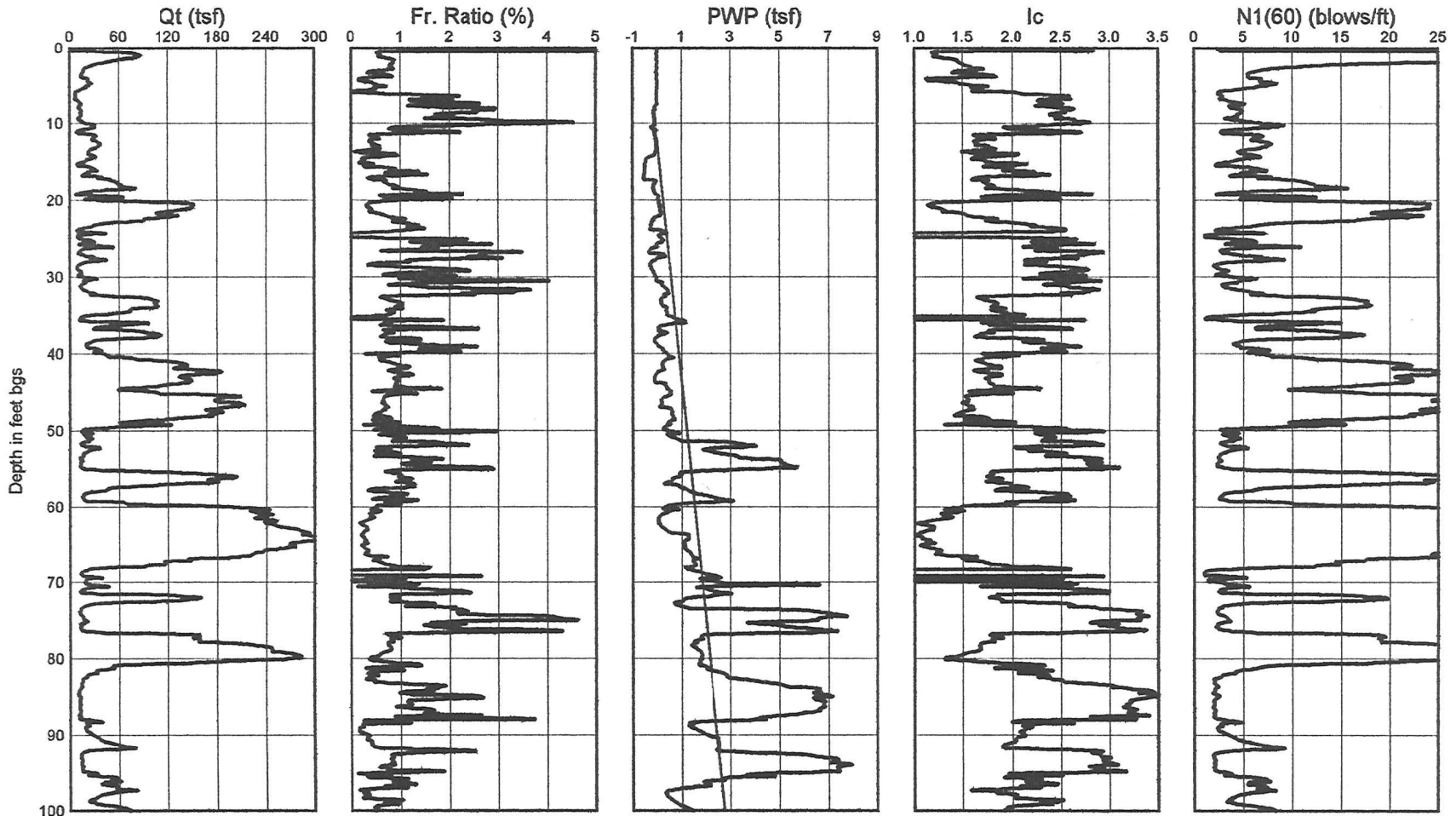
After Jefferies and Davies (1993)

Cone Penetration Test - CPT-10

Test Date : Jul 22, 1996
 Location : Pryallup Waste Water Treatment Plant

Operator : Northwest Cone Exploration

Ground Surf. Elev. : 33.00
 Water Table Depth : 12.00



Qt normalized for
unequal end area effects

Fr Ratio = $100 * F / (Qt * \text{Sigma}_v)$
Gamma = 110 pcf

After Jefferies and Davies (1991)

- Ic < 1.25 - Gravally sands
- 1.25 < Ic < 1.90 - Clean to silty sand
- 1.90 < Ic < 2.54 - Silty sand to sandy silt
- 2.54 < Ic < 2.82 - Clayey silt to silty clay
- 2.82 < Ic < 3.22 - Clays

After Jefferies and Davies (1993)

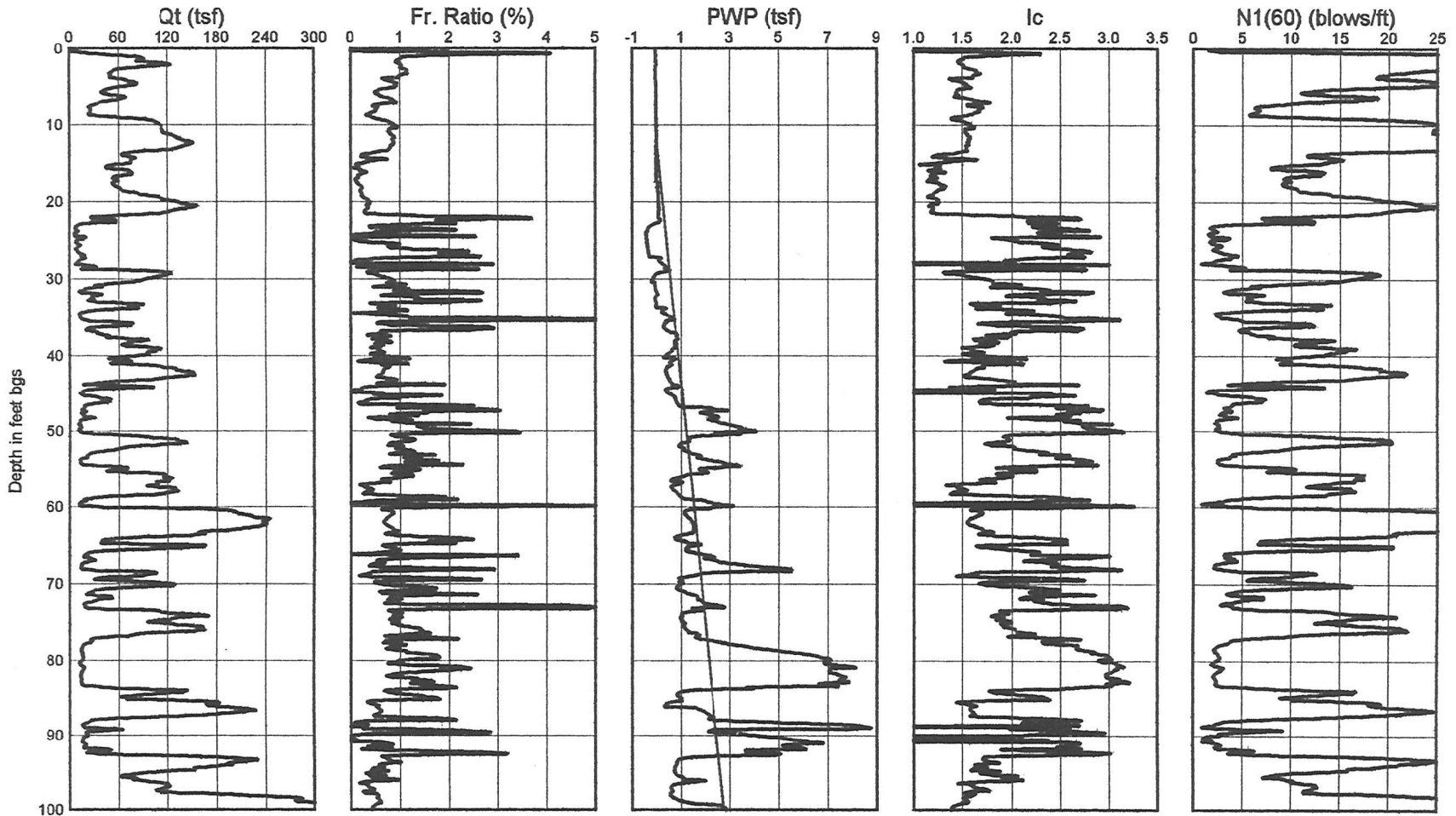
FIGURE: A-19

Cone Penetration Test - CPT-11

Test Date : Jul 22, 1996
 Location : Payallup Waste Water Treatment Plant

Operator : Northwest Cone Exploration

Ground Surf. Elev. : 30.00
 Water Table Depth : 12.00



Qt normalized for
unequal end area effects

Fr Ratio = $100 * F / (Qt - \text{Sig} \cdot \gamma)$
 Gamma = 110 pcf

After Jefferies and Davies (1991)
 $I_c < 1.25$ - Gravelly sands
 $1.25 < I_c < 1.90$ - Clean to silty sand
 $1.90 < I_c < 2.54$ - Silty sand to sandy silt
 $2.54 < I_c < 2.82$ - Clayey silt to silty clay
 $2.82 < I_c < 3.22$ - Clays

After Jefferies and Davies (1993)

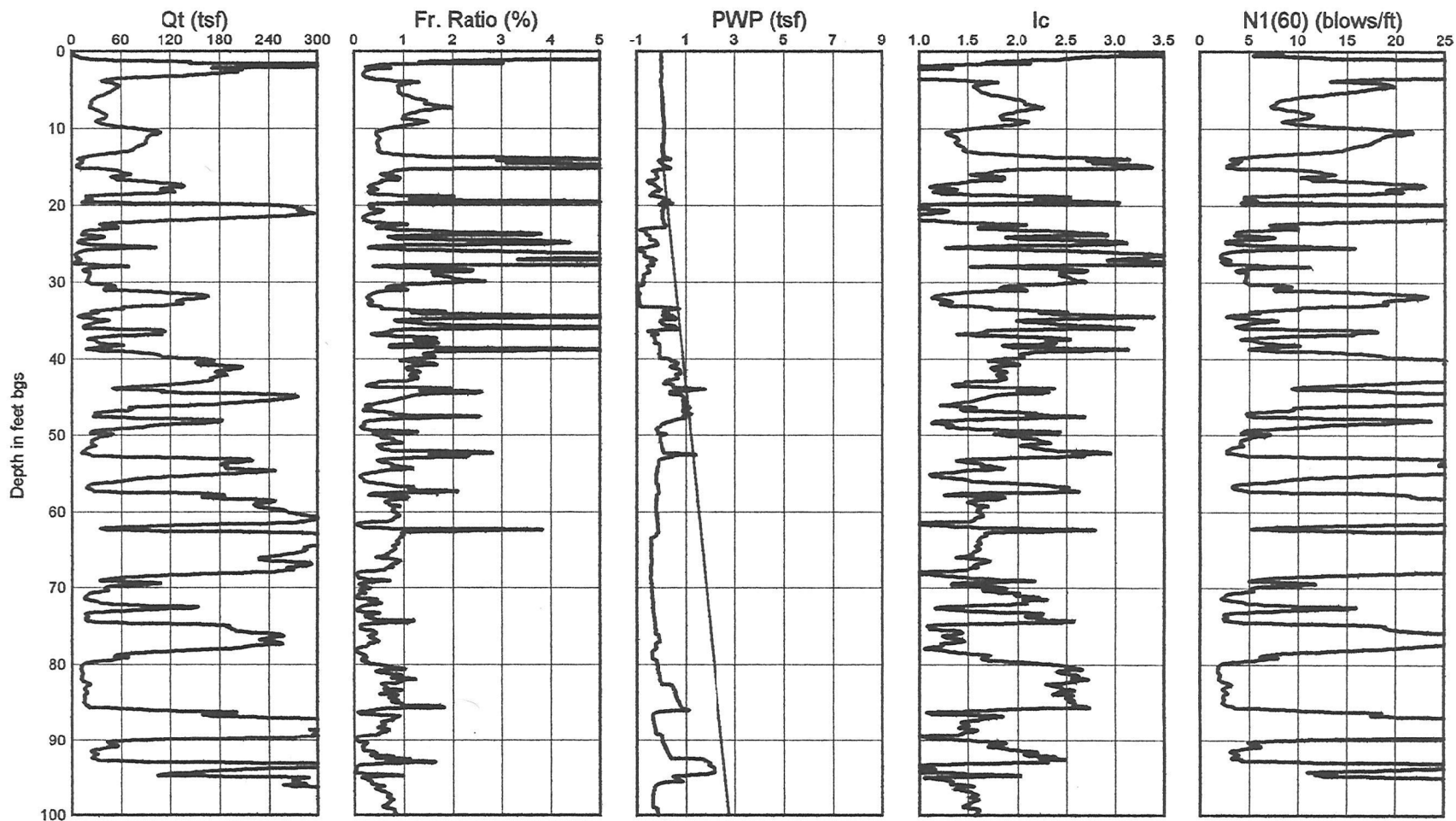
CPT-15 Hong West & Associates (1996)

Cone Penetration Test - CPT-15

Test Date : Jul 24, 1996
 Location : Puyallup Waste Water Treatment Plant

Operator : Northwest Cone Exploration

Ground Surf. Elev. : 33.50
 Water Table Depth : 12.00



Qt normalized for unequal end area effects

Fr Ratio = $100 * F / (Qt - \text{Sig} \cdot \gamma)$
 Gamma = 110 pcf

After Jeffries and Davies (1991)
 Ic < 1.25 - Gravelly sands
 1.25 < Ic < 1.90 - Clean to silty sand
 1.90 < Ic < 2.54 - Silty sand to sandy silt
 2.54 < Ic < 2.82 - Clayey silt to silty clay
 2.82 < Ic < 3.22 - Clays

After Jeffries and Davies (1993)

APPENDIX 2 – DOCUMENTATION OF HAZARDOUS (CLASSIFIED) AREAS LETTER

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APPENDIX 3 – SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA

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APPENDIX A

**SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA FORMS
WATER POLLUTION CONTROL PLANT
THIRD SECONDARY CLARIFIER INSTALLATION**

These forms shall be completed in their entirety and submitted by the apparent two lowest Bidders to the City of Puyallup by 12:00 p.m. (noon) of the second business day following the bid submittal deadline.

Failure to submit and meet the requirements as stated in Section 1-02 of the Special Provisions shall be grounds for rejection of the bid. The City of Puyallup will be the sole judge in determining if the prospective contractor meets the minimum experience requirements.

Contractor:

Name: _____

Address: _____

Phone: _____

Contact Person: _____

2. Delinquent State Taxes

Instructions to Bidders: Check the appropriate box

The Bidder does not owe delinquent taxes to the Washington State Department of Revenue.

Alternatively, the Bidder does owe delinquent taxes to the Washington State Department of Revenue.

If the Bidder owes delinquent taxes, they must submit a written payment plan approved by the Department of Revenue, to the Contracting Agency.

(Date)

(Signature)

(Print Name)

(Title)

3. Claims Against Retainage and Bonds:

Instructions to Bidders: Check the appropriate box

- The Bidder has not had claims against retainage and bonds in the 3 years prior to the bid submittal date.
- Alternatively, the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date.

If the Bidder has had claims against retainage and bonds in the 3 years prior to the bid submittal date, submit a list of public works projects completed during this period that have had claims against retainage and bonds and include name of Project, contact information for the Owner, a list of claims filed against retainage and/or payment bond for any of the projects listed; and a written explanation of circumstances surrounding each claim and the ultimate resolution of the claim.

(Date)

(Signature)

(Print Name)

(Title)

4. Public Bidding Crime:

Instructions to Bidders: Check the appropriate box

- The undersigned certifies that the Bidder and/or its Owners have not been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.

- Alternatively, the undersigned confirms that the Bidder and/or its Owners have been convicted of a crime involving bidding on a public works contract in the 5 years prior to the bid submittal date.

If the Bidder and/or its Owners have been convicted of a crime involving bidding on a public works contract, provide a written explanation identifying the date of the conviction and a description of the circumstances surrounding the conviction.

(Date)

(Signature)

(Print Name)

(Title)

5. Termination for Cause/Termination for Default

Instructions to Bidders: Check the appropriate box

- The undersigned certifies that the Bidder has not had any public works contracts terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date.
- Alternatively, the undersigned confirms that the Bidder has had public works contracts terminated for cause or terminated for default by a government agency in the 5 years prior to the bid submittal date.

If the Bidder has had any public works contracts terminated for cause or terminated for default in the 5 years prior to the bid submittal date, provide a written explanation for all contracts terminated for cause or terminated for default by identifying the project contract that was terminated, the government agency which terminated the Contract, the date of the termination, and a description of the circumstances surrounding the termination.

(Date)

(Signature)

(Print Name)

(Title)

6. Lawsuits

Instructions to Bidders: Check the appropriate box

- The undersigned certifies that the Bidder has not had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts.

- Alternatively, the undersigned confirms that the Bidder has had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts.

If the Bidder has had any lawsuits with judgments entered against the Bidder in the 5 years prior to the bid submittal date that demonstrate a pattern of failing to meet the terms of contracts, submit a list of lawsuits along with a written explanation of the circumstances surrounding each lawsuit. The Contracting Agency shall evaluate these explanations to determine whether the lawsuits demonstrate a pattern of failing to meet the terms of contracts.

(Date)

(Signature)

(Print Name)

(Title)

7. Contract Time (Liquidated Damages)

Instructions to Bidders: Check the appropriate box

- The undersigned certifies that the Bidder has not had liquidated damages assessed on any project it has completed in the 5 years prior to the bid submittal date.
- Alternatively, the undersigned confirms that the Bidder has had liquidated damages assessed on projects in the 5 years prior to the bid submittal date.

If the Bidder has had liquidated damages assessed against projects in the 5 years prior to the bid submittal date, submit a list of projects along with Owner contact information, and number of days assessed liquidated damages. The Contracting Agency shall determine whether the Contractor has a pattern of failing to complete projects within Contract Time.

(Date)

(Signature)

(Print Name)

(Title)

8. Capacity and Experience

The Bidder shall have sufficient current capacity and the Project Superintendent assigned to the Project shall have experience to meet the requirements of this Project. The Bidder and Project Superintendent shall have successfully completed at least two projects as the prime contractor, of a similar size and scope, during the 5-year period immediately preceding the bid submittal deadline for this project. Similar size is defined as a minimum of 70 percent of the bid amount submitted by the Bidder.

A. Capacity

i. Gross dollar amount of work currently under contract:

ii. Gross dollar amount of contracts currently not completed:

iii. List five major pieces of equipment which are anticipated to be used on this project by the Contractor and note which items are owned by the Contractor and which are to be leased or rented from others:

iv. Number of superintendents on Bidder's staff:

B. Experience

i. General character of work performed by firm:

ii. Identify who will be the superintendent on this project and years of experience. Also, list the number of years this person has been with your firm.

iii. Similar Size and Scope Projects Completed in the Past 5 Years

#1 Owner's Name and Contact Information: _____

Owner is a Government Agency? ___ Yes ___ No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

Project Description: _____

#2 Owner's Name and Contact Information: _____

Owner is a Government Agency? Yes No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

Project Description: _____

#3 Owner's Name and Contact Information: _____

Owner is a Government Agency? Yes No

Superintendent's Name: _____

Project Name: _____

Awarded Contract Amount: _____

Final Contract Amount: _____

Completion Date: _____

Project Description: _____

APPENDIX 4 – PRIME CONTRACTOR PERFORMANCE REPORT

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Prime Contractor Performance Report

Section I Contractor Data		Section II Project Data		
Company Name		Project Title		
Address		Project No.	Auth. Working Days	Working Days Charged
Phone No.	Project Manager	Work Starting Date	Substantial Comp. Date	Physical Comp. Date
Superintendent	Foreman	Contract Award Amount		Contract Completion Amount
Description of Work:				
Rating Explanation (anything below Average):				
Signatures				
Project Inspector				
_____		_____		
Signature		Print Name		Date
Project Manager				
_____		_____		
Signature		Print Name		Date
City Engineer				
_____		_____		
Signature		Print Name		Date

Section III Numerical Rating					
	1	2	3	4	5
	Below Average		Average		Above Average
Effectiveness of on-site supervision, delivery and storage of materials and supplies					
Anticipation of problems and making necessary adjustment to adapt to altered requirements					
Coordination & Cooperation with dept. personnel on project matters					
Timely response of RAM/Submittals and Invoices					
Availability of responsible representative for instruction & decision making					
Adherence to plans and specifications as related to quality of project work					
Standards of materials					
Standards of workmanship					
Optimum utilization of contractor personnel					
Conditions of contractor's tools and equipment					
Effectiveness of contractor's coordination & management of subcontractors and material suppliers					

	1	2	3	4	5
	Below Average		Average		Above Average
Relations with general public, other agencies and adjacent contractors					
Adequacy and timeliness of progress schedules & completion of work					
Accurate and timely contract change order proposal responses, and payment support docs					
Maintenance of employment safety standards					
Attention to public safety and traffic control					
Compliance with environmental laws, ordinances and regulations					
Diligence in completing final work.					
Closeout paperwork completed timely					
Affidavits filed timely by all contractors					
Subtotal Column Evaluation Scores:	0	0	0	0	0
TOTAL EVALUATION SCORE	0				
Total Available Scores	20	40	60*	80	100

* Meets requirements of the contract without needing to be reminded.

APPENDIX 5 – WAGE RATES

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State of Washington
Department of Labor & Industries
Prevailing Wage Section - Telephone 360-902-5335
PO Box 44540, Olympia, WA 98504-4540

Washington State Prevailing Wage

The PREVAILING WAGES listed here include both the hourly wage rate and the hourly rate of fringe benefits. On public works projects, worker's wage and benefit rates must add to not less than this total.

A brief description of overtime calculation requirements is provided on the Benefit Code Key.

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APPENDIX 6 – CONSTRUCTION PLANS

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